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Page 16

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Present Conditions and the Outlook

IT is only history repeating itself that a period of financial depression should follow one of marked activity. The present moderate depression, however, should not cause widespread unrest throughout the commercial and industrial community. Underlying conditions are absolutely sound and Canada's proverbial resiliency will doubtless be reflected in the early return of confidence to business circles.

In order to understand the state of trade and commerce in the Dominion it may be well to glance at the monetary conditions of some of the leading nations. The financial and commercial organization of the world is of so delicate an adjustment, that a disturbance in any one part is naturally felt in others to some extent. Some of the European financiers trace the beginning of the stringency back to the Morocco incident, when Germany was forced to recede from her position through the withdrawal of loans by other nations. To prevent a recurrence of such an unpleasant situation the German Empire has since been hoarding gold. The Balkan war, however, is generally held responsible for the present crisis. War inevitably produces commercial depression. It often ends in the bankruptcy of one or all of the nations engaged. It is impossible to withdraw money from the ordinary commercial enterprises and use it for the accumulation of vast war stores and in the equipment of enormous forces; it is impossible to withdraw thousands of men from peaceful pursuits and support them as non-producers, without disturbing the world's trade. So, with the great continental powers hoarding their gold and mobilizing their armies, and private lenders in alarm withdrawing their loans, very little money has been available to finance regular business enterprise. The European outlook has vastly improved, but confidence will not be completely restored until the diplomats now in London arranging the financial basis of the Balkan peace, have completed their task.

Germany, as a result of her attempts to keep in a state of naval, military and financial preparedness, is running her business on bank credits and, as the banks curtailed their credits during the period of hostilities, the manufacturing output has been greatly lessened and trade seriously embarrassed. In England the stringency was augmented by labor unrest and costly and destructive strikes. The United States, in sympathy with the world markets, felt the money scarcity severely; this lack of ready capital was further accentuated by local conditions. Uncertainty arising from proposed tariff changes, the "anti-capital" attitude of the government as it is termed by one coterie of critics, the projected reorganization of the banking system, the refusal of the Interstate Commerce Commission to advance freights, and the conduct of the money trust—these, operating conjointly, have caused a depreciation in the value of the best American securities, reaching, it is estimated, the enormous sum of $3,000,000,000. However, uncertainty is now apparently giving place to confidence and financial conditions are greatly bettered.

In Canada the money tightness has been intensified by peculiarly national causes. Undoubtedly there has been excessive land speculation and municipal expansion, and this very expansion is in itself a cause of money scarcity. The Northwest farmer has not been receiving adequate returns. What with lack of storage facilities, high transportation rates, and the necessity for immediate sale, at low prices, to meet pressing liabilities, the profits have been, on the whole, small. Add to this the difficulty of procuring loans even at a high rate of interest, and it can be readily understood why there is no expansion of the wheat acreage this year. Eastern Canada markets much of her output in the Northwest provinces and is manifesting an attitude of uncertainty as to the probable outcome of the stringency.

Have Canada's resources been diminished or depleted? Not in the least. The same wheat areas are there deep and fertile, herds of cattle range the prairies and untold wealth lies buried in the hills. We yet have great measures of coal and iron and vast uncut forest. The cities of Canada have still the great additions they have made to their wealth in the form of civic undertakings and conveniences. The large manufacturing concerns with their buildings and equipment and trade organization and facilities have still that which industry and intelligence have gathered. Inexhaustible power in the rivers and streams of this country lies at our door. Land speculation is not the source of a nation's wealth; the excessive investment in land has helped to make money tight. This flurry will only cause land prices to be placed more nearly on their actual values. Municipal development may be restricted, but that need last only until this year's crop is marketed.

There is no cause for alarm, only need of confidence and sanity. Everything points to improved conditions for the western producer. Better storage is in sight. The terms of the new bank act ought to prove beneficial. The creation of the American Federal Reserve Banks should have a tendency to obviate the necessity for large loans from the banks of this country, and cause Canadian capital to be used in Canadian development. The crop reports are most favourable and with the lessened output in Europe as a result of the war and the two million and over of men added to the standing armies of that continent, and thus requiring support while not producing there should be a ready market for every bushel grown.

In the east manufacturers report an abundance of orders. Some feel that because of the great strain placed upon their institutions they have not been able to cope with the business rules to their entire satisfaction and would welcome a period of conservatism. For the Canadian manufacturing, contracting and building circles there is this cheering feature: the great public works at present under construction and contemplated by the Dominion Government and the various Provincial Governments, the vast enterprises now being pushed to completion by the four railway corporations of this country, will call for large supplies of material and will furnish abundance of work for some time to come. These undertakings are estimated to be at least two hundred millions of dollars and this is assured capital and should go a long way to prevent any serious falling off in production until money is more readily obtainable.

What is needed is cheaper money for the farmer in Western Canada and reasonable patience before the withdrawal of support from the smaller manufacturer. What is needed above all is an exercise of that confidence expressed by Sir Edmund Walker, when he said in regard to the present situation, "There is bound to be considerable stringency in the autumn and it won't be so easy to finance the crop-moving operations this year as during the past few years. But I do not anticipate anything serious."

These are the times that test the strength of men. These are the days demanding calm thought and deliberate judgment and a broad, statesmanlike grasp of the commercial situation. Carefulness in word and deed and absolute refusal to be stampeded by mere alarmist reports, may not only save the situation, but also serve to put our commerce on the firm basis that provides regular and conservative expansion.

Editorial Notes

THE announcement is made that the output of the waterworks plant at the Island, Toronto, will be increased from 40,000,000 gallons per day to 100,000,000 per day. The work will be undertaken probably next spring. If the experiment at west Toronto combining mechanical and slow sand filtration is a success, the process will likely be adopted in the equipment of the extension.

* * *

HOW trade is welding together the nations of the world is seen in the difficulties of some building trades in the American Republic. Since the Balkan war not a shipment of Grecian marble has been received. The Greeks have been too busy to bother with their quarries. Consequently a number of large contracts are being held up because the builders cannot get the grade of marble required for inside finishing and decoration.

* * *

THE attention of the readers of the Contract Record is called to several letters published in this issue bearing on the question of deposits with tenders. The letters are from prominent contracting firms and show the interest that the discussion has aroused. Several of the firms seem to recognize that there is a real difficulty involved in the question and that the required deposit may be a serious matter for some contractors. Solutions for the difficulty are suggested and no doubt some benefit will result from the discussion.

* * *

WINNIPEG is looking for a new water supply. The water now used has a temporary hardness of 150 to 170 parts per million and double that of permanent hardness. A board of engineers appointed in 1907 recommended a filtered supply from the Winnipeg River, but no action was taken. A new board consisting of Mr. R. Hering and Mr. J. S. Fuertes, of New York, and Mr. E. P. Stearns, of Boston, will report on the possibility of getting a supply of softer water from Lake Shoal which is really the western part of the Lake of the Woods.

* * *

EGYPT stands as the permanent expression of what engineering skill can accomplish. Prior to the advent of the British engineers the country was wholly dependent upon the uncertain rise and fall of the Nile. The areas under cultivation depended entirely upon the extent to which the river overflowed its banks. The building and enlarging of the great Assouan dam and the establishment of a system of irrigation has given an assurance of regular harvest and made possible a constantly increasing area of cultivation. At the present there are over one and a half million acres of cotton producing land. But this is not all. A second dam is to store the waters of dangerously high floods. Further, some manufacturing is contemplated, the reservoir supplying the necessary power. As one would expect, Lord Kitchener in his very able report announces the formation of a Main Roads Department to study and develop the highways. So much for British rule and the British engineer.

New C. P. R. Double Track Tunnel

The activity of the C. P. R. is seen once more in the announcement of Mr. J. G. Sullivan, Chief Engineer of the Western Division, that the Selkirk mountains are to be pierced by a tunnel 5 miles in length. This is one of the largest contracts given in recent years and involves the expenditure of several millions of dollars. The Canadian Pacific engineers look upon the tunnel scheme as a work of the greatest importance and expect that it will effect a very marked saving in the expense of transportation. The tunnel will shorten the line by 4½ miles and will reduce the elevation that the trains are required to be lifted now by 540 feet and will save 2,400 degrees of curvature. As a result of this undertaking there will be but one stretch of 2.20 grade against westbound traffic from coast to coast. The tunnel will enter the Selkirk mountains on the east end in the valley below Bear Creek Station on the present line and will come out at the loop. The contract has been let to Messrs. Foley Bros., Welch & Stewart, of Vancouver.

Philadelphia's Fight Against Water Waste—Splendid results have already been obtained by Director Cooke in his fight to reduce the waste of filtered water in Philadelphia. Instead of being strained to their capacity, the filter plants, due to the lessened demand, are being operated under much more favorable conditions, both as to wear and tear and to coal consumption. In West Philadelphia the consumption rate has been cut from 170 to 125 gals.

Deposits With Tenders—Discussion Continued

Deposit Advantageous to Neither Party

Editor Contract Record,—

In answer to your communication of the 20th inst. I may say that I never could see why a large deposit should be demanded from a contractor along with his tender.

Most advertisements calling for tenders for work reserve the arbitrary right to the party calling for same to reject the lowest or any tender. Reserving such right to deal with the tendering as he sees fit the owner has it in his own power to make all necessary inquiries with regard to the ability and reliability of the tenderers and if any of these appear to him objectionable on any ground whatever, all he has to do is to turn down such tender.

Then so far as the tenderer is concerned it is an undue burden on him to have his capital tied up by the furnishing of a large deposit which may be held for a long period with no results but the loss of the use of this capital. Again, the size of the deposit demanded with the tender on large work sometimes leads to the contractors getting together before tendering, to the detriment of the party calling for the tenders.

Altogether I see no adequate advantage to either party in demanding a large deposit with the tenders to balance the positive disadvantage to the tenderer and possible disadvantage to the other side.

Yours truly,
The Constructing & Paving Co. of Ont., Ltd.

Practice of Bidding Criticised

Editor Contract Record,—

The question you raise has not been of very great interest to me. It seems to me that so long as proprietors can entice contractors to bid (or make bets with them) on how cheap they can do a piece of work, the added inconvenience of furnishing the guarantee is a very small matter. You do not appear to be interested in the great number of people who are experts in letting contracts to the lowest bidder, knowing that he cannot do the work with any possibility of profit. There are some people who take a delight in this kind of game, although if they were asked to make a speculative quotation on the goods they handle, they would think that someone was trying to be smart with them. This kind of people manufacture or stock goods or parts and add some work to them and afterwards add a profit. When this is done the goods are offered for sale not to the "lowest bidder." All the exigencies and contingencies and responsibilities are loaded on him, while the purchaser stands back and laughs at his struggles and takes a lot of labor for which he has not paid.

I suppose this kind of thing must go on until the purchaser is willing to pay the cost of the work plus a certain profit for the services of a responsible contractor whom he can choose before offering the work.

In your issue of June 18th on page 62 is an article evidently inspired by a Surety Company giving the outline of a very dishonest method said to be practised by contractors. In twenty-six years experience I have never had an opportunity of being one of a number in such a case, and I do not think the publication of such a plan is following out the purposes of your paper. I am of the opinion that some of the methods of surety companies for obtaining premiums are quite as reprehensible.

Yours truly,
A Contractor.

Commends the English Sytsem

Editor Contract Record,—

I have before me your letter of the 21st inst. regarding the Canadian system of requiring an excessive deposit with tender. I am very glad to note that you have taken this matter up, and I trust that you may succeed in bringing into effect the English system. You understand that at the present time Contractors are not only required to make, say a 5 per cent. deposit with tenders, but they are also required to pay an inspector, appointed by the authorities to see that their specifications are carried out, and in addition to that the authorities, in most cases, hold back 20 per cent. of the work done, for a period of months after the work has been completed, as a guarantee. This, I consider is very unfair. If the authorities make the specifications and appoint an inspector to see that they are carried out, why should the Contractor put up a cash guarantee?

What I would suggest would be that the authorities ask for a deposit not to exceed the expenses connected with the calling for tenders, and that an estimate be paid the contractors at stated times, to within 10 per cent. of the cost of the work done, and upon completion of the work the contract price should be paid in full.

I believe that if that plan were followed, the cost of construction would be greatly reduced.

Yours very sincerely,
Canadian Contracting and Construction Company.

Favors Guarantee by Bonding Company

Editor Contract Record,—

We believe that the submission of tenders on municipal and government work and on important private operations should be accompanied by a guarantee of ability on the part of the firm tendering, to carry out successfully the intent of their tender, but we are in favor of a bond issued by any responsible bonding company rather than a certified cheque and this in every instance.

Our reason is the low cost of the bond which serves exactly the same purpose as a certified cheque and does not tie up any portion of the working capital of the firm submitting the tender.

If the use of the certified cheque is to be continued, it is our idea that in all justice to the firm submitting the cheque that it should be returned upon the award of a contract and its place taken by a bond covering the successful completion of the work.

We also think in this connection, that the use of individuals or firms other than those in the bonding business for the purpose of guaranteeing the completion of any contract should absolutely be discontinued and prohibited by law for reasons that are obvious.

Yours very truly,
The A. B. Ormsby Company, Limited.

The city of Nanaimo, Vancouver Island, B.C., has been connected with the mainland by means of a telephone cable. The terminals of the line are at Nanaimo and Vancouver. The work covered a field involving the preparation of a 32-mile cable, careful soundings of the Gulf of Georgia and the preparation of the ship and the construction machinery to obtain a careful and uniform dropping of the cable. The task was accomplished without a hitch and it is expected that the convenience resulting will be of the greatest benefit to the business men of the Island of Vancouver.

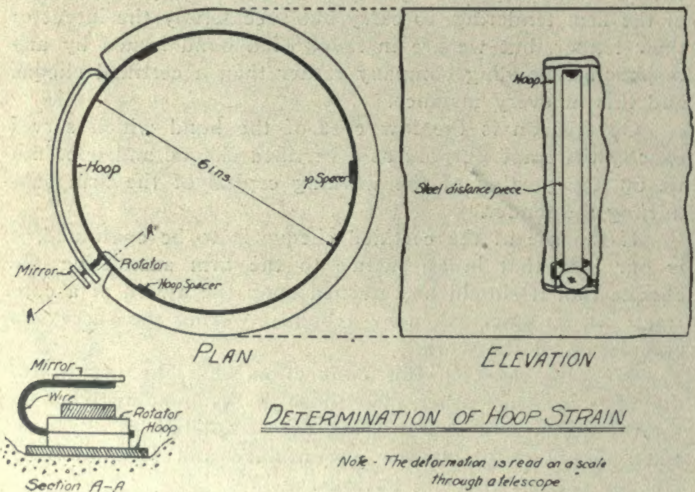
Reinforced Concrete Columns*

Restrictions Too Severe—Ideal Conditions For Strength —Tests on Hooped Concrete Columns — Inferences.

By Peter Gillespie, Associate Professor of Applied Mechanics, University of Toronto.

The growth in the use of reinforced concrete constitutes the greatest epoch in engineering of the present generation. The comparative cheapness of this material, its fireproofness, its adaptability and the general satisfaction which has attended its use where the design has been careful and the work reliable, have given it an increasing popularity. While it occupies a narrow but a growing field in the realm of aesthetics, its applications in constructive art per se are legion. Of it, beams, slabs and columns, and tension members even, have been constructed. These elements have been fabricated into warehouses, factories and dwellings; dams and retaining walls; standpipes, pressure mains and sewers; viaducts and bridges. So rapid indeed has been the progress that none but the experts have been able to keep pace with its advancement.

The concrete column has not, in my opinion, been accorded in building regulations the consideration it deserves. The demands of ultra-conservative building codes have been such that its use has been all but prohibited, because of the excessive size and cost required notwithstanding the fact that actual failures of structures due to collapse of concrete columns have been exceedingly infrequent. It seemed likely, however, after a number of preliminary tests had been made and analyzed, that the rich mixture concrete promised economics not afforded by the leaner grades, and in consequence, the columns to which the following remarks especially apply were a series made of a 1-1 mixture, the ingredients being equal volumes of cement and crushed stone of size three quarter inch and smaller. Some of these were plain, some were reinforced with longitudinal steel and some with welded steel hoops. They were tested at the age of six months.

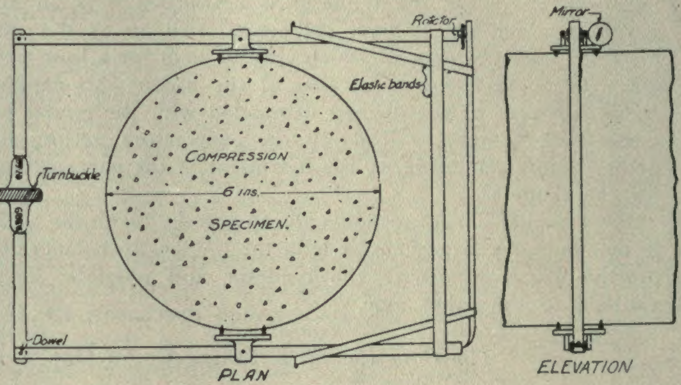


DETERMINATION OF HOOP STRAIN

Note - The deformation is read on a scale through a telescope

Fig. 1

Like all other materials of construction, concrete possesses to a greater or less extent the power of recovering after stressing its original size and shape. In this respect it bears some resemblance to steel, but unlike the latter, its elastic properties are very variable. Its rigidity may vary from one-fourth that of steel to one-fortieth, while its strength in compression may lie between one-twelfth and one-one hundred and twentieth of that of the metal. Ordinary 1-2-4 concrete has a strength in compression of about 2,000 pounds per square inch and a modulus of elasticity of about 2,000,000 pounds per square inch, so that it will be apparent that its strength, relative to steel, is one to thirty, while its rigidity or stiffness compared with the metal is one to fifteen. In consequence, in composite members where the two materials compress together, the stress in the steel will be fifteen times as great as that in the concrete, and the factor of safety of the former will be double of that of the latter. This will indicate one essential difficulty in employing longitudinal steel economically in combination with concrete in columns. Clearly, the ideal condition will occur when the relative strength ratios of the two materials are equal to their stiffness ratios. The extent to which this desideratum has been realized in the rich mixture column will be presently seen. Another circumstance is that at current prices of ordinary concrete and steel, a load in compression can be sustained by the former at about half the cost incurred when the latter is employed.



DETERMINATION OF POISSON'S RATIO

Note - The deformation is read on a scale through a telescope

Fig. 2

The actual crushing strength developed at the age stated above was, in the average, well over 5,000 pounds per square inch as may be seen from the following table. This in my opinion should warrant a working stress in compression of 1,250 pounds per square inch. This will insure as wide a margin of safety as that afforded when the ordinary grade of concrete is stressed to the extent permitted by common specifications.

Crushing Tests on Rich Concrete

Specimen	Crushing Strength
A	4,900 pounds per square inch

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* From the Journal of the Regina Engineering Society.

B	5,975	"	"	"	"
C	5,510	"	"	"	"
D	6,160	"	"	"	"
E	4,120	"	"	"	"
F	5,480	"	"	"	"

Columns of the aforementioned mixture, as stated above, were made and tested and accurate observations as to shortening under load were made. One of the most striking features in all cases was the remarkable manner in which the proportionality of stress to deformation obtained up to, and exceeding in many cases, stresses of 2,000 pounds per square inch. Any one who has studied the records of tests made on columns of the ordinary grade of concrete will recall how, as the stresses increase, the deformations increase also, but at a much greater rate, so that perfect recovery, except for low stresses, is impossible to attain. The following record gives the co-existent stresses in steel and concrete in a few instances of longitudinally reinforced columns of the present series. It will be observed that the factors of safety for concrete and steel are four and six approximately, assuming ultimate strengths of the two materials as 5,000 and 60,000 pounds per square inch respectively.

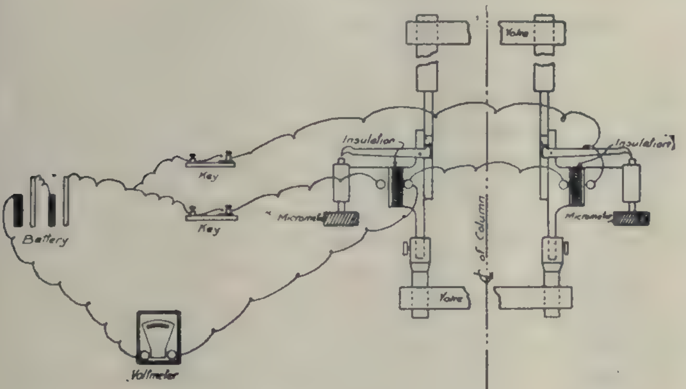


DIAGRAM OF COMPRESSOMETER DEVICE

Fig. 3

Simultaneous Stresses in Concrete and Longitudinal

Designation	Stress in Concrete	Stress in Steel
M	1,250	9,000
H	1,250	10,300
N	1,250	10,040
R	1,250	10,100
O	1,250	11,500
P	1,250	10,300
Average	1,250	10,200

This is a decided improvement over what would have resulted had the ordinary mixture been employed. In other words, through the utilization of the richer mixture, it is possible to secure a working stress for steel one-third higher than the usual one in longitudinally reinforced columns. The magnitude of the set after stressing was also very much less than when the poorer mixture was employed.

The function of hoops in columns is to resist the lateral expansion or dilation which occurs when a load is applied. If there were no lateral dilation manifestly there would be no necessity for hoops. It is probably not possible to correctly express the relation between the hoop stress and the axial compressive stress in a formula. The physicist, however, on the assumption that the core of concrete in the column behaves somewhat as a fluid would under similar circumstances, has evolved an equation which purports to give this relation. The equation:

$$\frac{f}{c} = \frac{2\,nq}{2 + p\,(n - nq)}$$

in which
f is the tensile stress in the hoops;
c is the axial compressive stress in concrete;
n is the ratio of rigidity of steel to concrete;
... is Poisson's ratio, or the ratio of diametral strain to logitudinal strain, and
p is the ratio of steel to concrete in the section—

gives the relation. In $n = 9$ and $q = \frac{1}{4}$, as was found experimental for this material, the equation becomes

$$\frac{f}{c} = \frac{9}{4 + \frac{27}{2}\,p}$$

It is thus seen that for given materials, f/c varies only with the quantity of steel present, and since p is generally small with respect to the constants involved, the variation in f/c is between narrow limits for most cases that are likely to occur. It will be seen that the ratio is in the neighborhood of 2, which means that, theoretically, the tensile stress in the hoop (for ordinary values of p) is only twice the axial compressive stress in the concrete. The experimental determinations were, in the main, confirmatory of this, as will be seen from the following:

A group of columns after testing.

Comparison Between Experimental and Theoretical Values of f/c

Column	c.	f.	f/c (Actual)	f/c (Theoretical)
A	1,500	2,600	1.73	1.88
B	1,500	3,700	2.46	1.88
C	1,500	2,700	1.80	2.04
D	1,500	2,200	1.46	2.03
E	1,500	2,600	1.73	2.03
Average			1.84	1.97

Another feature of interest is the occurrence of what may be designated the "residual stress" in the hoops. The loading in all cases was repeated several times.

After each release, it was observed that the steel had not quite recovered its former shape as was evidenced by the incomplete backward movement of the mirrors. Moreover, this residual stress appeared to be cumulative. For instance, in one case, the amount of residual tension in the bottom hoop of one column, after the first application of load had been released, was found to be 400 pounds per square inch while, after the second loading, it was found to be 1,800 pounds per square inch. Indeed it would seem as though the residual stress were some function of the next preceding maximum stress. It must be remembered too that after a resetting of the instruments, any residual stress in the metal would not be apparent and that whatever residual stress was observed after release or load would have to be regarded solely as an increment to whatever existed prior to the last previous stressing.

The significance of the phenomenon of residual stress will be apparent. If each successive loading augments the hoop stress left from the last preceding loading, clearly a time must come when the metal will be stressed to the point of rupture. This was tested experimentally in one instance and the result confirmed the belief that such is the case. A portion of column E, which had previously sustained a load of 247,000 pounds (diameter 7 inches), was placed in the testing machine after the ends had been carefully ground to a true plane. After four repetitions of the relatively moderate load, 180,000 pounds, the second hoop from the top burst and on the fifth application the upper one severed also.

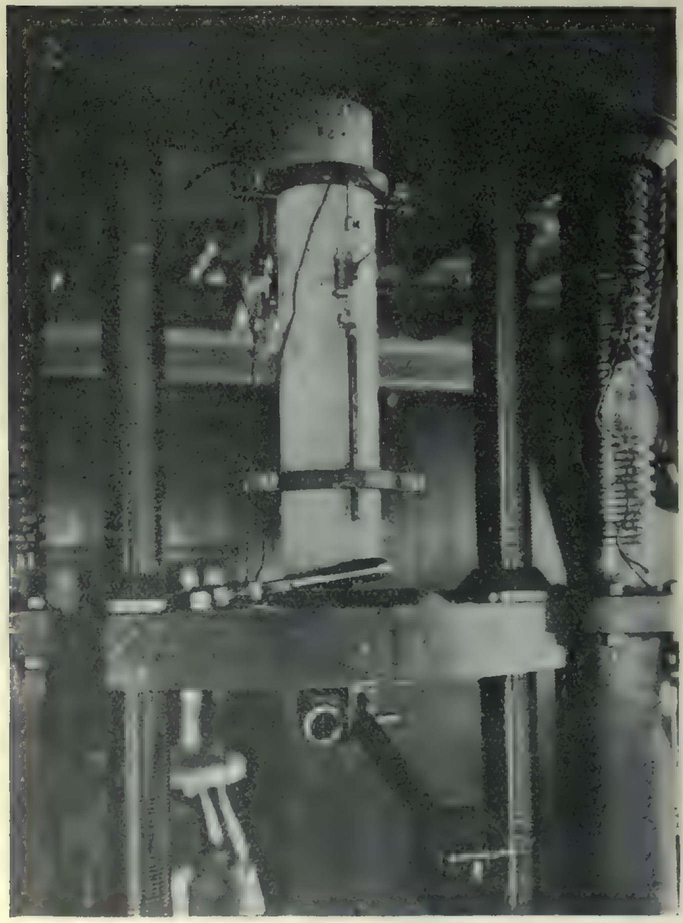

Arrangement of testing apparatus.

Figure 1 shows the manner in which the intensity of stress in the welded steel hoops is measured. It will be seen that a swelling of the concrete of the column and the consequent dilation of the hoop which encloses it will cause the mirror to rotate. The extent of the movement is caught on a graduated scale and from this the stress is computed. In figure 2, the method of measuring Poisson's ratio is shown. Again, the magnitude of the diametral dilation is read on a scale through the rotation of the mirror. The extent of the axial shortening is simultaneously observed by the mechanism shown in figure 3. The bicrometer screw and electric contact are here employed. Figure 4 shows in plan and elevation typical methods of reinforcing concrete columns.

Tests made by Professor Talbot in 1907 on hooped concrete columns using a 1-2-4 mixture, showed that the ultimate strength was increased about 669 pounds per square inch for each per cent. of hooping employed. Similarly, tests made at the Watertown Arsenal in 1906 show that one per cent. of metal in the form of hoops increased the strength of the member to the extent of 1,020 pounds per square inch. Professor Withey, in 1909, reported that for each per cent. of metal employed in the form of spiral reinforcing, the increase in ultimate strength on an average was 1,320 pounds per square inch for 1-2-4 concrete. From the above and from other tests which might be cited, it would seem as though an additional ultimate strength of 1,000 pounds per square inch for each per cent. of hooping present might be figured on.

Some years ago I made a few comparisons between the costs of columns of various materials capable of sustaining a specified load, taking the market prices of the place and time as a basis. While these prices cannot possibly apply to conditions to-day in the Canadian West, yet the conclusions would not be seriously different from what the investigation then led to, and so I propose to repeat them here. The materials laid down were assumed to cost as follows:

Cement, per barrel	$1.50
Aggregate, per cubic yard	2.00
Sand, per cubic yard	1.00
Plain reinforcing, per pound	3c
Hooping, fabricated, per pound	5c

For a 1-1 cement and rock mixture, the cost per cubic yard will be:

Cement	$8.10
Rock	1.58
Labor	1.00
Plain steel, ½ per cent.	2.03
Total	$12.71

Since the metal is added chiefly as emergency material, it will not be figured in the ultimate strength which will be taken at 5,000 pounds per square inch. A 1-2-4 concrete (the ultimate strength of which, plain, may be assumed at 2,000 pounds per square inch) will be rendered equivalent in strength to the 1-1 mixture by the use of 3 per cent. of hooping metal. The cost per cubic yard will then be:

Cement	$2.35
Rock	2.00
Sand	.50
Steel hoops	20.25
Labor	1.00
Total	$26.28

In addition to the greater cost, a column of this mixture will not possess the stiffness and probably not the margin of safety against bending stresses which are found in the cheaper column.

In order to compare the areas of three different types of column, and their cost per foot of length, it will be assumed that a 10-storey building with dead and live floor loads at 200 pounds per square foot and a roof load of 100 pounds per square foot is to be constructed. Assume also square floor bays of 15 feet on a side.

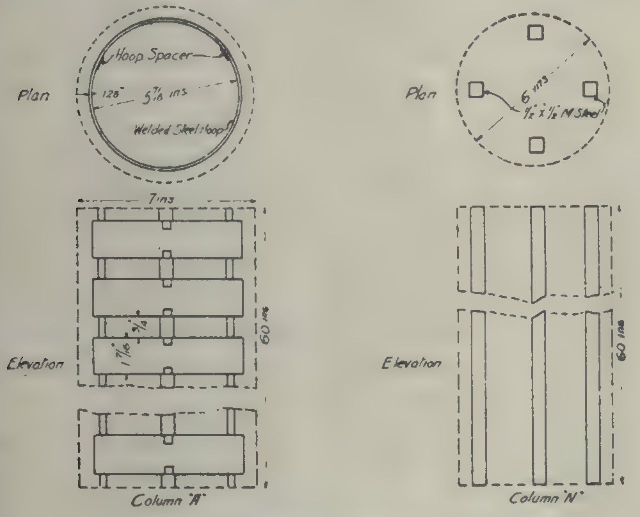
It will be seen that the load sustained by a column on the ground floor will be 427,500 pounds. This may be carried:

(a) By a steel column;
(b) By a column of the poorer grade of concrete;
(c) By a column of the richer mixture.

A reference of the Carnegie handbook, p. 141, shows that a steel column consisting of two 10-inch channels and two ⅞ inch plates will be adequate. This column weighs 121 pounds per running foot. The cost per foot of height will be:

Steel at 5c per pound	$6.05
Fireproofing, 2 inches thick	.58
Total	$6.63

A 1-2-4 concrete column with 1 per cent. of longitudinal metal will be figured at 450 pounds per square inch for the concrete and 450 × 15 = 6,750 pounds per square inch for the steel. The average stress will, therefore, be 450 (1 + .14) = 513 pounds per square inch. The gross area required will be 427,500 ÷ 513 = 833 square inches.



TYPICAL REINFORCEMENT FOR COLUMNS.

Fig. 4

Hence a column 29 inches square will be adequate. Allowing one inch additional for fireproofing, there results a column 30 inches square, the cost of which, per foot of height, would be

Concrete including 1 per cent. steel and labor.	$2.55
Forms	.46
Total	3.01

The third method employs a 1-1 mixture, the working stress on which will be taken as 1,250 pounds per square inch. The area required with be 427,500 ÷ 1,250 = 342 square inches. This is the area of a square of 18.5 inches to the side. Allowing 1½ inches for fireproofing, a column 20 inches square is obtained, the cost of which per foot of height with one-half of one per cent. of longitudinal steel would be:

Concrete including ½ per cent. of steel and labor	$1.30
Forms	.32
Total	$1.62

The areas of the cross-sections in the three cases are:

(a) 1.8 square feet.
(b) 6.3 square feet.
(c) 2.8 square feet.

It is thus seen that the difference between the smallest cross-section and the largest is 4.5 square feet, an item of considerable importance in districts where the rental of floor space is high. On the other hand, the difference in cross-sectional area between the most expensive method of carrying the load, and the cheapest is 1 square foot. Having regard then to the fact that the rich mixture column costs only one-fourth as much as the steel structure there would seem to be a good deal to be said in favor of the stronger mixture.

Inferences

Your consideration is invited to the following inferences to which the data at hand seem to lead:

(1) For a 1-1 mixture, a working stress of 1,250 pounds per square inch seems to be justified:

(2) The rich mixture is more uniform in its elastic properties than is the lean mixture, and for proportionate stresses the permanent stress is likely to be much less.

(3) The use of steel longitudinal for reinforcing columns gives an increase in strength very much less than the proportionate increase in cost.

(4) The porosity at the top of the column is likely to be a source of localized weakness.

(5) The employment of a rich mixture in columns permits of the more economic stressing of the steel longitudinals.

(6) The stress in steel hoops appears to be approximately twice the axial compressive stress in the concrete core.

(7) An approximate increase in ultimate strength of 1,000 pounds per square inch for each per cent. of metal employed may be figured on for hooped columns in excess of that existing in plain columns of the same mixture and age.

(8) Owing to the pseudo-plastic condition of the concrete within the hoops, the reinforcement does not completely recover its unstressed conditions after the removal of load. The residual stress resulting is probably augmented by each successive load, and finally rupture of the hoops occurs.

A chimney of unprecedented size has been built at the smelter plant of the Boston and Montana Consolidated Copper and Silver Mining Company, near Great Falls, Montana. It is 506 ft. high above the top of the foundation ring, and 50 ft. in interior diameter at the top. It is the highest in the world by about 40 ft., and the highest in the United States by 140 ft., the Eastman Kodak chimney being 366 ft. high, and the Orford Copper Company's chimney being 365 ft. Its discharge capacity is 4,000,000 cubic feet of gases per minute, with a draught of 3¾ in. water expected with gases at 600 deg. Fahr. average. The height was governed solely by the draught requirements, and not by the desideratum of discharging high enough in the air to prevent creation of a nuisance. This latter requirement is met by the existing stack, which is but 186 ft. high, the city of Great Falls being 500 ft. lower than the table land, and the valley being 250 ft. to 300 ft. lower.

Modern Principles of Machine Shop Design

THE laying out of machine shops must depend on the area, the shape of the ground available, and the nature of the product manufactured by a firm, says Industrial Engineering. The aim should always be to avoid handling materials and products more than is absolutely essential. To this end certain relations of shops to each other, and to railway sidings or canals, will have to be observed, in addition to the internal designs of the shops, the placing of heavy and light machines therein, and the systems of industrial railways and dispositions of hoisting machinery; so that the main problem includes much detail that varies with the requirements of different classes of manufacture.

With respect to the relative positions of shops as affecting the handling of work, two general cases arise. One is that of concentration in a few buildings, the other their isolation in separate buildings. In a large degree the choice between these depends on the size of a concern. The larger it is, the more desirable does the isolation of shops and of departments in shops become, partly because the necessities of supervision, partly of those of higher specialization. A small firm can carry on its machining and assembling work all under one roof, in charge of one foreman. A very large works must not only separate these departments, but must also create sub-departments in each, for light and for heavy work at least; and very often further sections must be arranged according to the class of machine used, as planers, drills, gear cutters, grinders, and so on. Then the question arises whether all these shall be included in one large shop covered by one roof, or be housed in separate buildings or on distinct floors, which can be decided only for each individual firm. Speaking broadly, the present tendency is towards isolation where the work done is of a sufficiently standardized and repetitive character to justify it.

Economic Hauling

But whatever arrangements are adopted, the cardinal element of economical haulage and handling must not be lost sight of. Raw materials—bars, castings, and forgings—should be taken in, and should, with the articles manufactured from them, not return on their tracks, but should progress from shop to shop, or department to department, in orderly sequence; and this idea must be uppermost when locating the positions of those departments in which preparatory work has to be done, as the casting, forging and plating departments, and the stores for iron and steel. Raw material should, as a rule, be utilized first nearest the point of debarkation. The heavy machine shops into which castings and forgings have to be taken should be located nearer to the foundry, forge shop, or boiler shop than the department in which light work has to be done.

It is well as a rule, when work is for the most part heavy, to conduct operations so far as possible on the ground level. There is, however, always a proportion, greater or less, of light work, and this can well be conducted on upper floors, or in galleries running round a shop, the latter usually having preference. In shops in which most of the work is light, as in the manufacture of small motors, brass fittings, and articles of similar bulk, floors and elevators can properly be utilized. But lack of light renders fine work difficult on dark days, and runs up the bill for gas or electricity.

Instead of building in the heart of a crowded city, most new factories are now erected in the suburbs of cities, or out in the country where ground is cheap and room for extension is ample, and where healthful cottage homes can be built for the workmen.

The arrangement of shops on a ground floor only is the modern ideal in factory design, and it is one which is admirably suited for engineering works. The work being mostly of a heavy character, its manipulation is awkward on upper floors, but if it can all be dealt with on a ground floor it can be run in and out, handled with hoists and cranes, while all the trouble of lifting and lowering from upper floors is avoided. Supervision, again, is easier on one floor than on several. A manager or foreman can have more men under more effectual observation, whereas different floors require either extra foremen or divided attention. Hoisting machinery can be more efficiently installed on a ground floor shop than in a building of several storeys.

Character of Buildings

With regard to the buildings themselves, it is better and cheaper to build one-storey shops than those with several floors. The walls, having no floors to carry, need not be so thick, and there is no expense for heavy joists, floor planking or concrete. More light can be admitted from the roof than from windows in walls, and a north light can be obtained with a saw-tooth roof, which avoids the direct glare of sunshine. With regard to the walls, in most engineering works they are made to fulfil other functions besides that of sustaining the roof. Details which have to be considered are the support of travellers and jib cranes, of main lines of shafting and counter-shafts, and sometimes of machines, such as wall planers, drills, etc., in whole or in part. Brick walls alone are not nearly so suitable for the fulfilment of these functions as are metal columns. This is one cogent reason why columns are generally preferred to brickwork, and it is all in favor of the ground floor shop in which columns take the place of brick walls as supports, the wall often being a mere filling in of a brick course, or even sometimes of sheet iron, between the columns.

Further, the modern shop ideal is to have an unbroken width across two, three, or half-a-dozen bays. Each bay has its own roof, but the bays are separated only by columns, which leave clear wide spaces across the entire width that is enclosed by the outer walls. The columns, of cast iron or structural steel, are made to suit exactly the requirements of the shop, with flanges and brackets to receive the gantries of overhead cranes, the pivots of swinging cranes, bearings for shafting or countershafts, and attachments for wall machines. In the event of future shop extensions these bays can be carried out lengthwise by making more identical columns, preserving the uniformity in width and height of the shop. In a well-lighted shop built on this model there is no objection to the erection of galleries of moderate width, provided they do not interfere with the employment of suitable hoisting tackle. They would sometimes block the way of an overhead traveller, but the latter is not required in light departments. Moreover, galleries need not occupy all the length, and they may be raised higher than the crane gantries. Where space is limited the galleried shops often offer the best solution of a difficulty.

Hoisting Machinery

Hoisting machinery is a costly item, and one in the laying down of which the best judgment is required. There are so many systems of hoisting adopted now that it is difficult to give statements of general application. But the following considerations should have weight. In the shops themselves the choice lies between overhead tracks with hoists, overhead travellers, and walking or single-post cranes. The choice of the first two should be favored because they leave an absolutely clear way beneath. But many firms employ the walking cranes, especially in machine shops. Wall cranes will often be needed both for light loads and the local service of heavy machines. Floor trolley tracks are often used. In the yards there should be travelling steam or electric cranes to go wherever required for unloading or loading, for hauling or pushing, in the absence of a yard locomotive.

The hoisting mechanisms for light service which run along the overhead tracks may be divided into two great groups; those which are trolleys only, having eyes from which the actual hoisting machines are suspended, and those that combine the travelling and hoisting tackle in one. The first-named are mostly of the direct lift types, worked by hand, pneumatic, or hydraulic power; the second are electrical. In the hand hoists pulley blocks are suspended from trolleys pulled along by hand. In the pneumatic and hydraulic types the movement of a piston or ram in a cylinder is equal to that of the lift. In electrical hoists toothed gears, drum and wire rope are employed, driven by the motor located on the trolley. The movements of the latter may be controlled from a distance, but more commonly dependent rods with handles are employed, so that the men standing by their loads can operate the hoist from the floor. So extensive are these developments that several firms in England and America make a specilty of the fitting of overhead tracks and light hoists for them. For heavy duty overhead travelling cranes are practically universal. They are made in many styles and powers to suit all conditions, operated from above and from the floor, and as a rule now each motion is provided with its own separate motor.

Alternative to the overhead tracks are the walking or single-rail cranes, which have for a long time been favorites in the machine shops of the Manchester district and north country shops. They occupy only the room in which they happen to be engaged for the time being, and the single line of floor and overhead rails does not block the shop much. As they are slewing jib cranes, they cover an area corresponding with the entire sweep of the jib.

Floor Trolley Tracks

The question of floor trolley tracks is often difficult of settlement. Where they come into rivalry with overhead tracks is in the handling of work seldom exceeding from one to two tons in weight. The advantage of the overhead system lies in the fact that the floor is left clear. It is not desirable to occupy a shop floor with tracks where heavy articles are being handled, or where the area available is not ample, or in a small shop or department where the work is all of a very light character. All such areas are best served either with overhead travelling cranes or with overhead tracks with hoists, supplemented, if need be, by swinging cranes to serve heavy machines. The ideal arrangement is to run the floor trolley lines up to the entrance of the department or shop, so making connection between it and the outside, but to serve the shop area with overhead tracks. Another objection to tracks in some shops is the presence of turntables. Speaking generally, the fewer of these the better. They can often be avoided by making connections with curves of large radius and switches.

The altruistic side of a works is not neglected in shops that are built now. In the best shops every man has his seat in the dining room, a wash basin, and a reserved and numbered locker. In some a regular kitchen and chef are provided and the men are supplied with properly cooked meals and various drinks at cost price.

A GROWING interest in the subject of preserving timber against decay is being manifested by the users of railway ties. This is largely due to the rising price of woods such as cedar, which resist decay without any special treatment. A British firm has recently established a large plant, 28 acres in extent, at Fort Frances, Ont., for preserving ties by means of zinc chloride with the addition of sulphate of alumina to prevent leaching. The prepared solution is forced at high pressure into thoroughly seasoned lumber, so that it permeates every part of the wood, and being aqueous, readily mixes with any slight moisture that may lurk in the inner pores. Wood treated in this manner has been reduced to sawdust, washed for over an hour, and yet still contained a large proportion of zinc chloride. This compound has the further advantage, as compared with creosote, of cheapness, and of being colourless and odourless. Moreover the preserved wood may be painted or polished.

The causes of destruction of railway ties, in order of importance, are decay, mechanical wear and insect pests. Treatment with zinc chloride or creosote will so overcome decay as to more than double the life of a tie, and will keep away the insect pests entirely. Mechanical wear may be reduced by the use of flat tie-plates of either metal or hardwood to lessen the cutting of the rail base, and of screw spikes to minimize the wear due to spike pulling. Though at present such devices are not common outside of Europe, yet with the growing employment of soft woods such as jack pine and spruce, some such precautions will shortly need to be adopted in Canada, perhaps with the anomalous result of giving us a safer track.

In good practice it might be best to give the number of square feet superficial of wall, and give the thickness. The same method is adopted with each storey, with its varying thicknesses of walls, every dimension being entered in precisely the same order, with its particular location noted.

When rough cutting to brick work is required, every square foot of it should be measured. Brick work in footings or foundations, or walls below ground or at unusual heights, should be all segregated and given separately, with full descriptions.

Railway Equipment Installed in Canadian Northwest

THE extremely severe winters which are experienced in Northwestern Canada along the route of the new Grand Trunk Pacific Railway have caused the railroad engineers to devote considerable time and study to the question of a suitable water supply for locomotives which would be available at all times. In addition to the extreme cold which would freeze solid a small outlet pipe in an ordinary locomotive supply water tank, there is also great danger of forest fires, so we may say that the conditions to be met are,—

Steel railway water tower, used on G.T.P.R.R. capacity 100,000 gallons

Typical railway tank with spout, capacity 50,000 gallons

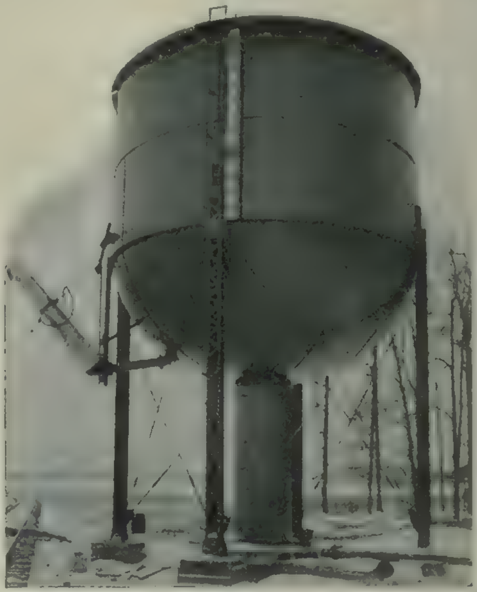
(1) Absolutely certain storage with no danger of leakage or bursting of tank.

(2) Water must be available at all times—i.e., must be protected from freezing.

(3) Storage tank must be fireproof.

It was first agreed by the Grand Trunk engineers that the only structure which would be water tight, fireproof, and permanent was a steel water tower. But an ordinary water tower would not do. Provision had to be made for heating the water in winter, so the leading manufacturers of steel water towers were called upon to submit suitable designs for this work.

We show herewith the photograph of a structure similar to the twenty-nine which the Des Moines Bridge & Iron Company of Pittsburgh, Pennsylvania and Des Moines, Iowa, are building to meet these conditions. Each tank is constructed entirely of steel. The most interesting feature from an engineering point of view is the heating system. The tank is built with a large rivetted steel riser pipe, six feet in diameter, which is constructed to provide for the expansion and contraction induced by the temperature changes in the supporting tower or columns. At the base of this riser pipe is a roomy concrete heater chamber in which may burn either coal, gas or oil. Four 2-in. hot air pipes run from this stove up through the tank to a ventilator in the roof. This hot air system is sufficient to keep a circulation in the tank and outlet pipe during the most severe winter weather. The heater chamber also serves as a valve house from which the tank may be cleaned of any sediment which collects in the water and accumulates in the large riser pipe.


Large railway water tank, capacity 56,000 gal. height to bottom 17 ft. 10 inches

The contraction and expansion of the supporting tower may be provided for conveniently at one or two places, either at the connection of the riser pipe to the tank bottom by means of a water-tight expansion or slip joint, or as in the case of the new structures for the Grand Trunk Pacific Railway, by allowing the entire six foot riser pipe to move on the outside of the concrete heater chamber at the base. The latter method suspends the riser full of water from the tank bottom which would not be possible in the case of a water tank on a high tower. On the contrary, the method of using a properly designed expansion joint may be applied to any structure whatsoever, and for this reason, would appeal to the engineering profession. A rather interesting example of this is the 150,000 gallon water tower which the Des Moines Bridge & Iron Company is building at present for the Department of Public Works, Province of Manitoba to be used at the Agricultural College at St. Vital, Manitoba. This structure has a six-foot diameter riser pipe which is 125 feet high and the expansion is taken care of at the connection to the tank bottom by means of a special diaphram expansion joint.

The installation of steel water towers on the Grand Trunk Pacific, Canadian Northern and in fact all the large railroads in Canada, is a noticeable and significant fact in itself. It proves that these roads are being built and supplied with the most modern and efficient equipment which it is possible to buy. In this respect, the Canadian lines are a step ahead of some of their older neighbors in the United States, but without exception, we may say that the most progressive roads are using only steel structures for water and coal storage, and are rapidly replacing the old, worn-out wooden equipment.

The twenty-nine steel water towers mentioned above as being covered by a recent order placed with the Des Moines Bridge & Iron Company of Pittsburg and Des Moines by the Grand Trunk Pacific, are all being fabricated at the company's Pittsburgh plant. The design and details of construction were approved by Mr. J. G. LeGrand, bridge engineer, Grand Trunk Pacific Railway, Winnipeg, Manitoba.

Difficulties Encountered in Smoke Elimination

SOOT has a two-fold destructive action, first, physical, and second, chemical. An analysis shows that it consists of carbon in a finely divided state which absorbs corrosive acids produced in the combustion of coal containing sulphur; tar which makes it cling and contains carbolic acid; sulphurous acid, sulphuric acid, sulphuretted hydrogen and hydrochloric acid, these corrode metals and attack even stone buildings and decorative substances; ash which settles just as dirt and ammonia and arsenic in very small quantities. Its physical power of destruction consistis in soiling surfaces by depositing carbon and tar, the latter acting as an adhesive for dirt. Through chemical action it destroys by the tarnishing and the corrosion of metals and even by attacking stone, brick and terra cotta. In these days, large business firms display a penchant for erecting fine office buildings and warerooms of costly material and frequently with some pretense of architectural beauty, but business convenience compels these structures to be erected in the proximity to factories and railway lines, much to the detriment both of the material and the external appearance. It is interesting to note the attempts to prevent this destruction through smoke and with this in view we publish an address on this subject by Mr. D. F. Crawford before the 20th Century Club of New York City.

Chief Smoke Producers

The largest proportion of the smoke emitted in any locality where bituminous, or soft coal, is generally used, may be attributed to one source—that is, the stationary boiler which supplies the steam power for so many purposes.

From a point of vantage in almost any city on a cool morning a glance around the horizon will disclose the vapour of steam arising from many buildings, including with those used for strictly manufacturing purposes, many hotels, office structures, stores and apartments. At practically every point where the vapour is observed there is a possible source of smoke emission and where any considerable quantity of smoke arises from sources such as mentioned it may be attributed generally to one cause, namely, the capacity of the boiler plant is insufficient for the work imposed on it.

If a boiler having a capacity of say 100 horse-power is not loaded beyond 75 horse-power there is very little probability of smoke, unless the plant is very carelessly handled. If loaded to its rated capacity, with careful handling, but little, if any, objectionable smoke will be produced. However if the boiler be loaded beyond its capacity, it is difficult if not impossible, so to handle it as to prevent objectionable smoke.

The greater part of the smoke emitted in any of the large cities may be eliminated by insisting that the owners of manufacturing plants and other classes of buildings mentioned provide boilers of adequate capacity.

Next in importance as smoke producers are the many fires used in a city for domestic purposes. Each individual fire produces only a small quantity of smoke but in the aggregate their contribution to the smoke annoyance is very large indeed, but in some cities the smoke and gases from this source exceed that from all others. It is a matter of record that the heaviest black fogs in London occur on Sundays and on Christmas Day, or other holidays when the manufacturing plants are closed. While the smoke from fires used for domestic purposes does not attract the attention as much as that from a large plant, the effect on objects with which it comes in contact is greater on account of the fact that the smoke from small slow fires contains considerably more tarry matter than that from large fires burning at high temperatures. The soot contained in this tarry matter adheres more firmly to the buildings, people, clothing, etc., than does the soot which consists principally of carbon coming from fires of greater intensity.

In the cities which are adjacent to rivers, lakes or harbors, a considerable portion of the annoying smoke comes from the water craft, where the problem of producing a large amount of power with limited space tends to make the boiler plants small in comparison with the work required.

While it is true that locomotives produce a certain proportion of the smoke in localities where they are used, it is a fact that if all of the locomotives in use were to cease making smoke but twenty to forty per cent. of the smoke of cities such as Philadelphia, Chicago, Cleveland and Pittsburgh, would be eliminated leaving from sixty to eighty per cent. of the smoke now existing to trouble us.

The railways of America produce transportation of passengers and freight at the lowest cost of any in the world, and to obtain this result large locomotives and consequently large coal consumption, is necessary and large coal consumption with comparatively small boilers means smoke, as before explained.

The dimensions of the boiler must be confined to the permissible limits of width and height clearance, the length must be made to conform to the limit of practicability, and for these reasons it is impossible to increase the capacity of the boiler. The further reason that the public demands rapid and luxurious transportation makes is impracticable to reduce the work required of each unit.

Destruction Caused by Smoke

The railways are most vitally interested in the elimination of smoke for economic reasons, for while smokeless combustion does not always mean economy, combustion with heavy smoke always indicates loss and as many millions of dollars are spent annually for coal even a small saving per locomotive would make a large sum in the aggregate. The property of the railway adjacent to the tracks such as stations, bridges, signals, telegraph lines, etc., is damaged and deteriorated by smoke, requiring large expenditures for renewals, as well as for maintenance such as painting and cleaning.

The possibility of largely reducing the expenses for these items without reference to the point of view of the aesthetic or personal comfort, has been a sufficient incentive to cause the railway people to give the smoke subject a large amount of consideration.

The railway officers and employees suffer the annoyance caused by the smoke to the same or even greater extent than do the patrons or others who are located near the tracks, as their occupation requires almost continuous proximity to the smoke source.

The personal interest, the interest of the community, added to the possibility of the savings mentioned above, has led to almost continuous study of the locomotive smoke problem. This study has extended over twenty-five years to my personal knowledge, and from the records, many years farther back.

During the last fifteen years I have examined drawings and patents of many devices which were supposed to eliminate smoke, and made personal observations of their performance. Unfortunately, but very few of these were even promising, and if worthy of installation and trial, the results obtained were not such as to warrant using the apparatus in regular service. The Pennsylvania Railroad System has devoted a great deal of attention, and expended a large amount of money, in experimenting with and developing, either on its own account, or in co-operation with representatives of other railways, or the technical societies, devices which gave promise of reducing the smoke from locomotives and in 1910 the management sent a committee of three to Europe to study conditions and results obtained with the various devices and methods in use there, for comparison with the practice in this country.

Many Unsuccessful

For many years devices designed to admit steam or air into the fire-box have been used as a means for reducing smoke, with generally unsatisfactory results. During the past year, however, a device for supplying air to the fire-box was developed and subjected to rigid and painstaking scientific study. Tests were made at the testing plant of the Pennsylvania Railroad, and the results were confirmed by carefully watching the performance of the locomotives in regular service. This device considerably reduces the amount of smoke under some conditions, and the results obtained so far are sufficiently promising to permit extending its use, especially for the smaller locomotives.

During the past nine years there has been developed on the Pennsylvania lines west of Pittsburgh, a device which, up to the present time, is the most promising yet produced for the reduction of smoke, and in fact under favorable conditions, the practical elimination of locomotive smoke. I refer to the locomotive stoker, with which one hundred and fifty-four locomotives have been equipped, and one hundred and forty more are under construction.

With this stoker we have succeeded in greatly reducing the amount of smoke emitted by locomotives in heavy passenger train, freight and switching service. Repeated comparisons of the smoke made by locomotives with and without the stoker show that those equipped with the stoker may be operated with from one-tenth to one-fourth of the smoke made by similar locomotives in the same service without the stoker.

As stated above this is the result of nine years' experimentation and development, but now while the apparatus is sufficiently developed to warrant the trial of a large number, the problem of maintaining, and satisfactorily operating them, with various kinds of coal, is still before us.

What does this mean to you as to reducing the annoyance from locomotive smoke? Only this—that there are now in existence two devices for reducing the smoke which are sufficiently promising to make it probable that the use of them will be extended and that the information obtained from them is likely to lead to the development of others.

In addition to the study and development of mechanical devices for the elimination of smoke, the railways, by additional supervisors and instructors, are causing reduction in the amount of smoke emitted by having more careful firing and handling by the engine man, and are making a comprehensive study of the problem of reducing the amount of smoke about engine houses where fresh fires are made, the smoke from which is the most difficult to control.

All of this shows that the railways are keenly interested in this subject, and in addition thereto the American Railway Master Mechanics' Association has a committee studying the problem, and the railways are also co-operating with the various other associations, and city officials interested.

Of course, one way to eliminate locomotive smoke would be to eliminate the steam locomotive by substituting electric motors. No doubt from time to time the use of electricity will be extended but it must be borne in mind that to do so will require tremendous outlay of capital for the installation, and it does not yet appear, except under the most favorable circumstances that the expenditure will be warranted by the returns. Further, if the railways are electrified there will still remain from sixty to eighty per cent. of the existing smoke to be dealt with.

A careful study of all accidents, no matter what their nature, has been made by the Pennsylvania Railroad, during the past year, and it has been found that probably 75 per cent. of them could have been prevented if the employees had exercised special caution. This has led to the publication of a booklet entitled "Safety Hints and Suggestion for the Prevention of Personal Injury Accidents."

Efficiency of Concrete in Road Work

(Contributed)

Concrete paving material for both city streets and country highways has been developed rapidly in the United States in the last few years, and has proved to be a durable and economical means of solving traffic problems.

The use of concrete for pavements in the case of cities and particularly in the case of large towns, is on the increase. Its success in this capacity has been uniform. Various types of construction have been developed, chief among which are the single course, two course, and reinforced pavements.

The use of concrete as a material for the construction of rural roads promises to develop into the standard type for that class of construction work. It has already been used in a majority of the States in the Union and it has met satisfactorily the demands of traffic, both of the old horse-drawn type and the newer motor propelled type. At the same time it stands out as the one material within financial reach that will provide road service economically for any long period of time.

The road situation is such that far greater sums of money are expended annually on road repair than on the construction of new roads. For example: In 1911, $142,000,000 were spent for road improvement, and of this sum $102,000,000 was expended for repair and maintenance, while only $40,000,000 was expended on new construction. To complicate the problem further there is no system to control the building of the tremendous mileage of roads in the United States, and even many of the States have no jurisdiction over the construction of roads in the various counties and townships. Therefore, the road building is a local, rather than a State or National problem, and the residents of various communities must depend upon their own efforts for the improvements of their roads. Under the present conditions the county is the logical road building unit, and each county must solve its own problems to the best advantage.

Even under such adverse circumstances, when any type of road construction is liable to be improperly built, concrete has shown a remarkable durability and has given road service far in excess of the gravel or the macadam types that are prevalent in the country.

A second phase of the road situation is the necessity of road types that will withstand automobile traffic At the present time there is already an enormous number of automobiles in use on country highways. In the near future the motor truck will undoubtedly come into large use as the means of transporting the country's agricultural products to the city. This will further necessitate the type of road construction that will withstand the ravages of motor propelled vehicles. In this connection it will be noted that the funds previously spent for road types of gravel or macadam will be practically wasted. In 1907 the State of New Jersey had a large mileage of macadam which was well adapted to the horse-drawn traffic of that period, and spent but $600,000 for road repair during the year. In 1908 the charges jumped to $800,000; in 1909, to $1,421,000 and in 1911 to $1,565,000. These increased repair charges were in close proportion to the increased number of automobiles in use in the State. The figures show conclusively that a more permanent type of construction is necessary. Even the later types of bituminous and oil-bound macadam that were built after the European method of construction, in the hope of finding a type less expensive to maintain, were found to reduce the cost of road repair but little, and it came to be conceded by engineers generally in the various counties and states, that brick or wood block paving similar to city construction was a necessity for rural roads.

A concrete road, believed by engineers to be a solution of the road problem in the United States.

In the meantime, however, the road commissioners of Wayne County, Michigan, found a satisfactory solution of the road problem by means of concrete, built in much the same manner that the concrete pavements under brick and granite blocks are built in the cities. Detroit, which is the metropolis of the country, is one of the largest automobile centers on the continent. In general it is the automobile owners who are the keenest advocates of road improvement ,and the automobile interests in Detroit were largely instrumental in the raising of funds for the construction of concrete pavements built in Wayne County.

This brings to light still another peculiarity of the road situation. Without question the agriculturists are the ones who profit most by road improvement and they are at the same time the class that objects most strenuously to road taxation. These Wayne County roads were experimented with at first and when the Board of County Road Commissioners had satisfied themselves that concrete was both adaptable to traffic conditions and sufficiently permanent to be a real economical type of construction they invested $65,000 in the purchase of road building equipment so that the work could be prosecuted advantageously and economically. Almost with the first mile of pavement built, the sentiment among the farmers of the county changed, and there was a demand for more concrete roads over which four or five times larger loads could be hauled. The county bonded itself for $2,000,000 for the continuance of the work, and at the present time Wayne County has eighty miles of roadway that is a distinctly American type, and meets the traffic conditions so satisfactorily as to more than justify the expenditure.

These pavements have attracted the attention of road builders all over the United States and Canada. Almost daily road officials inspect the pavements and return home satisfied that they have seen the solution of the American road problem. European engineers visiting this country are astonished at the permanency, and at the low cost of maintenance of the roads. And at the present time the United States Office of Public Roads is experimenting with concrete, after careful inspection of the Wayne County work.

The initial cost of concrete in Wayne County is about $10,000 a mile for a sixteen-foot roadway seven inches in thickness. This is somewhat higher than the cost in other localities where sand and gravel are easily obtainable. The cost of maintenance of these roads is nominal, averaging less than $10 per mile per year, and the larger part of this cost of maintenance is spent in rounding up the gravelled shoulders of the road, cleaning out the ditches—an expense that is necessary with any type of road.

On the other hand the cost of properly built macadam or gravel, the heretofore prevailing types, ranges from five to eight thousand dollars per mile. And the cost of maintenance, particularly in the eastern states, where the automobile traffic is heavy, ranges from eight hundred to two thousand dollars per mile per year. In addition to this the life of macadam is but four or five years, while concrete may be safely counted upon to last at least twenty years. In addition, concrete has a further advantage of affording better road service throughout the entire period.

Thus it may be seen that although the outlay for concrete is slightly greater than for macadam or gravel it is really a far more economical type of road construction when considered for a period of anything over five years. As these pavements are now built they are similar in construction to the concrete foundations used under the heavier types of city pavements, and no doubt when their period of service as a pavement proper has ended, they can still be utilized as foundation material under brick, and still give service for an additional twenty years. And these facts account no doubt for the nation-wide adoption of concrete for pavement purposes.

A Wayne County, Michigan, concrete road

Co-operation is the first purpose of organization. The employee who lacks loyalty to his employer can at best render but half-hearted service. The employer who secures loyalty of his men, not only secures better service, but enables them to accomplish more with less effort and less exhaustion.

City of London Incinerator

The city of London, like several other leading Canadian cities, is modernizing its system of garbage disposal. The system adopted is that followed in most of the European countries of high temperature incineration.

With the attention that has been given to the question of incineration within the last few years, it is scarcely necessary to define the difference between this system and the low temperature furnaces, which about forty years ago were in use in England. These plants were all operated by natural draft, with a rate of burning of about six tons per twenty-four hours, on a grate area of about 30 square feet. An example of this type of furnace is still in use in the city of Montreal. This furnace was designed and erected some twenty-five years ago under the supervision of an engineer from one of the British destructor companies. The slow rate of burning is quite apparent. No attempt is made to utilize the products of combustion.

In the early style of furnace the temperature was probably not much above 800 degrees, whereas in the modern type utilizing forced draft a temperature of 1,800 to 2,000 degrees is employed with the result that the heat can be utilized for the production of steam. At the same time, this high temperature ensures absolutely the complete combustion of all gases; consequently, there is never any objectionable odor emitted from the stack.

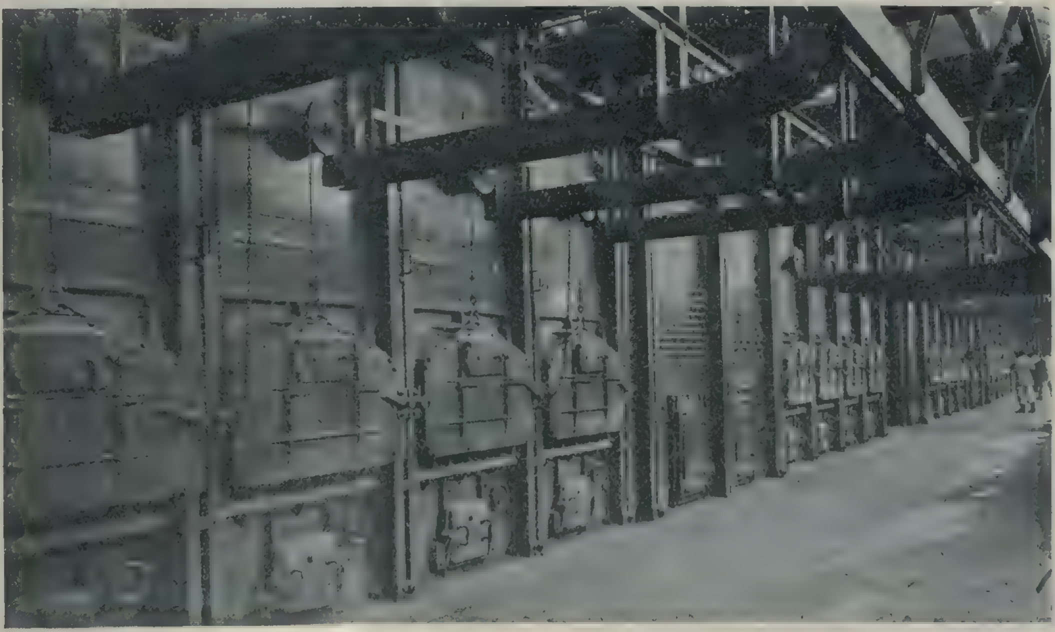
The London destructor, which is of the Heenan & Froude type, is of sufficient capacity to destroy fifty tons of refuse per twenty-four hours, with a guaranteed minimum temperature in the combustion chamber during the ordinary operation of the plant of not less than 1,250 degrees. The plant consists of three cells or burning chambers of the "trough" grate type. This type of grate is a considerable improvement over the original flat grate, as it allows the forced draft to reach the garbage not only from underneath but from both sides. This type of grate also permits of mechanical clinkering, which is one of the most important improvements made in recent years.

The accompanying cut is an excellent illustration of a four-cell Heenan incinerator recently installed at Rotterdam, Holland, and is similar in type to the plant now in operation in London, Ontario.

The form of the "trough" grate is plainly indicated in this illustration by the clinkering door. During clinkering this door is raised by means of rope, pulley and balance weights. A clinker truck is run on the rails up to the cell door. A chain is hooked to a drawbar resting in the bottom of the cell and extending its full length. When ready for clinkering, this movable drawbar is pulled forward by means of the chain and winch into a truck, of the right size to receive the whole contents of the cell. By this means, the clinkering operation, which in the plants erected three or four years ago occupied ten to twelve minutes per cell, is now being performed in less than two minutes, the result being much higher efficiency on account of the short time the cell doors are open, and it also very considerably reduces the labor of the operator.

The garbage will be brought into the incinerator building on the upper floor and dumped direct into hoppers, the foot of which will be on the charging floor. The operation of charging is very simple, the garbage being raked forward into containers and placed in the top of each cell. Each container holds sufficient for one charge. When charging, the top door of the container is closed, and a door opening direct into the cell is withdrawn, the whole charge being thus deposited on the grate.

The garbage is consumed without additional fuel



Type of incinerator erected at London.

of any kind, and as each cell is charged and clinkered at different times, the fire in the adjoining cell is sufficient to ignite the newly charged refuse, burning being maintained at a high rate by means of the forced draft system. The air for the forced draft is expelled by a large fan operated by a direct connected enclosed type engine. Before passing into the grates the air is heated in a regenerator consisting of a large nest of tubes, through which the hot gases from the furnace pass on their way to the stack. By this means, the air is brought from a temperature of about 60 degrees to over 200 degrees before it reaches the grates.

The smoke and heat from the cells passes directly into a combustion chamber the construction of which is such that it produces a thorough mixing of the gases and the greatest heat is obtained. This is sufficient to complete the combustion of all gases and particles of unconsumed matter carried over with the smoke. The process going on in this chamber is indicated by the deposit which results. This deposit consists of an exceedingly fine soft dust, and this is absolutely sterilized. In some European countries this deposit is used in the manufacture of toilet-powders.

After leaving the combustion chamber, the volume of intensely heated air passes through a Babcock & Wilcox boiler in which an evaporation is guaranteed of 1¼ lbs. of water at 212 degrees per lb. of garbage. After passing through the boiler and air regenerator above referred to, the product emitted from the stack is such that absolutely no nuisance of any kind is caused.

The erection of the London plant is in charge of Mr. H. A. Garratt, who is an incinerator engineer of fifteen years experience. He came to London direct from Rotterdam, Holland, after erecting the large plant illustrated.

The London contract is being carried out by Heenan & Froude of Canada, Limited, of which Messrs. Laurie & Lamb of Montreal, are managers. Previous installations carried out by them are in successful operation in Westmount, Moose Jaw, and Calgary.

Storage System for Construction Plant*

An equipment of plant necessary for the creation of structural steelwork, especially buildings, is stored at Greenpoint, Brooklyn, by Post & McCord, Inc., New York, for use in New York and the immediate vicinity. The plant consists of standard apparatus and ordinary tools and supplies sufficient for the requirements of twenty or thirty erection gangs under ordinary conditions. This equipment has an inventory value of approximately $100,000 and is constantly being replaced and added to. At the completion of every contract the erection plant is invariably returned to the storage yard, inspected, repaired or renewed if necessary, and put in order before it is permitted to be used on another contract.

Storage of Derricks, Timber and Engines

The storage yard has frontage on Newtown Creek, where a large proportion of the heavy plant is received from and delivered to lighters by a set of three wooden guy derricks with 65-ft. booms of about 12 tons capacity, operated by hoisting engines, equipped with Crocker-Wheeler 7 h.p. electric motors. The derricks are located on a line perpendicular to the shore line and interlock so as to command the entire area of the lot, about 100 ft. wide and 300 ft. long. The stored masts, booms, stifflegs, sills and long timbers are piled several tiers high on skids in the open air, and the hoisting engines, air compressors, boilers, dynamos and similar equipment are stored in an adjacent building, while ropes, tackles, fittings, connections, chains and miscellaneous supplies are stored in another building especially adapted to that purpose.

There are about eighty derricks of all sizes and varieties, including house or breast derricks and jinniwinks. The stiffleg derricks are of 1 to 20 tons capacity, and the guy derricks of 1 to 50 tons, the longest boom being 85 ft. All of the house derricks and jinniwinks are of wood, but a constantly increasing majority of the guy and stiffleg derricks are of steel.

Inspection and Care of Derricks

As soon as a wooden derrick is received all of the fittings are stripped from the wood, bolts removed and a very careful inspection made for breaks, cracks and other injuries or defects. All defective portions are replaced or repaired and the wood and metal thoroughly cleaned. The wood is oiled with raw linseed oil, over which there is applied a coat of hot coal tar. The iron and steel fittings are painted and bolted in place. The masts, booms, stifflegs and sills are protected by coverings of tarred paper tacked on over the upper surface and sides of each piece to exclude weather and moisture.

The erection of an ordinary steel building may occupy two or three months, during which period from 1000 to 2000 tons of materials are often hoisted by one main derrick, after which it is returned to storage, overhauled and sent out again when necessary. When maintained as above described in good condition and carefully handled it is expected to have a life of 6 or 8 years' actual working service. It is discarded before it shows signs of serious weakness.

Most of the steel derricks have sectional masts and booms with rectangular cross-sections made of four angles, with the flanges turned inward to offer as little projection as possible. In later models the flange angles are latticed with diagonal angles, riveted to their inner faces to give a stiffer member and one less likely to be injured. Steel derricks can be made much stronger than wooden ones and with proper care have an indefinite life. They do not, however, give warning when overloaded as do wooden derricks, and they are subject to bending and distortion from accident, blows and poor handling, as, for instance, when the flange angles in the boom and masts are frequently buckled or crimped by the careless application of hooks and links for handling them. Such injuries are watched for and promptly repaired when the derricks come to storage. When they are received they are dismantled and minutely examined throughout. The fittings are removed and examined, the condition of the sheaves and bearings is especially noted, all defective parts are repaired or replaced, the fittings reassembled in position and the derricks thoroughly painted.

Besides the ordinary derricks there are two two-boom mule travellers and one wooden tower traveller which are inspected, maintained and stored like the derricks. There is a 30-ton double-deck steel tower traveller adjustable to fit either 20 or 30 ft. gage track and a steel tripod tower adjustable to a height of 15 or 25 ft., which is intended for service in cellar excavations to form a pedestal for a 50-ton derrick.

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* From the Engineering Record.

Engines, Pneumatic Hammers and Timber

For the operation of the derricks and travellers there are 35 double-drum hoisting engines. A number of these have steam engines and boilers, chiefly of the Lidgerwood and Mundy types. About half of them are furnished with electric-driven gear, mostly of the Thomas and Lidgerwood types. On their arrival the engines and hoists are dismantled and thoroughly overhauled, particular attention being paid to alignment and bearings. The boilers are tested and all of the metal work is thoroughly oiled. There are three steam-driven duplex, two-stage Clayton air compressors, two steam-driven and two electrically driven Westinghouse compound air compressors, and one electrically driven Chicago Pneumatic Tool Company's air compressor. There are about 50 Chicago pneumatic hammers, a number of pneumatic holders-on, air and hand forges, reamers, and electric drills, besides a few 10 and 15-ton hydraulic jacks and a large number of screw-jacks with capacities up to 40 tons. All of these tools are carefully inspected and put in perfect repair as soon as received.

All derrick rigging consists of plow steel cable ⅝, ¾ and ⅞ in. in diameter for hoisting and topping lift tackles and up to 1⅜ in. in diameter for guys. The tackle ropes, up to 1000 or 1200 ft. long, are received on drums, from which they are unwound in the rope shed, where they are laid on the floor and every foot of their length is carefully examined for wear, injury or defects, and wherever suspicious is tested by bending sharply. Any badly worn, defective or suspicious portions are cut out and the ends spliced and the rope treated with Cablelene dressing and rewound on the drums. Manila ropes are used only for hand lines, tag lines and light service and for slings and tackles to handle very small members and for setting beams in place, for which service the slings are renewed every three or four weeks. Steel rope slings for the same service are expected to last through one ordinary building erection, a period of perhaps two or three months. One wire rope sling has a record of handling 5,000 tons of structural steel, after which it was still apparently in good condition, although condemned as a matter of safety.

Slings

Formerly most of the hitches for hoisting steel members were made with chains from 8 to 16 ft. long, with a ring at one end and a hook at the other end. The links were made of Swedish iron, ¾, ⅞, 1, and 1¼ in. in diameter, and they were considered when new to have safe working strengths of 9,000, 12,000 and 16,000 lb. each respectively. When returned to storage at the completion of a job they were very minutely inspected and any parts found defective were replaced or repaired, after which they were annealed, oiled, and hung up until issued for another contract. In very cold weather or when used for extra heavy loads they were annealed as often as every two or three months.

Notwithstanding the utmost precautions the chains were sometimes broken and considerable time and money were spent in an effort to find a satisfactory substitute for them. One device consisted of a chain with links about 4 in. long, made of ⅝ in. plow steel cable, spliced and served with annealed steel wire at both ends. A circular link served as a ring at one end of the chain and the other end was provided with an ordinary iron hook. These chains, although very strong, proved unsatisfactory on account of the stretch in the links, which were very much distorted and flattened under strain, although they resumed their normal shape when released, and on account of the difficulty experienced by the links catching on the points of the hooks.

The rope chains were, therefore, replaced by steel ropes ⅞ and 1 in. in diameter, 10 and 12 ft. long, which have a rated working strength of 18 and 28 tons each respectively. They are manufactured by the Roebling Sons Company, who fit each end of the rope into a coned clevis, one of which is connected to a ring and the other to a hook. These attachments are strong enough to break the body of the rope, and the slings are usually used for one job only—say during a period of about two months—after which the rope parts are scrapped. The most injurious stress that they are subjected to is believed to be at the sharp bend where the standing part takes bearing in the ring. The sling with a record of 5,000 tons of steel was of this type.

For girders and other heavy members the simple slings are replaced by bridles invented and patented by Mr. M. V. B. Ruland. Each bridle has a 3½ in. iron ring 1½ in. in diameter which is shackled to the hoisting tackle. To the rings are shackled through their clevises two 1 in. steel ropes 16 ft. long, with a hook at the other end. A double grommet about 10 in. long over all, made of ⅝ in. steel rope spliced over two iron thimbles, engages the 1 in. rope and slides freely up and down, receiving the hook in any position and slipping over the standing part of the rope until the bearing adjusts itself.

It is interesting to note that the ropes do not sustain any apparent injury by cutting or breaking over the sharp corners of the structural steel and that no cushions or packings are provided to relieve those bearings. The bridles and rope slings are considered very satisfactory, the principal objection being that after using they kink at short intervals, probably due to sharp bends and severe stresses. These kinks will straighten out under tension, but will reappear as soon as the tension is released.

For very heavy loads special slings are made of nineteen parts of ⅜ in. steel cables from 16 to 26 ft. long, attached at one end to a ring and at the other end to a hook. The different parts are thoroughly seized together with steel wire at intervals of 3 ft. and are parceled with canvas, renewed every time the slings are stored.

Guys

The steel guy ropes, about 100 to 150 ft. long, are examined, tested and dressed with Cablelene like the tackle ropes, and are coiled up on the vertical arms of skeleton reels, which are revolved by hand with a miter-geared crank. This winds them up so quickly that two or three times as many can be inspected in a day as was the case when they were coiled by hand. After being coiled they are wired together, lifted by an overhead differential hoist and stored on shelves along the walls. Each guy rope has a turnbuckle providing about 3 ft. adjustment and fitted at the upper end with a special clevis-like attachment made with two ½ or ⅜-in. steel plates riveted together, with space between them sufficient to receive the rope. At one end of the plates there is a 1½ in. bolt engaging the turnbuckle eye and at the other end a 1½ in. bolt receiving a cast iron sheave around which the end of guy rope is passed and clamped to the standing part. This arrangement is considered very reliable, efficient and satisfactory and eliminates the trouble previously caused by the guy ropes slipping over the head of the sheave and breaking the flanges of the latter or becoming wedged between it and the clevis.

In many cases the use of slings, bridles and chains is eliminated by providing a pair of angles shop riveted to the girders and columns and bored through their outstanding flanges to receive clevis pins by which they can be safely and expeditiously handled. After erection these angles are left in position if they do not interfere with the structural requirements or, if necessary, the outstanding flanges are scored on both sides near the root of the angle by a diamond-pointed chisel and easily broken off, leaving the other flange permanently shop-riveted to the member.

The lower ends of the plumbing turnbuckles have eyes engaging U-pieces, with the parallel ends shut close together and bent to form hooks suitable to engage an I-beam flange and offset about 45 deg. to correspond with the average inclination of the guys. Formerly these double hooks were made of round iron, but as these sometimes failed they are now made of 1¼ in. square iron, which has proved very strong and satisfactory. All hooks and clevises are annealed whenever they are returned to storage; the turnbuckles and screw ends are only occasionally annealed. Annealing is effected by heating to a cherry red in a gas furnace and allowing the pieces to remain and cool over night in the furnace after the gas is shut off. All forged connections are made of the best Swedish iron.

Miscellaneous Supplies

All tackles have steel blocks fitted with metalline bearings and a maximum of six 18-in. cast-steel sheaves, manufactured by the W. H. McWilliams & Sons Company. Wooden blocks are used for secondary purposes and with a maximum of four 12-in. sheaves for 2-in. Manila rope. Large wooden tool boxes filled with wrenches, bars, drifts, axes, saws and ordinary hand tools are kept packed ready to supply any job, and steam and air pipe, lanterns, water buckets and other miscellaneous supplies are kept in quantities and issued as required.

Complete records are kept of all the derricks, engines, air compressors, ropes and tackles, and other principal items of the plant. These show the different contracts for which they are used, their service there and the date when they are returned; what condition is disclosed by inspection, what repairs are made, and any other items of interest. The storage yard is provided with a shop equipped with forge and simple machine tools for ordinary repairs and renewals. The force consists of a dozen men, including a blacksmith, a carpenter, a machinist and a rigger, under the direction of Mr. M. V. B. Ruland and the general supervision of Mr. Aubrey Weymouth, chief engineer, and Mr. Frank McCord, engineer.

Cable street railways are still in use in the city of Edinburgh, Scotland. It is probable that this is the only city in the world where the cable system for ordinary street railway traffic, which was so extensively introduced twenty-five years ago, still remains in active service. It is recognized in Edinburgh, however, that extensions to the present cable system are not advisable. In view of the demand for new lines to suburbs the City Council of Edinburgh has appointed a committee to visit a number of English cities and examine various types of street railways. It should be understood that the Edinburgh street railways are owned and operated by the city.

New Montreal Building

Work has been commenced on a ten-storey office building on Beaver Hall Hill, Montreal, for the Guarantee Company of North America, from plans by Mr. Kenneth G. Rae, Montreal. The building is Gothic in design, and fireproof in construction. The foundations are to be of concrete, and the exterior granite up to the third floor, the remainder being built of terra cotta. A prominent feature will be the large amount of light provided for all the offices; the windows will be of metal. The interior is to be finished in oak, and the installation of two electric elevators will add to the convenience. The plan calls for steam heating and lighting by electricity. The contractors are the Geo. A. Fuller Company, Montreal.

Proposed building for Guarantee Company of North America, Montreal.

In many cities of Europe various types of vacuum cleaners are being tried on the streets. Most of them are motor vehicles in which the motor operates the suction pumps and drives the car. In Milan a street sweeper similar to the ordinary carpet sweeper is being used. A revolving broom, 5 ft. wide and 4 ft. thick, revolves in an iron shell, which fits it closely except for the slot where the broom sweeps the pavement. The motor drives the broom round so fast that it creates a suction in the shell, sucking in dirt that is stirred up by the bristles. The dirt is then carried two-thirds of the way round the shell and thrown into a bin.

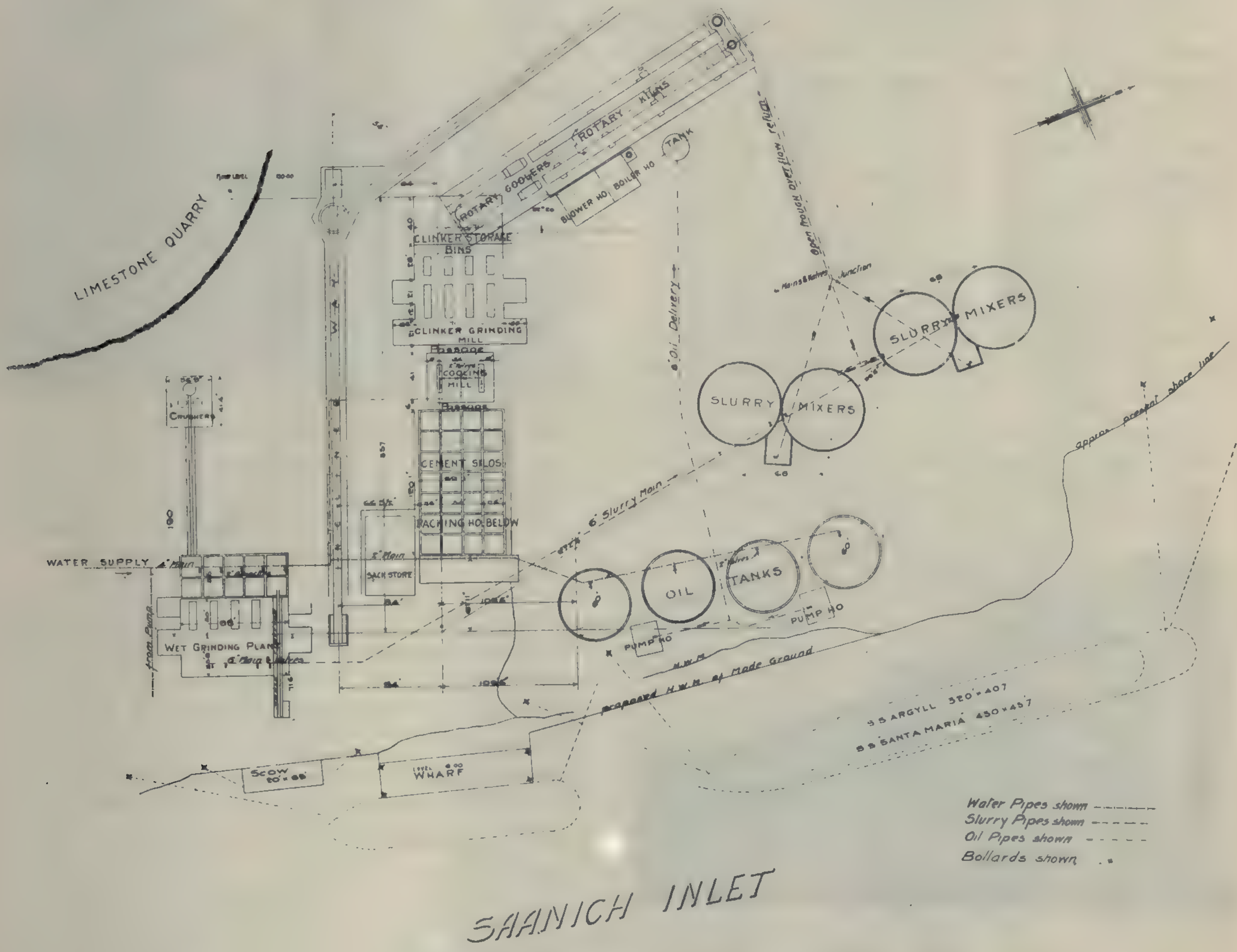
Modern Methods in the Manufacture of Portland Cement

THE subject matter of this address is one which has had the close attention of the engineering profession during recent years, because of the important functions which this material exercises in almost all constructional work. More especially is this the case where the engineer has to combat the mighty forces of nature, which are continually acting upon such constructions, notably in connection with hydraulic and marine work, such as docks, harbors, breakwaters, water reservoirs, etc., where the combination of forces is such that only the most skilful design, coupled with the use of the highest quality of the most suitable material, can insure success.

To the engineering profession is largely due the credit for the improvement in the quality and adaptability of the material which is the subject of our discussions. By collaboration of their varied experiences in the use of Portland cement, aided by the technical knowledge of the manufacturer, improvements have been introduced into processes of making, which have wholly, or almost entirely removed the defects which existed in the early days of its production.

Specifications have been drafted as the result of the combined experience of engineers in all branches of the profession, which have gone far to raise the standard of quality, and to insure uniformity of this most important material of construction. The general principles governing the manufacture of Portland cement are well known to the profession. It will therefore be necessary to refer but briefly to the usual methods of manufacture, devoting the time at our disposal more particularly to those processes, upon the proper conduct of which, depends the ultimate quality and reliability of the material produced.

Portland cement is now being manufactured in all parts of the world from a variety of raw materials all having as their base some form of calcium carbonate, which, together with suitable argillaceous materials, form the principal ingredients of manufacture. These materials must be amalgamated perfectly and combined chemically in fixed and definite proportions, the limits of which are not so wide as is generally supposed. Nature has, in some localities, partially prepared and amalgamated these raw materials, but apparently without any preconceived ideas as to the use to which such material might ultimately be put, or the stringent require-



General plan of cement works, Pemberton.

ments of engineers' specifications, with the result that in localities where such partially mixed materials are found, too much reliance is sometimes placed on these ancient natural operations. The cement manufactured therefrom usually has a reputation noted for the variety of its characteristics, and frequently contains one of the principal elements of failure, that is, want of uniformity. Unless such pseudo-natural raw materials are dealt with on scientific lines, it is preferable that they should exist in their elementary condition, having a fixed, definite and uniform chemical composition, such as pure calcium carbonate, the lime in which constitutes the base of the finished material, and clay or shales containing the acid constituents in correct ratio. Given modern machinery for the proper proportioning, amalgamating, and calcining of such substances, and the subsequent reduction, to a fine powder of the resulting clinkers, a more uniform product can be obtained than by the use of semi-natural materials, where too much reliance is placed upon the reducing and mixing effects of ancient geological operations.

The manufacture of Portland cement had its origin in Great Britain, where suitable raw products are found in the greatest abundance. The advancement of chemical science, however, has enabled materials of different characteristics found in various parts of the world to be brought into use, and the author himself has been engaged on the construction of a cement plant, at Bamberton, on the Saanich Inlet, Vancouver Island, for the Associated Cement Company, Canada, Limited. This company was formed by the Associated Portland Cement Manufacturers (1900) Limited, of England, to operate upon a practically pure limestone and a clay shale of very uniform composition. With these materials and with the aid of the modern plant which has been installed, it is confidently expected that cement will be produced of a quality equal, if not superior, to the cement imported from the United Kingdom. The utmost importance is being placed on the great desideratum of all engineers, uniformity of quality.

While describing the general methods of manufacture usually adopted, particular reference will be made to the special processes which have been introduced in the new plant on Saanich Inlet, in order to insure the absolute uniformity of quality, the absence of which in the product of many plants has been the cause of much anxiety and trouble to the constructional engineer.

Rotary kiln and rotary cooler

Atmospheric Influences on Cement

There are many factors which help to produce various unsatisfactory results, but perhaps the feature of the most prominence in the experience of the engineer, and the one in which uniformity is most desirable, is that of setting time. The difficulties are great, if during the construction of some important work one is suddenly confronted by a change in the characteristics of the material he is using, to counteract which might necessitate a reconsideration of his methods of construction. It should be the aim of all cement manufacturers to supply as uniform a material as possible, so regulating the various properties of their product to suit the climatic and other existing conditions which have a most important bearing on the setting time of all cement. As a chemical product cement is rapidly affected by changes in atmosphere. The difficulties which confront a maker of cement who has produced an article, the very first quality of which is subject to variation in many of its characteristics from atmospheric changes, are neither fully realized nor understood; and it frequently happens when some difficulty due to these causes arise in connection with construction, the quality of the cement is unjustly impugned. Long experience has taught the prudent manufacturer how to produce cement which is least affected by such changes, and the methods adopted will be shortly described.

The Processes of Manufacture

The manufacture of Portland cement necessitates three distinct and separate operations. The first process is mechanical, and includes assembling, proportioning, amalgamating, and the grinding of the raw materials. The second is a chemical process during which the materials prepared by the first are calcined at a high temperature, thus bringing about chemical combination of the various ingredients. The third and final operation is partly mechanical and partly chemical. Through this the clinker resulting from calcining, together with small percentage of retarder, is reduced to a fine powder. During the latter operation the cement is submitted to a partial process of hydration by means of steam, at a temperature ranging between 220 and 300 Fahr., and after subsequent cooling the cement is ready for immediate use.

First Steps in the Process

It is essential that the raw materials selected are of such physical character as to be of easy reduction, and such chemical composition that the resulting mixture contains the necessary ingredients in proper ratio one to the other. If so constituted, and thus available for the purpose, the proportions of the mixture are kept constant by means of continuous chemical supervision, the permissable limits of variation in the composition of raw mixture being very narrow. This preliminary part of the manufacture may be conducted by one of three methods, depending upon the physical condition of the raw material to be operated upon.

(1) Where the materials are soft, as in the case of chalk, clay and marls, such as are found in England, the wet process is usually adopted, which consists of reducing the materials together to a pulp, or slurry, containing about 40 per cent. water. This is easily accomplished in open wash mills, requiring but small expenditure of power.

(2) When one or both of the materials are of a hard or crystalline character, and in some cases with the soft materials already referred to, the dry process is adopted, which consists of evaporating the water from the raw materials as quarried, and grinding them in a dry state to a fine powder, by means of suitable machinery.

(3) The third process, which is suitable for both soft and refractory materials, has been adopted for the works at Bamberton, and consists of a semi-wet process, in which the drying of the raw materials is avoided, the materials being reduced to a thick slurry in mills suitable also for the dry process, but with a small percentage of water, producing a more uniform and reliable product than is possible with the dry process.

In any of the processes it is essential to reduce the raw material to such fineness that at least 95 per cent. will pass through a sieve having 32,400 holes per sq. in., more particularly where the materials have not been partially mixed by nature.

A great improvement in the quality of the cement is produced by the introduction, at this stage of the manufacture, of such storage capacity and machinery that large quantities of this prepared slurry can be kept in reserve, and continuously mixed, thus correcting any irregularities that may have occurred in the composition of the material during the first mixing and grinding operations. By this means, a product of absolutely correct and uniform composition is presented to the kiln for calcination. It will be readily understood that, although the cement industry as a whole has not until recently thought it necessary to provide such intermediate storage of prepared raw material, it is a matter of great importance before the material is submitted to an expensive chemical process of calcination, in which the desired results are so adversely affected by any irregularity either in the material, or the temperature at which the operation is conducted, that this correcting process should be installed. It is not possible to get perfect chemical combination of the lime and the silicates and aluminates of the clay or shale, unless the materials have been reduced to a very fine state of subdivision, and have been thoroughly amalgamated.

Grinding and cooling mills

The Second or Chemical Process

The calcining or clinkering is carried out in rotary kilns, which with modern practice are increasing in size, now averaging from 150 to 200 feet in length, and from 7 to 10 feet in diameter, being set at an angle to the horizontal of ½ in. to the foot. The raw material is fed into the upper end of the revolving kilns, while the fuel for raising the temperature within the kiln is introduced at the lower end, the raw material passing successively through the three operations of drying, calcining, and clinkering, on its passage down the kiln, the clinker leaving the kiln at red heat. This heat is removed by passing it through rotary coolers, and is used for heating the air for combustion passing into the kiln.

The cool clinker is now ready for the final grinding operation, but before being submitted to this the clinker is stored and mixed under cover in large bulk, so that once more, any small irregularities of the calcining operations are spread over the product of several days, and thus tend towards uniformity of the finished product.

The Third or Grinding Process

After cooling and mixing, the clinker, which is of a hard and refractory character, is reduced to a fine powder with the aid of very powerful crushing and grinding machinery. The importance of very fine grinding was not realized until recent years, but its value will be understood when it is known that it is only the impalpable powder of the cement which has any cementitious properties, the coarser particles present being of no more value than their equivalent bulk of sand or crushed rock. It is common practice at the present time to so reduce the clinker that 85 per cent. will pass through a sieve having 32,400 holes per square inch, but at the new works at Bamberton, machinery has been installed to enable the cement to be so ground that 95 per cent. will pass through this sieve if required. This extra fineness materially increases the cost of production, but adds considerably to the cement value of the material. Using this fine ground product a much richer and stronger concrete is obtained, by reason of the larger quantity of cementitious material present in the finely ground article and in addition economies in the cost of construction can be obtained by reason of the larger amount of aggregate which such fine ground cement will carry, to produce equal results.

During the process of grinding, provision is made for the regulation of the setting time of the cement. Clinker ground without any such provision always sets very quickly. The method adopted at the Bamberton works is similar to that now almost universally employed in England, and consists of injecting steam into the tube mills during the final process of grinding, together with the addition of a much reduced proportion of gypsum, which is used as a retarder. The effect of this process is to hydrate and thus remove the expansive properties of any loosely combined lime compounds which have passed the earlier processes uncorrected, and thus produce a cement which is safe to use immediately after manufacture, even if taken hot from the mill. By means of this process the setting time of cement can be regulated to suit all requirements.

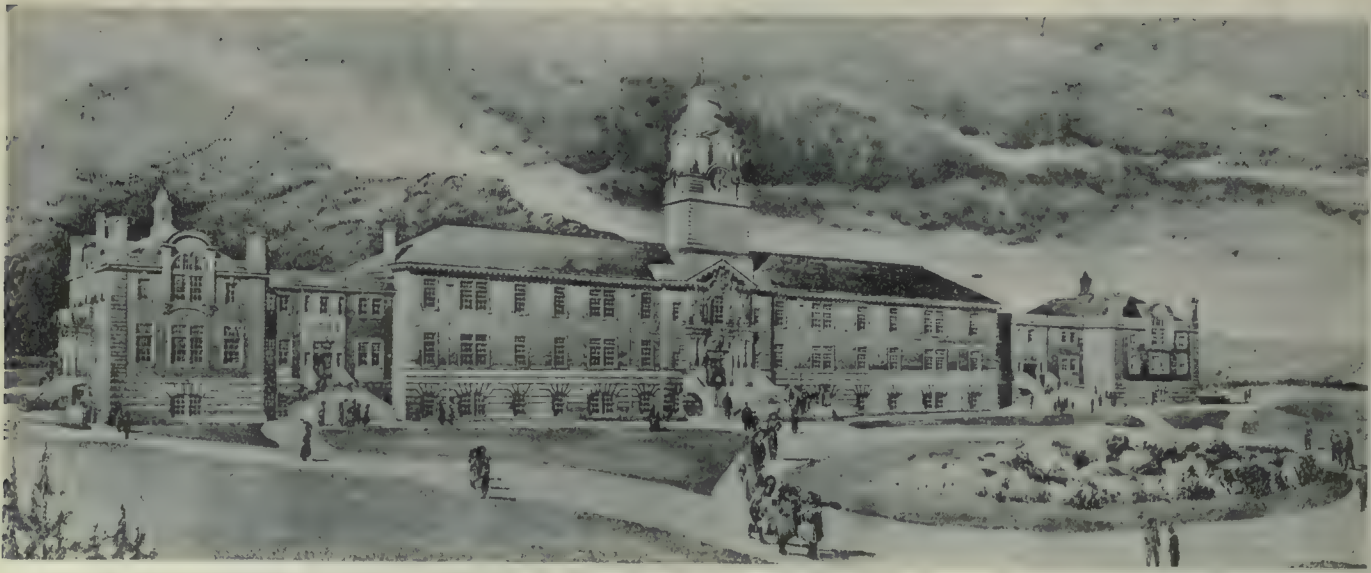
Improvements in Making

The difficulty often experienced by engineers, however, in using hot cement is being provided against by the introduction, at the Bamberton works, of a separate cooling plant, through which all cement as it leaves the grinding mill is passed. This special plant extracts the heat from the cement, reducing it to atmospheric temperature before storage. This is a very important addition to the methods of modern manufacture, and, although used largely in English plants, is being introduced for the first time into Canada. Indeed, this is the first installation of the kind on the American continent. After the cement has been submitted to the process described, it is stored and mixed in large bulk at atmospheric temperature, before being placed on the market, and it is hoped that the provision which has been made at the new works to produce cement of an absolutely uniform quality will be appreciated by engineers and contractors throughout the province of British Columbia.

The works at Bamberton are now just commencing manufacturing operations, and will be producing the full output of 2,000 barrels per day by the end of June. The plant was designed by the Associated Cement Company's own staff, and practically the whole of the machinery was manufactured in England.

The work of construction was entrusted to Messrs. McAlpine, Robertson & Company, of Vancouver, under the supervision of the Associate Company's resident engineer's staff and the power for the plant is supplied by the British Columbia Electric Railway Company.

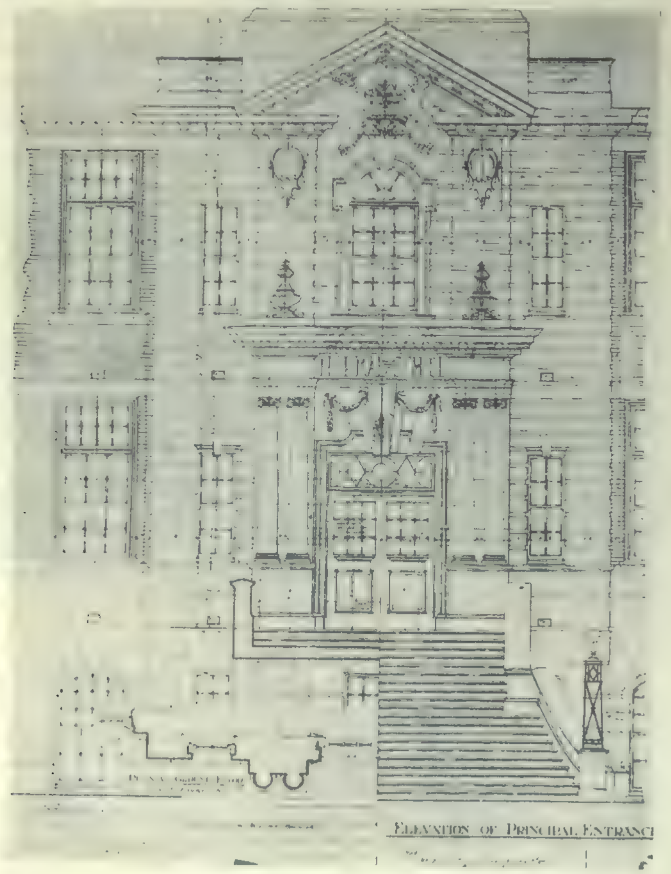
Street accidents in London, England, cost the lives of 538 persons and injuries to 16,651 more in the year 1912, according to statistics issued by the British Home Office. The greatest number of fatal accidents from any one class of street traffic was 182 deaths caused by motor omnibuses; electric cars caused 37 deaths; motor vehicles, 171; horse-drawn vehicles, 143, and horse-drawn omnibuses, 5. More than half the nonfatal accidents were due to motor omnibuses and other motor vehicles.



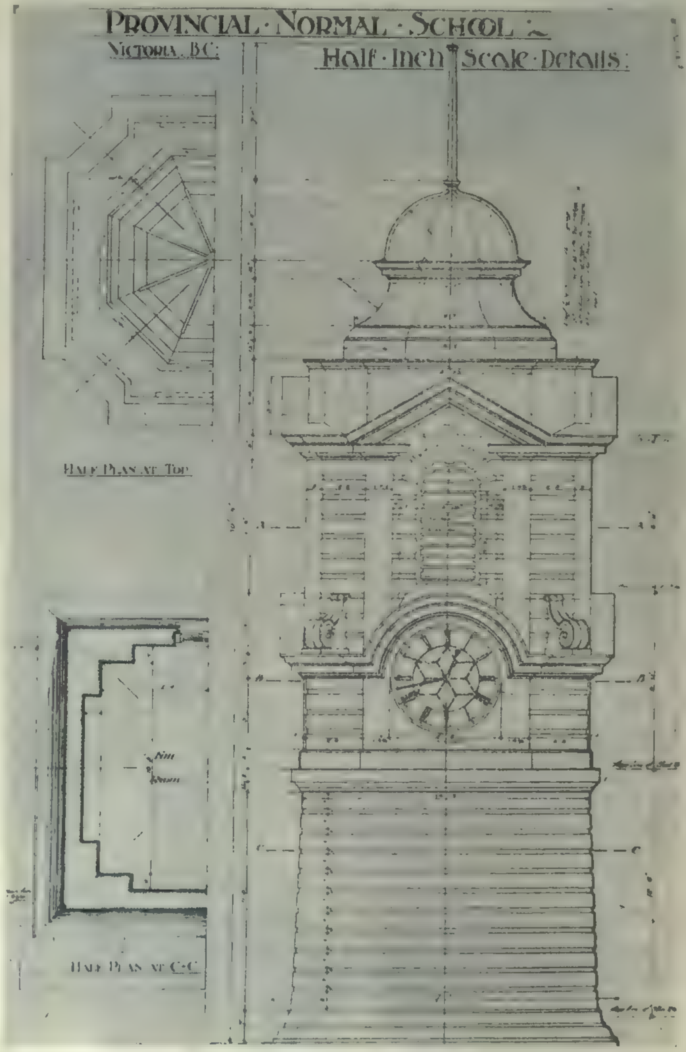
Normal School at Victoria, B. C.

THE general contract for erecting the proposed Provincial Normal School Building at Victoria was recently awarded by the Department of Public Works to Luney Bros., of Victoria, the contract price aggregating $300,000. The extreme exterior dimensions of the building are 76 x 313 feet, the construction is to be thoroughly fireproof, of reinforced concrete, red pressed brick, and terra cotta with slate roof. A central tower, 95 feet in height, is one of the features of the design. The main entrance to the building will be finished in terrazzo tile. The interior of the auditorium is carried out in plaster decorations. The specifications call for a complete fire protection system.

Included in the equipment will be a system of low-pressure steam heat; exhaust ventilation; vacuum cleaning plant;



Elevation of principal entrance.



Elevation of tower

gas plant; wood block floors throughout; automatic temperature control; electric time system; inter-communication telephone system; and a full equipment for the various rooms and departments on the different floors.

On the lower floor will be a gymnasium, 73 x 35 feet, recreation rooms, heating and fuel chambers, store rooms, lavatories, bath and dressing rooms, and plunge and shower baths for both sexes, luncheon rooms, manual training; masters' rooms, cycle rooms; games and storage rooms, janitor's rooms.

An auditorium, 73 x 35 feet, with gallery, platform, anterooms, etc., four students' class rooms, etc., three model scholars' class rooms, principal's and teachers' rooms, two music rooms, secretary's office, cloak and locker rooms, library, store and stock rooms, lavatories, etc., will occupy the ground floor.

On the first floor will be situated four class rooms, clay modelling, art, science, lecture and preparation rooms, optical dark room, biological, chemical and physical laboratories, balance and stores rooms, science master and assistant science masters' rooms, lavatories, etc.

A feature on this floor will be a section devoted to the study of domestic science, including lecture room, a laundry, dressmaking and sewing rooms, cookery department, and a complete living suite, with two bedrooms, dining-room, etc On the first floor will also be rest and sick rooms, a room for medical stores, etc.

An ideal site for the location of the school has been chosen on a 7-acre tract at the corner of Richmond and Lansdowne Roads. Mr. W. C. F. Gillam, of Vancouver and Victoria, is the architect.

Canadian Boving Company

The business of The Canadian Boving Company is now being operated under the title of Boving & Company of Canada, Limited, in order to bring the style into line with that of the other branches of Boving & Company, Limited, London, which are operating in Japan, New Zealand, Brazil, Mexico, etc. Owing also to the grent increase in the volume of business and to their having purchased the works of the Madison Williams Manufacturing Company of Lindsay, Ontario, the capital of the Company has been increased to $1,000,000, a portion of the first issue having been found in Canada.

The company is now in a position to turn out in their Canadian works the following machinery, water turbines, centrifugal pumps, pulp and paper making machinery and sawmill machinery. Previously, centrifugal pumps had been made in England, and the water turbines, pulp making and paper making machinery in Sweden, while the sawmill machinery has been manufactured by the Madison Williams Company in Lindsay.

The Canadian Boving Company, Limited, completed their first large plant in Canada in 1910, viz., water turbines of some 8,000 h.p. for The Calgary Power Company and among other important contracts which have since been executed are:—City of Winnipeg—5 double horizontal open flume Francis turbines, 29,000 h.p.; 2 double horizontal enclosed Francis turbines (exciters), 900 h.p. The Sydney Power Company, Trenton, Ont.—4 double vertical open flume Francis turbines, 6,000 h.p.; 6 double vertical open flume Francis turbines, 4,800 h.p. Ocean Falls Pulp Company—6 single horizontal enclosed Francis turbines, 10,800 h.p.

Centrifugal Pump Contracts

City of Toronto—4 pumps 54,000,000 gals. capacity per 24 hours, 250 ft. head; 4 pumps 40,000,000 gals. capacity per 24 hours, head 100 ft. Montreal Water & Power Company —3 pumps, 31,000,000 gals. capacity per 24 hours, 440 ft. head. City of Moose Jaw—2 pumps, 1,700,000 capacity per 24 hours, head 69 ft.; 2 pumps, 1,700,000 gals. capacity per 24 hours, head 120 ft. They have also installed a considerable amount of pulp making machinery.

The experience gained during the past three years by The Canadian Boving Company has enabled them to gauge the Canadian market, and to familiarize themselves with its requirements to give accurate estimates as to the cost of manufacture. The firm is working in close alliance with Boving & Company, Limited, Union Court, Old Broad street, London, England, to whose designs their machinery will be manufactured with such modifications as may be necessary to suit Canadian needs.

The existing works are quite up-to-date, having been built in 1906. Large additions, however, will be made to them imediately so that in twelve months time the capacity of the works will be about four times that of the present shops, and a number of new and up-to-date machine tools will be added so as to ensure the accurate workmanship now required for modern machinery.

Canadian Railroad Development

The Canadian Northern Railway is stated to have made an agreement with the city of St. Catharines to carry the proposed line from Toronto to Buffalo through that city on consideration of the payment of a bonus of $100,000. It is stated that the entire line is promised complete and in operation in three years.

Work will probably be started next month on the harbor improvements and building of grain elevators at Port Nelson, which is to be the terminus of the Hudson Bay Railway. About $5,000,000 will be expended for these improvements. Frank Cochrane, Ottawa, Ont., is Minister of Railways and Canals.

The mountain section of the Grand Trunk Pacific Railway will be completed, and the whole line from Winnipeg to the coast ready for operation in August of next year, according to Mr. Collingwood Schreiber, C.M.G., the chief consulting engineer of the railway department, who has just returned from an inspection of the line.

The railhead of the Canadian Northern Railway from the west has reached Anderson Creek, which is as far as it can go until a steel bridge over the creek is completed. Work on this structure, which is to be an eleven-span viaduct 1,000 feet long, was begun only a short time ago. As soon as they cross Anderson Creek, the track layers will have a clear fifteen miles of completed grade ahead of them.

The Grand Trunk Railway Company will hold a special meeting at Montreal on July 16 for the purpose of passing a by-law authorizing the issue of debentures for $15,000,000 under the provisions of the act passed by Parliament recently, by which the Government is to loan that amount to the company. The debentures, when issued, will be delivered to the Dominion Government, and they will be guaranteed as to principal and interest by the Grand Trunk Railway.

Plans are being prepared for the new Dominion Government buildings and Union passenger station to be built between Yonge and York streets, Toronto. It is proposed to widen both Front and Yonge streets to provide ample approach to the new Customs and station buildings. The Customs-house and examining warehouse will occupy the block from Yonge to Bay streets, and the station will be built on the block between Bay and York. A large station distributing post office will be placed on the York street corner of the station block. Yonge street south of Front will be widened to 100 feet and Front will be widened from 88 to 105 feet between Yonge and York. This means the removal of the present Customs building. They will be replaced by a handsome seven-storey building, the estimated cost of which will be between a million and a half and two millions. The Union Station, plans for which are being completed, will cost probably two millions.

The recent opening of the new C. P. R. Wilkie-Kerrobert line means a reduction of railroad mileage to points from Saskatoon in the Kerrobert district, and consequently a reduction of freight rates. Prior to the opening of the line, shipments destined for Kerrobert and points adjacent had to be conveyed from Saskatoon to Macklin via Wilkie and thence to destination, which is approximately 209 miles. By the new route the distance is reduced to 144, or a saving of 65 miles.

According to information from the west, the C. P. R. has elaborate plans in regard to the depot accommodation for Calgary. The new C. P. R. hotel is progressing favorably, and will be opened towards the end of the summer months. When the double-tracking of the road is finished into Calgary, an additional exit and waiting room will be erected on the south side opposite the present station, and the entire tracks will be covered with a large roof in practically the same manner as the new train shed at Montreal. The approximate cost of the added facilities and improvements will, it is stated, be about half a million dollars.

Mainly Constructional

The News in Brief—From Coast to Coast

R. McLean & Company have been awarded the contracts for laying sewers in various districts near Kerrisdale, B.C., for a total sum of $501,855.35, if paid in cash, and $516,911.06 if paid by treasury certificates.

The Dominion Government has purchased a harbor at Port Credit, Ontario, for $30,000. For years this harbor has been little used, but it is now possible that it will be dredged and put into a proper state of repair.

The Milton Pressed Brick Company, Limited, Milton, Ont., have recently increased their capital from $250,000 to $1,000,000. The new stock is in the form of 7,500 shares of $100 each, of which 4,000 are preference and 3,500 common.

The Westholme Lumber Company, who were the original contractors on the Sooke Lake Waterworks scheme, have entered a law suit against the city of Victoria and various officials, alleging misrepresentation and deformation of character.

A contract involving about $175,000 has just been let by the Canadian Swift Company for the erection of its proposed new branch house for Victoria. The structure will be three storeys high and of reinforced concrete. The building is to be finished early next year.

The board of works of South Vancouver has approved of an estimated expenditure of over $87,000 on plank walks and roads, clearing and grading, construction of box culverts, racking, etc. They also appointed Mr. Peter Wylie to act as street superintendent of the engineering department at a salary of $225 per month.

The Cowichan Lake branch of the E. & N. Railway on Vancouver Island, a subsidiary of the C. P. R., will be opened in a few days. Since the completion of this branch preparations have been made for extensive exploitation of the district's timber resources, and a camp has been established near the lake. It is expected that within a month logs will be available to keep thirty to forty cars moving every day.

With the letting of a contract to the Canadian Pipe Company, Limited, for the supply of wood-stave pipe at a cost of approximately $20,000, the early completion of the waterworks system which the Sooke Harbor Water Company, Limited, will instal at Sooke Harbor, is assured. The plans of the system are now in the hands of the Government, and as soon as they are approved the work will be rushed, and will, it is expected, be completed within two or three months.

With the new main at present being completed for the supply of the Mount Pleasant district, of St. John, N.B., a sufficient amount of water for all modern requirements will be available there at a height of at least 250 feet above the sea level. This would mean that the present gravity system would carry the water to this height, and fourteen storey buildings in the business section will not find it necessary to install pumping systems in order to have water in abundance, even on the roof.

Marked progress is being made in the extensive project of grade separation and elimination of level crossings of the Canadian Pacific and Canadian Northern Railways at North Toronto. The viaduct grade has been reached from Yonge street to Avenue road, while the operations between Summerhill avenue and Dufferin street are being pushed forward without interruption. While the appeal of the city to the Governor-General-in-Council against the order of the Dominion Railway Board fixing the height of the subway at twelve instead of fourteen feet, is pending the work in the immediate vicinity is advancing rapidly.

Announcement of a Royal Commission to report on the provincial roads system may be expected from the Ontario Provincial Government at an early date. The Commission is expected to consist of three members, Mr. C. A. Magrath, who is a member of the Canadian section of the International Waterways Commission, and is a former M.P. for Alberta, is stated as one of the three, and will probably act as chairman. Mr. W. A. McLean, chief engineer of the highways branch of the Department of Public Works, and who is at present representing Ontario at the International Good Roads Congress in London, England, will be another member. The third will probably be a member of the Legislature.

Personal Mention

Mr. James Goodfellow Mann, who was one of the pioneer contractors of Victoria, died in that city on June 17.

Mr. P. E. Jarman has been appointed acting chief engineer of the City of Westmount, P.Q., until 31st October, the end of the fiscal year. Mr. Jarman was assistant to Mr. Archibald Currie, who is now city engineer of Ottawa.

Street Commissioner Wilson and Dr. Hastings, M.O.H. for Toronto, have recently returned from a trip of investigation of the garbage disposal and incineration plant systems of several United States cities. They are both strongly in favor of municipal ownership.

Mr. Alexander Cox, one of the chief engineers of the Peking-Tientsin Railway of North China, arrived recently in Victoria from the Orient. Mr. Cox was one of the original constructors of the railway which connects Peking with Tientsin, and is a prominent official in the Anglo-Chinese railway systems. He is making personal observations of the systems of the Canadian railways.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
Pavements planned by Town Council. Clerk, W. H. McFadden. Engineer, Wm. Treadgold. Queen street, vitrified brick, $4,389; Main street, asphalt block, $17,526; Queen street, Dolarway, $14,837. By-law passed.

Dundas, Ont.
Town Council plan to purchase drainage tiles. Chairman Board of Works, A. B. Wilson. Clerk, J. S. Fry.

Elma Twp., Ont.
Drains. Council will have plans prepared for a number of new drains and also repairs to others. Clerk, Geo. Lochhead, Atwood, Ont.

Montreal, Que.
Park Improvements, cost $20,000, St. Helen's Island, for Board of Commissioners. Secretary, L. N. Senacal. $20,000 voted for water supply, etc.; $500 for water; $7,500 for 3 kiosks; $6,000 for 4 double lavatories; $1,500 for repair to roadways.

Board of Control asked for vote of $34,500 to pave Champ de Mars. Sec., L. N. Senecal.

Mosa Twp., Ont.
Drain repairs, for Twp. Council. Clerk, C. E. MacNaughton, Newbury, Ont. Repairs to drains Nos. 7, 3 and 4 and drain No. 1 to be completed.

Preston, Ont.
Sewers and pavements on a number of streets, planned by Town Council. Clerk, H. C. Edgar.

Petrolia, Ont.
Tenders received by Clerk, J. McHattie, until July 7th for construction of sewers on several streets. Plans and specifications at office of Clerk.

Toronto, Ont.
Trunk sewer, cost $4,000,000, North Toronto and Moore Park, contemplated by the Board of Control. Mayor H. C. Hocken, City Hall. Commissioner of Works, R. C. Harris, Will take three years to complete, septic tanks recommended in the meantime.

Tile pipe sewers, cost $11,410, for Board of Control. Mayor, H. C. Hocken, City Hall. Commissioner of Works, R. C. Harris. Commissioner recommends sewers on number of lanes.

Virden, Man.
Roads, cost $25,000, for Municipality of Wallace. By-law passed for good roads and highway improvement.

Victoria, B.C.
Concrete conduit, for city council. Water Commissioner, C. H. Rust. Tenders received at office till noon July 15th, for the fabrication and laying of 27½ miles of reinforced concrete pipe and apparatus on the line of the Sooke Water Supply Conduit. Plans, specifications, etc., at office of Sooke Water Supply, 1414 Douglas street.

Woodstock, Ont.
Sewers. Clerk, Jno. Morrison. Chairman Board of Works, Jas. Mitchell. City Engineer, F. J. Ure. Plans, etc., at office of Engineer. Tenders received by Chairman until July 10th.

CONTRACTS AWARDED

Brampton, Ont.
Concrete pavement and curb, planned by Town Council. Clerk, W. H. McFadden. Engineer, Wm. Treadgold. General contractors, Curran & Clement. $1.40 per yd. for pavement, and 38c for curb.

Dunnville, Ont.
Watermains, cost $3,100. Supt. Waterworks Commissioners, Robt. G. Kyd. General contractor, W. H. Cockman, Niagara Falls, N.Y.

Dunwich Twp., Ont.
Tile drains planned by Twp. Council. General contractor, F. O. Canfield, St. Marys, Ont. Contract for supplying twelve carloads of 16 in. tile.

Twp. of Enniskillen, Ont.
Drains, Lewis and Bradley streets. Clerk, Geo. V. Wyant, Petrolia. General contractors, Davidson & Brownscombe, Petrolia, P.O., and James Barr, Petrolia, P.O.

Hull, Que.
Sewer, cost $4,000, Church street. Mayor, Mr. Dupuis. Engineer, J. A. Laforest. General contractors, International Construction & Supply Company.

Listowel, Ont.
Cement walks planned. Mayor, Wm. Climie. General contractor, S. Alberts, Listowel. 12½c sq. ft.

Montreal, Que.
Watermains, Pointe Claire. Engineer, V. H. Dupont, 225 St. James St., Montreal. General contractors, Laurin & Leitch, 5 Beaver Hall square, Montreal. Pig lead, pipe and fittings, Garth Company, 28 Craig street west, Montreal.

Sewerage system, Pointe Claire. Engineer, V. H. Dupont, 225 St. James st., Montreal. General contractors, Laurin & Leitch, 5 Beaver Hall square, Montreal. Tile pipe, Alex. Bremner, 100 Bleury street, Montreal.

New Hamburg, Ont.
Pavements. Clerk, David Eby. General contractors, Royal Artificial Stone Paving Co., Guelph.

Osborne, Ont.
Tile drains planned by council. General contractors, Copeland Bros., Woodham, Ont.

St. John, N.B.
Sewerage system planned by County Council. Chairman Sewerage Board, Wm. Golding, 58 Harding st., Fairville. Pipe, Jas. Robertson Co., Ltd., 1 Sheffield street. Work, Murray Long, 241 Prince St. W.E. Engineer, G. G. Murdock, 74 Carmarthen street.

St. Martin, Que.
Macadam roadways, cost $160,000, Laval Co., planned by Town Council. Sec.-Treas., Nap Mallette. General contractor, William Plouffe.

Winnipeg, Man.
Contracts awarded to E. F. Campbell, Supt. of Asphalt plant No. 2 pavement for sewer in Merrion ave. from Helen to Berwick St., at $1,089.05. Secretary, M. Peterson.

Watermain for Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Contract awarded to J. W. Astley, Engineer of Construction City Yards, for watermain on Wall St. from Portage to Wolever Ave., at $526.50.

Granolithic walk, on east side of King street, Jarvis street to Dufferin. Contract awarded to J. W. Astley, Engineer of Construction, City Yards.

Sewers, Stainer, Battery and Nassau streets. Engineer, H. N. Ruttan, 223 James Ave. Contract awarded to Henry Martin, 620 Redwood Ave. Sec., M. Peterson, Board of Control.

Sewers, in Alfred Ave., Shaughnessy St., St. Nichol St. and Brazier St. Contractor, J. W. Astley, Engineer of Construction, City Yards. Sec., M. Peterson, Board of Control.

Asphalt and flux. Engineer, H. N. Ruttan, 223 James Ave. Contract divided equally between Alloway & Champion, 362 Main st., and Can. Mineral Rubber Co., Canada Bldg., for suoply of refined asphalt and contract awarded to Union Oil Co., of California. Chicago, for fluxing oil at $20 per ton. Sec., M. Peterson, Board of Control.

Windsor, Ont.
Pavements, cost $9,850, Langlois. City Engineer, Edw. Brian. General contractors, Benjamin Oldani & Co. Reinforced concrete, 5,000 sq. yds.

Railroads, Bridges and Wharves

Berlin, Ont.
Grand Trunk Railway Company has been authorized to construct siding and spur therefrom for the Dom. Tire Co., Ltd. (Canadian Consolidated Rubber Co.

Decker, Man.
C. N. Ry. Co. has been directed to erect 3rd class station at Decker, Man., and construct two car cattle pen. Work to be completed by Sept. 15th.

Elmsley Station, Ont.
C. P. Rly. Co., has been authorized to construct bridge No. 312 near Elmsley Station, Havelock Sub-Div., Ontario Div., Ont.

Foster Station, Que.
C. P. Rly. Co. has been authorized to

construct bridge No. 103.7, near Foster Station, on Sherbrooke Sub-Div., Eastern Div., Que.

Kingston, Ont.
G. T. Rly. Co. has been authorized to construct siding for A. Davis & Son, Limited.

Kingston, N.S.
Dom. Atlantic Rly. Co. has been authorized to construct siding for Markland Fruit Co., Ltd., at Kingston, Kings County, N.S.

Levis, Que.
Dredging. Tenders received by Sec., P. E. Ryan, Ottawa, Ont., Commissioners of Transcontinental Railway, until July 3rd. Plans, etc., at office of Mr. Gordon Grant, Chief Engineer, Ottawa, and A. E. Doucet, Dist. Engineer, Quebec City.

Car ferry slip. Tenders received by Sec., P. E. Ryan, Ottawa, Ont., Commissioners of Transcontinental Railway, until July 3rd. Plans, etc., at office of Mr. Gordon Grant, Chief Engineer, Ottawa, and A. E. Doucet, Dist. Engineer, Quebec City.

Little Current, Ont.
Algoma Eastern Rly. Co. has been authorized to construct Goat Island Coal Handling Bridge, on Goat Island Dock, near Little Current, Ont.

Prov. of Quebec
Bridge, cost $8,800, over White River, for Municipal Council of St. Andre d'Acton. Plans and specifications at office of Sec.-Treas., J. S. Beaudet. One span, 150 x 17, concrete, steel and 4 in. red pine. Beurrerie Provost bridge.

Stratford, Ont.
Bridge, cost $2,400, Romeo, planned. Mayor, C. N. Greenwood. Chairman of Board of Works, Ald. Pauli. City Engineer, A. B. Manson, City Hall. One span 60 ft. long and 14 ft. wide, concrete and steel. Plans, specifications, etc., may be seen at Engineer's office. Surveys have been made.

Thorold, Ont.
G. T. Rly. Co. has been authorized to construct spur into premises of Pilkington Bros., Limited, on Lots 71 and 72, Twp. Thorold Co., Welland, Ont.

Toronto, Ont.
Parks Commissioner Chambers contemplates dredging and making improvements to Cat Fish Pond in High Park, estimated cost $30,000. Mayor H. C. Hocken, City Hall.

Viaduct, etc., cost $13,000,000, The Board of Control have approved of the agreement between the city representatives, Harbor Commission, G. T. R. and C. P. R. The viaduct will take the form of an earth embankment from Cherry street to Yonge street, 500 feet south of the present esplanade. Earth embankment with concrete retaining wall, west of Yonge street, right-of-way 230 ft. 8 to 12 tracks. Subways of concrete construction to be provided. Windmill line to be extended 1,030 ft. south, will allow for new wharves and dock to cost about $5,000,000. A new waterfront street 130 ft. wide south of the viaduct will extend from Cherry street to Bathurst street to connect with the proposed boulevard drive. The Union Station will be built south of Front street between Bay and York. The new Customs House between Yonge and Bay, Both Yonge and Front streets will be considerably widened.

C. P. Ry. Co. has been authorized to construct 2 additional sidings into premises of C. A. Scott, on part lot 2 south of Carlaw Ave.

Vancouver Island, B.C.
Esquimalt & Nanaimo Rly. Co. has been authorized to construct Bridge No. 27.8 over Coal Creek, on Comox extension, Dist. Newcastle, Vancouver Island, B.C.

Winnipeg, Man.
Canadian Northern Railway Company has been authorized to construct spur for Manitoba Gypsum Co., Ltd., through Lot 20, R. L. 41 and Lot 4, R. L. 42. To be completed by September 17th, 1913.

CONTRACTS AWARDED

Brampton, Ont.
Bridge, cost $2,415. Clerk, W. H. McFadden. Engineer, Wm. Treadgold. General contractor, Patterson. Concrete arch.

Belleville, Ont.
Dredging and wharf, cost $116,000. Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractors, Randolph Macdonald Co., Queen and Victoria Sts., Toronto, Ont.

Burlington, Ont.
Cement bridges, Caroline and Pearl. Clerk, Jas. S. Allen. General contractor, W. H. Murphy, Burlington.

Fort William, Ont.
Dock, cost $5,000, Island 2, for W. H. Dwyer, Ltd., Ottawa and Fort William. Builder, D. A. Gordon, Fort William. 205 x 12.

Howard Twp., Ont.
Bridge, cost $4,646, Lake Shore Road. Clerk, George McDonald, Ridgetown. General contractor, A. S. Everitt, care Clerk.

Halifax, N.S.
Cable station and wharf, cost $65,000, for Western Union Telegraph Co., Hollis street. Architect, R. A. ohnson, 16 Barrington street. General contractor, G. B. Low, 7 Oakland Road. Two stys., 100 x 100.

Harriston, Ont.
Crow's Bridge. Owners, Counties of Grey and Wellington. Engineers, Bowman & Connor, 36 Toronto street, Toronto. Steel, Alexander Hill, Mt. Forest. Abutments, Cole & Bryson, Owen Sound. 43 ft. steel and concrete.

Twp. of Hibbert, Ont.
Three bridges, cost $3,525, for Twp. Council. Clerk, James Jordan, Dublin. County Engineer, John Roger, Mitchell.

Montreal, Que.
Freight sheds and offices, cost $90,000, Wellington, for G. T. R., McGill street. Architect and builder, John S. Metcalfe Co., Ltd., 54 St. Francois Xavier street. Roofing to be awarded. Heating and plumbing, Guarantee Heating & Plumbing Company, 41 Devienne street. Other work done by builder.

Ottawa, Ont.
Canal lock gates, cost $250,000. Dominion Government, Dept. Railways & Canals. Secretary, L. K. Jones, Ottawa. General contractors, Roger Miller & Sons, Lumsden Bldg., Toronto. Forty double lock gates north of Trenton.

Public Buildings, Churches Schools, etc.

Brampton, Ont.
Addition to Central School, cost $4,000, planned by Town Council. Clerk, W. H. McFadden.

Hull, Que.
Incinerator under contemplation. Mayor, Mr. Dupuis. City Engineer, J. A. Laforest.

Marshville, Ont.
School. Separate tenders received by Sec.-treas., Wm. W. Simpson, until July 12th for masonry and carpentry. Plans, etc., at office of Sec.-treas. 39 x 45, brick construction.

Montreal, Que.
Theatre, cost $70,000, for Peter Griffin Theater Co., c/o H. Lubin & Co., 87 Notre Dame W. Plans will be prepared.

Point Grey, B.C.
Addition to fire hall contemplated. Clerk, G. C. Heighway, Kerisdale. Council has decided to start work as soon as possible.

St. Thomas, Ont.
Public building, interior fittings, for Dom. Govt., Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until July 9th. Plans, etc., at offices of Thos. Hastings, Clerk of Works, Postal Station "F," Yonge street, Toronto. W. G. Luton, Caretaker of Building, St. Thomas, or Secretary, Public Works Dept. Electric light fixtures, wiring, etc., for public building.

Toronto, Ont.
Incinerator, cost $1,000,000, planned by Board of Control. Mayor H. C. Hocken, City Hall. Street Commissioner Wilson and Dr. Hastings, M.H.O., are now considering sites for four buildings. Above amount was voted by ratepayers Jan 1st.

Theatre, cost $8,000, Bertmount and Queen, for Hutchinson & Webb; 1 Grenadier Rd. Architect, A. J. Rattray, 123 Bay street. Tenders in, contracts not awarded yet. One storey, 26 x 110, structural steel and brick construction.

Schools. Board of Education have approved plans for 4-room enlargement to Pape Ave. School and 6 rooms to Shirley street.

Registry office. The Board of Control invites competitive plans for above office. Pamphlet with full information may be obtained from City Architect after July 2nd. Drawings to be sent to City Clerk before September 1st.

Windsor, Ont.
School repairs planned by the Board of Education. Secretary, Alex. Black. Dougal Ave. School, plumbing, Robert Paddon & Co.; painting, J. Lauckner; Park Street School, kalsomining, painting and varnishing, Peter S. Love.

Winnipeg, Man.
Shingling church, Arlington street, for St. Edwards R. C. Congregation. Architect, D. W. Bellhouse, 703 Canada Bldg. Tenders will be received by general contractors, Fred Lewis Co., Ltd., 637-9 Somerset Bldg.

CONTRACTS AWARDED

Chatham, Ont.
Sunday school, cost $10,000, planned by Methodist Trustees. Pastor, R. G. Ful-

ton. Work being done by day labor. Foundations in.

Fort William, Ont.
Addition to school, cost $15,000, Isabella. Architect, R. E. Mason. General contractor, Chas. E. Ward. Foundations in.

Kaslo, B.C.
School, cost $40,000, for Public School Board. Secretary, W. H. Burgess. Architect, W. Haldane, Nelson. General contractor, J. Dancy & Co., Nelson. Heating and plumbing, B. C. Heating & Plumbing Co., Nelson. Three storeys and basement, six rooms, brick construction.

Montreal, Que.
School, cost $25,000, Laval avenue, for Comsn. School, St. John Baptiste. Builder, general contractor and mason, P. Jos. Charlebois, 1234 St. Hubert. Heating and plumbing, J. & C. Brunet & Co., 223 St. Lawrence. General contractor will receive tenders for other trades. Three storeys, 44 x 44, concrete foundation, terra cotta and brick construction.

Church, cost $120,000, Bernard and Waverly, for St. George's Church, Laurier Ward. Architects, Gauthier & Daoust, 180 St. James street. General contractors, Belanger Freres, Valleyfield, Que.

Presbytery, cost $18,000, Bernard and Waverly, for St. George's Parish, Laurier Ward. Architects Gauthier & Daoust, 180 St. James St. General contractor, Theo. Leuard, 210 Park ave.

Garage and display hall, cost $50,000, near 963 St. Catherine W., for Motor Import Co., St. Catherine W. and Atwater. Architect, J. A. Godin, 269 St. Dennis street. General contractors, Mount Royal Construction Co., care architect. Three storeys, 75 x 103,

Alteration to St. Patrick's Orphanage, cost $8,000, Ellerslie ave. and St. Catherine Road. Engineers, Nygren, Tenney & Ohmes, New Birks Bldg. General contractor, Thos. O'Connell, 183 Ottawa street. Putting in new boiler and renovating heating and plumbing.

Addition to school for Protestant School Commissioners, Montreal West. Architects, Peden & McLaren, 20 St. Alexis. General contractors, Reid, McGregor & Reid, 14 Guy Block. Carpenter, T. S. Hudson, B12 Board of Trade.

Ottawa, Ont.
Addition and alterations to Rideau Hall, cost $125,000. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractor, Peter Lyall Co., Montreal, Que.

St. Anne de Bellevue, Que.
Church, cost $25,000, for Union Church Congregation. Architects, Peden & McLaren, 20 St. Alexis street, Montreal. General contractor, S. W. Hamilton, 402 Bleury. 36 ft., 40 x 67, stone foundation, brick construction. General contractor will receive tenders about July 2nd for heating, plumbing, electric lighting and roofing.

St. John, N.B.
Infirmary for Catholic Diocese, Sisters of Charity, c/o Bishop Le Blanc, Waterloo street. Foundations in.

Sunday School Building, for Germain Street United Baptist Church. Pastor, F. S. Porter, Queen street. Architect, F. Neil Brodie, 42 Princess St. General contractor, R. A. Corbett, Douglas ave.

St. Thomas, Ont.
Gymnasium and manual training building, cost $10,334, for Board of Education. Secretary, J. C. Spencer. General contractors, Wey & Howe, care secretary. White brick construction.

Springhill, N.S.
Church, cost $18,000, Main street, for Methodist Congregation. Rev. Harry B. Clarke. Builders and general contractors, McLellan Bros. Heating, plumbing, electrical work and interior fittings, not let. Wood and frame construction. Seating capacity 1,000.

Sandwich, Ont.
Public school, cost $45,000. Secretary, David Tasker. Architects, Van Leyen & Schilling, 1115-21 Union Trust Building, Detroit, Mich. General contractors, Wells & Grey, Windsor. Heating and plumbing, Pennington & Brian, Windsor. Two storeys, 50 x 141.

Toronto, Ont.
Theatre for Pollock & Stein. Architect, G. D. Redmond, Dineen Building. Excavating and masonry, Orr Bros., Queen E. Heating, W. J. Sutherland, 140 Galley ave. Plastering, Hodson & Warren, 815 Dovercourt Rd. Roofing, Reggan & Spence, 530 Front St. W. Electric wiring, Can. Elec. Fixtures & Contracting Co., 13 Queen E.

School (painting) for Board of Education. Secretary, W. C. Wilkinson. Contracts for painting as follows: James Taylor, 179 Markham, Park & Pyne, $1,005; Taylor & Co., 9 Bloor St. E., Sackville & Withrow, $350. Geo. Eales, 880 Queen W., Winchester St., $390. Jas. Phinnemore, 445 Yonge St., St. Clair ave., $125.

Addition to Riverdale High School planned by Board of Education. Secretary, W. C. Wilkinson. The Shipway Iron Bell & Wire Mfg. Co., King W., has been awarded contract for iron stairs.

Church, St. Clair and Ravensden, for St. Clair Roman Catholic Congregation. Rev. R. E. McCabe, 4 Ravensden ave. Architect, A. W. Holmes, 10 Bloor E. Masonry, Fred Holmes & Son, Limited, 1113 Yonge street.

Additional Sub-contracts awarded. Technical High School, by Board of Education. Secretary, W. C. Wilkinson. Architects, Ross & MacDonald, C. P. R. Bldg. General contractors, Norcross Bros., 98 Bay street. The general contractor has sublet the following: Indiana limestone, Geo. Oakley & Son, 278 Booth ave. Excavating, Wm. H. Thomson, 29 Marlborough ave. Architectural terra cotta, Federal Terra Cotta Co., New York.

Vancouver, B.C.
Creche building, cost $3,800, for City Council. Clerk, Wm. McQueen. Architect, Alfred Williams, 509 Metropolitan Bldg. General contractor, Geo. E. Williamson, 150 6th ave. east. Two storeys and basement, reinforced concrete and brick construction.

Vancouver, B.C.
Old People's Home, cost $42,017. Clerk, Wm. McQueen. Architects, Perry & Fowler, 320 Pacific Bldg. General contractors, Campbell & Wilkie, 615 Pender street west. Two storeys, 97 x 147.

Twp. of Wallace, Ont.
School, cost $4,000, Clerk, David Greer, Brotherston, Ont. General contractor, Geo. Black, Palmerston, Ont. Pressed brick construction.

Winnipeg, Man.
Club House, cost $10,000, Pritchard ave., for J. Kojiarsky, 654 Pritchard ave. Architect and builder is owner. Two storeys, 25 x 90, stone foundation, brick construction.

Business Buildings and Industrial Plants

Coquitlam, B.C.
Hotel, cost $45,000, planned for The Coquitlam Terminal Co., will be situated in the first division between Kingsway and Tyner Road.

Edmonton, Alta.
Hotel, cost $30,000, for Jos. Mantel, North Edmonton. Three storeys, cement foundation, stone and brick veneer construction. Plans drawn.

Forest, Ont.
Addition to hardware store, cost $4,200, King, for W. Lochead, King street. Two storeys, white brick construction. Plans being prepared.

Fort William, Ont.
Warehouse, for Fife Hardware Co., Hardisty. 60 x 125, common brick construction, cement foundation, felt and gravel roofing. Plans in progress.

Hagersville, Ont.
Bank building for Union Bank of Canada. Plans prepared.

Merlin, Ont.
H. B. Bostaph, Tilbury, contemplates equipping a brick and tile manufacturing plant at a cost of $38,000.

Mimico, Ont.
Brick manufacturing plant planned by Provincial Government. Work in charge of Asst. Prov. Sec., S. A. Armstrong. Work will be done by prison labor. Capacity $10,000,000 per year.

Montreal, Que.
Offices, etc., Cote St. Paul, for Imperial Oil Co., 105 Board of Trade Bldg. Building may not be erected until next spring.

St. Catharines, Ont.
Flax mill, cost $150,000, contemplated for Canadian Flax Mills Ltd., 24 King W., Toronto. By-law passed first reading to give fixed assessment and exemptions.

Toronto, Ont.
Warehouse, cost $4,000, Queen E., for J. W. Gillard, 2173 Queen St. E. Architect and builder, W. J. Wibby, 190 Silver Birch ave. Three storeys, 26 x 48, structural steel and brick construction. Plans ready.

Windsor, Ont.
Office Building, Ouellette, contemplated by A. T. Curran. Plans will be prepared.

Windsor, Ont.
Store, cost $8,000, Pitts, for Osterhout & Little, Windsor. Architects, Leybourne & Whitney. Two storeys and basement, 85 x 26, brick foundation, brick construction. Plans in progress.

CONTRACTS AWARDED

Amherst, N.S.
Steel car plant, cost $100,000, for Canadian Car & Foundry Co. Owners are buying all material and doing work by

day labor. 1½ storeys, 160 x 400, concrete and tile roofing, telephone system, motors and generators, belting.

Burlington, Ont.

Business block, cost $9,000. Owner and builder, W. Campbell, Brant street. Two storeys, white brick construction.

Calgary, Alta.

Store and office, Eighth ave. E., for E. W. Home, 8th ave. w. Builder, A. A. Rose, David Block. Two storeys, 36 ft. 6 in. x 100, cement foundation, brick construction. Excavating started.

Blacksmith shop, cost $5,600, 3rd ave. west, for City Cartage Co., 501 3rd ave. west. Builder, P. Clansen, 720 4th ave. west. Two storeys, 40 x 100, brick construction.

Fort William, Ont.

Business block, cost $12,000, for Dr. Stewart. Builder and general contractor, R. E. Wright, Victoria ave. Two storeys, 27 x 60, Foundations in.

Hamilton, Ont.

Addition to factory, cost $20,000, Victoria ave., for Otis Fensom Elevator Co., Victoria ave. north. Architects, Stewart & Witton, 2 Hughson street south. General contractor, W. H. Cooper, 67 York St.

Hamilton, Ont.

Stables, cost $10,000, Hughson St. N., for Pure Milk Co., John St. N. Architect, A. W. Peene, Clyde Block. General contractor, Geo. F. Webb, Wentworth St. S. Painting, Peter Thompson, Walnut W.

Montreal, Que.

Store and residence, cost $10,000, Outremont (Bernard). Builder and architect, A. Desjardins, 7 Casgrain. Three storeys, 30 x 77, cement foundation, pressed brick construction. Excavating started.

Factory, cost $25,000, for Canada Wire Factory, care architects, T. Pringle & Sons, 419 Coristine Bldg. Concrete, brick and painting, Nicholson Construction Co., 960 St. Catherine W. Heating and plumbing, McKnight & Blackadder, 91 Inspector. Steel sash, Steel & Radiation, 138 Craig W. Carpenter, T. S. Hudson, C12 Board of Trade. Two storeys and basement, 50 x 75, cement foundation, brick construction.

Store and flats, cost $5,000. Architect and builder, Marcelin Betournay, 113 Verdun. Three storeys, 25 x 40, cement foundation, brick construction.

Five stores, cost $10,000, Dorchester and St. Charles Borromee, for L. Cohen & Sons, 36 Prince street. Architect and builder, C. W. Strang, 76 Plymouth Grove. 1 sty., 116 x 60, cement foundation, brick construction.

Stores and flats, cost $16,000, Ontario and Chambly, for Eug. Sansregret, 365 St. Louis. Architect and builder, M. Bourdon & Fils, 527 Panet.

Alterations to factory, cost $4,614, Ontario E., for Mederic Laurier, c/o builders, A. Kelly & Co., 1955 St. Urbain St. Architect, Jos. A. Godin, 269 St. Denis. Three storeys, 41 x 71.

Stores and flats, cost $7,000, City Hall ave., for Estate E. D. Roy, 470 Parc Lafontaine. Builder, M. Ouimet, 20 Christopher Columbus. Three storeys, 42 x 40, stone foundation, brick construction.

Store and apartments, cost $50,000, Green and Sherbrooke, for Brilon & Jarry, c/o architect, G. A. Monette, 260 St. James street. Masonry, carpentry and brick work, Peel & Peel, 710 Fullum. Steel, Phoenix Bridge Co., 83 Colborne. Painting, Jos. Guy, 325 Workman. Electrical work, Canada Electric Co., 230 Dorchester W. Plastering, A. Cusson, 38 Laporte ave. Foundations in.

Two stores and five flats, cost $15,000, Outremont (Durocher and Lajoie). Owner and contractor, A. Frenette, 212 Fabre street. Architect, Z. Trudel, 238 St. Andre. Masonry, Villeneuve & Lavallee, c/o owner. Three storeys, 90 x 50, stone foundation, brick construction, felt and gravel roofing. Architect will receive tenders for heating, plumbing, electric wiring and roofing at once.

Factory extension Lachine (St. Joseph) for the Dominion Wire Rope Co., Ltd. Builder, E. G. M. Cape, New Birks Bldg., Montreal. One storey, 90 x 91, brick construction, felt and gravel roofing. Foundations in.

Warehouse, cost $20,000, 144-6 Craig W., for H. H. Vachelle Koelle, 59 St. Gabriel street. General contractor, D. F. Sheeny, 16 St. Cecile. Repairs to building, damaged by fire.

Store and flats, cost $9,000, St. Lawrence, for D. Leonard, Ste. Monique des deux Montagnes. Architect, G. L. Leonard & Frere, 554 Parc Lafontaine. Three storeys, 50 x 60, concrete foundation, brick construction.

Store and flats, cost $5,000, St. Lawrence. Builder and owner, Leonard & Frere, 554 Parc Lafontaine. Three stys., 25 x 60, cement foundation, brick construction.

Coal shed, cost $35,000, Western ave., for Hartt & Adair Coal Co., 146 Notre Dame W. Architect, Adolphe Suck, Hyde Park, Mass., U.S.A. General contractors, Marcells Construction Co., Portmouth, New Hampshire.

Stores and flats, cost $7,000, Sixth ave., for J. Belisle, 345 6th ave., Rosemount. Architect and builder, owner. Three storeys, 25 x 58, cement foundation, brick construction.

Store and flat, cost $5,000, Amherst, for Antoine Charland, 2119 St. Catherine E. Builders, Michel Bourdon & Sons, 527 Panet. Brick, N. Beauchamp, 1559 Bordeaux. Painting, Nap. Allard, 836 Dorion. Two storeys, 21 x 66.

Ottawa, Ont.

Addition to bank, cost $3,000, Rideau, for F. G. Mager, Rideau street. Architect, J. Albert Ewart, 193 Sparks. General contractors, Smith Bros., 448 McLeod. Solid brick construction.

Stores and apartments, cost $40,000, for F. X. Laderoate, 85 Bank street. Architect, E. Measter, Creighton Street School. General contractor and carpenter, R. A. Kemp, 149 1st ave. Masonry, Cowie & More, 1st ave. Some sub-contracts not let. Foundations started.

St. John, N.B.

Warehouse and office, Prince William street for McClary Mfg. Co. Manager, Geo. S. Bishop, Chipman Hill. General contractor, owner.

Factory, Mash Rd., for Oil Motor & Mfg. Co., Ltd. Director, M. L. G. Vincent, 126 Charlotte street. Architect, F. Neil Brodie, 42 Princess street. General contractor, Jas. Myles, 175 Wright St.

Ste. Therese, Que.

Piano factory, cost $100,000, for Willis Piano Co., Drummond and St. Catherine, Montreal. Architects, Ross & MacDonald, 1 Belmont street, Montreal. General contractors, The James Shearer Co., Ltd., 225 St. Patrick street, Montreal. Three storeys, 100 x 150, cement foundation, brick, structural steel and mill construction.

Sudbury, Ont.

Warehouse, Builders and owners, Lester Brothers. Asbestos and steel or cement and brick veneer construction.

Toronto, Ont.

Stores and apartments, Queen E., for D. Abramovitch, 161 York street. Architect, I. Feldsman, 199 Yonge street. Masonry, Jenner & Evans, 775 Crawford. Carpentry, Bell & Thorps, 1211 Dufferin. Roofing, Ormsby & Co., George & Queen. Electrical, Toronto Electric Light Co., 12 Adelaide St. E. Plastering, W. J. Hynes, 718 Dupont street. Two storeys, brick construction.

One pair stores and residences, cost $7,500, Pape and Selkirk. Builder and owner, A. F. Taber, 21 Muriel. Two storeys, 40 x 43, structural steel and brick construction.

Warehouse, cost $65,000, 433 King W., for Samuel Benjamin Co., King and Spadina. Architects, Burke, Horwood & White, 28 Toronto street. Masonry, Holtby Bros., 61 Hepbourne. Carpentry, Geo. Sparling, 759 Dufferin. Plastering, W. J. Hynes, 718 Dupont street. Heating, Toronto Furnace & Crematory Co., 111½ King E. Galvanized iron, W. E. Dillon Co., 78 Richmond E. Steel, Reid & Brown, Esplanade E. Electric wiring not awarded. Six stys., 50 x 121.

Vancouver, B.C.

Office building for Credit Foncier Franco Canadian Co., 35 St. James St., Montreal. Architects, Barott Blackader & Webster, 508 New Birks Bldg., Montreal. General contractors, H. L. Stevens & Co., 119 Pender W. Cement foundation, reinforced concrete, terra cotta and limestone construction.

Victoria, B.C.

Packing warehouse, cost $55,000, Store and Telegraph streets, for Canadian Swift Co. General contractors, the B. C. Granitoid Co., Exchange Bldg., Vancouver. Two storeys, reinforced concrete construction. Complete equipment including freezers, coolers, smoke houses, power, etc., will be required.

Wallaceburg, Ont.

Business block, cost $12,000. Builder and Owner, George Warrener, Two storeys, 50 x 85, stone and cement foundation, white brick construction.

Willow River, B.C.

Hotel for Grand Trunk Pacific Railway Co. Architects, Holabird & Roche, 104 S. Michigan ave., Chicago, Ill. General contractors, Purdy & Henderson, 470 Granville street, Vancouver, B. C.

Winnipeg, Man.

Warehouse, cost $60,000, Dublin, for Dom. Bridge Co., Canada Bldg., Donald street. Architect and builder, owner. 1-sty., 108 x 272, steel construction.

Store and residence, cost $6,500, Stella ave., for M. Soronow, 217 Stella ave. Architect and builder, owner. Two stys., 30 x 33, brick foundation, brick construction.

Addition to pool room, cost $12,000, Donald street, for Chas. Plaxton, c/o architect, F. R. Evans, 506 Somerset

Bldg. General contractors, W. J. Lailey & Co., 367 Maryland street. Three stys., 64 x 22, structural steel and brick construction.

Weston, Ont.
Stores, cost $9,000. Builder and owner, J. C. Cleman. Three stores on Main.

Residences

Calgary, Alta.
Residence, cost $5,000, Elbow Park, for H. W. Allen, c/o architects, Alliance Investment Co., 711 1st St. N. Two stys., 31 x 32 ft. 6 in., frame construction.

Halifax, N. S.
Residence, cost $4,000, Oxford, for Ralph M. Hall, 51 Upper Water street. Architect, H. E. Gates, 88 Hollis street, Two storeys and pitch roof, 37 x 55, frame and stucco construction. Plans ready.

Residence and stable, cost $5,000, Oakland Rd., for Dr. Louis Saunders, 135 Barrington street. Two storeys, 40 x 28, cement foundation, frame construction, Work done by day labor. Plans ready.

Hamilton, Ont.
Residence, cost $5,000, Westmoreland, for H. Siderski, 34 James N. Architect, J. A. Armes & Walter Scott, 68 Federal Life Building. Tenders received by owner. Two storeys and basement, 30 x 45, pressed brick construction.

Montreal, Que.
Residence, cost $9,000, Lachine (Broadway), for W. E. Ranger, 368 St. Joseph. Architect, Louis Amos, 6 E. T. Bank Bldg., St. Catherine W. Three storeys, 37 x 51, cement foundation, pressed brick construction. Private tenders called by architect.

Regina, Sask.
Apartment block, cost $10,000, Dewdney street, for F. G. Stephens, Dewdney street. Architect, Mr. Miller, care owner. General contractor, A. W. McGregor, Masonic Temple. Two storevs, 25 x 52, cement and brick foundation, brick and artificial stone construction.

Toronto, Ont.
Residence, cost $5,400, Indian Road, for National Trust Co., 22 King St. E. Architect, H. G. Macklin, 36 Toronto St. Two storeys, 24 x 50, brick construction, brick foundation. Plans drawn.

Alterations to residence, cost $17,000, for J. B. O'Brien, 7 Thornwood avenue. Architect, H. F. Secord, King and Bay streets. Two storeys, 24 x 40, structural steel, reinforced concrete and brick construction, cement and brick foundation. Plans drawn.

Victoria, B.C.
Residence, cost $16,000, 1392 Rockland ave., for W. H. Wilkinson, c/o architect, H. T. Whitehead, 13 Green Block. 15 rooms. Plans prepared.

Winnipeg, Man.
Residence, cost $6,000, Ashburn, for P. J. McRae, Suite 18, Douglas Bldg., Graham ave. Two storeys, 24 x 30, stone foundation, frame construction.

Windsor, Ont.
Residence, cost $9,000, Ouellette, for Osterhout & Little, Windsor. Architects, Leybourne & Whitney. Plans in progress.

CONTRACTS AWARDED

Bedford, Que.
House and barn, cost $60,000, for C. S. Campbell, 605 Merchants Bank Bldg., Montreal. Builders, Laurentian Construction Co., 103 St. Francois Xavier St., Montreal. Cement foundation, brick construction. Excavating started.

Calgary, Alta.
Residence, cost $5,000, Houndsfield Heights, for E. J. Riley, Hill hurst. Architect, Leo. Dowler, Alexander corner. General contractor, C. Grindley, 816 6th ave. west. Frame construction.

Residence, cost $15,000, So. Mount Royal, for Hon. Justice Walsh, c/o architects and general contractors, Alliance Investment Company, 711 1st St. W. 2½ storeys, 40 ft. 8 in. x 45 ft. 8 in., stone and brick construction. Foundations in.

Edmonton, Alta.
Rooming house, cost $20,000, for John Johnston, 50 Stewart street. Architects and builders, Hardy & Markland, c/o owner. Five storeys, cement foundation, frame construction.

Two residences, cost $8,000, 26th St., for E. Arrowsmith, General Delivery. Architect and general contractor, owner. Two storeys, 24 ft. x 29 ft., cement foundation, frame construction.

Residence, cost $5,000, 32nd street, for Mallitt Bros., 1545 26th ave. Architect and general contractor, owner. Two stys., 32 ft. x 34 ft., cement foundation, frame construction.

Residence, cost $5,000, for A. W. Cairns, 91 5th ave. Architect, E. A. Cowley, 406 Agency Block. General contractors, Mallet Bros., 1545 26th St. Two storeys, 30 x 33, concrete foundation, frame construction.

Residence, cost $5,500, Huston. Architects and builders, Magrath Hart & Co., General Delivery. 2½ storeys, 28 x 31, cement foundation, frame construction. Excavating done.

Edmonton South, Alta.
Residence, cost $7,500, 3rd ave. north, for Mrs. Alex. Benson, Box 4167 Edmonton So. Architect, Cyril Fry. General contractor, Albert Moreside, 1st ave. northeast. Two storeys, 30 x 40, concrete and cement foundation, pressed brick construction.

Halifax, N.S.
Residence, cost $4,000, for H. P. Story, Waegwoltic ave. Builder and general contractor, masonry, iron and steel, painting and heating, Thompson & Theakston, Hollis street. Two storeys, 35 x 45, cement foundation, frame construction.

Levis, Que.
Residence, cost $5,000, St. Onesime, for Damase Blais, St. Onesime St., Levis. Builder and general contractor, owner. Three storeys, 30 x 45, brick construction.

Montreal, Que.
Six flats, cost $9,000, Panet, for A. Martineau, c/o Geo. Bail. Architect and builder, 102 Stadacona. Three storeys, 50 x 40, cement foundation, brick construction.

Four flats, cost $14,000, Marlowe. Architects, builders and general contractors, Jos. Belisle & Frere, 808 Papineau. Three storeys, 25 x 40, brick construction, cement foundation. Owner will receive tenders for brick work and electrical work. Excavating started.

Two residences, cost $12,000, Westmount (Lansdowne ave). Architect and builder, Isaac Collins, 207 Ash ave. Owner does his own work. Two storeys and basement, 25 x 45, brick construction. Foundations in.

Residence, cost $8,000, Beaulieu, for British Construction Co., 238 St. James street. Architect and builder, owner. 3-storeys, 50 x 70, hardwood floors. Owners will receive tenders for painting only.

Alterations to residence, cost $5,000, for A. R. Tourgis, 444 Durocher. General contractor, Art. Chausse, c/o owner. One storey, 25 x 25.

Six flats, cost $9,000, Colonial. Builder and owner, Geo. Bail, 102 Stadacona. Roofing, heating, plumbing and electrical work, Jos. St. Amand, 109 Laurier W.

Eighteen flats, cost $16,000, Colonial, for Geo. Bail and E. Vincent, 102 Stadacona. Architect and builders, owners. Roofing, heating, plumbing and electrical work, Jos. St. Armand, 109 Laurier W.

Twelve flats, cost $30,000, Park ave., for E. Goldfine & Chananie, 3 Ontario W. Builder, G. Bail and E. Vincent, 102 Stadacona street. Three storeys, 90 x 45, cement foundation, stone and brick construction. Builders will receive tender for heating, plumbing, roofing and electric wiring.

Residence, cost $15,000, Westmount, for F. McNally, 405 Aqueduct. Architect, W. E. Doran, 189 Bleury street, Montreal. Roofing, Campbell, Gilday Co., 663 St. Paul. Painting, H. Daniels, 139 Fulford. Heating and plumbing, T. Lessard & Sons, 191 Craig E. Electrical work, Moncel Electric Co., 157 Craig W. Plasterers, R. D. Clark & Sons, 26 Lincoln ave.

Flats, cost $7,500, for J. A. Courchesne, 1815 Chateaubriand, architect and builder. Three storeys, 50 x 45, concrete foundation, brick construction.

Residence, cost $10,000, Esplanade ave., for Fred Vincent, 207 Esplanade. Architect, W. E. Doran, 189 Bleury St. Carpentry, A. Kelly & Co., 1955 St. Urbain. Heating and plumbing, J. J. Briard, c/o architect. Electrical work, Moncel Electric Co., 157 Craig St. W.

Six flats, cost $6,000, Fabre, for F. St. Louis, 496 Fabre, architect and builder. Three storeys, 47 x 40, concrete foundation, brick construction.

Six flats, cost $7,000, Stadacona. Builder and owner, Frs. Tremblay, 201 Aylwin. Three storeys, 51 x 60, cement foundation, brick construction.

Flats, cost $25,000, Park ave., for Osias Lamoureux, 15 St. James street, Architect, Art. St. Louis, 80 St. Gabriel. Owner will do all the work. Three storeys, 100 x 100, cement foundation, stone and brick construction. Excavation started.

Flats, cost $6,000, Forsyth, for Dr. G. H. Martineau, 341 Forsyth. Builder, A. Roberge, 786 Garnier. Roofing, heating and plumbing, F. Paquette, 586 St. Timothee. Three storeys, 25 x 76.

Residence, cost $8,000, Outremont (Elmwood) for Mrs. A. Chevalier, 3400 St. Lawrence Blvd. Architect, Z. Trudel, 238 St. Andre. Builder and general contractor, J .A. Lamontagne, 3061 St. Dominique. Two storeys, 23 x 56, stone foundation, brick construction.

Four flats, cost $7,000, Belgrave. Owner and builder, Lenon Alarie, 2461 Clark. Two storeys, 25 x 60, cement foundation, brick construction. Excavating started.

(Continued on page 75)

Tenders and For Sale Department

CITY OF PRINCE ALBERT,
SASKATCHEWAN

Tenders will be received, addressed to the City Clerk, Prince Albert, Sask., until noon, Wednesday, July 16th, 1913, for the following contracts:

13 D—Laying approximately 22,000 feet of steel water main.

13 E—Laying approximately 25,000 feet of steel water main.

13 F—Laying approximately 26,000 feet of sewers.

13 G—Laying approximately 25,000 feet of sewers.

Plans and specifications are on file at the office of The Canadian Engineer, Union Bank Building, Winnipeg, and at the office of the City Engineer, Prince Albert. Instructions to bidders and form of tender may be had on application to the City Engineer. Plans and specifications not to be sent out.

The lowest or any tender not necessarily accepted.

M. H. BAKER, City Engineer.
N. W. MORTON,
H. E. M. KENSIT,
C. O. DAVIDSON, City Commissioners.
Prince Albert, Sask.,
June 23rd, 1913. 27-28

Department of Railways and Canals, Canada

TRENT CANAL

Steel Pontoon Gate Lifter

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tender for Steel Pontoon Gate Lifter, Trent Canal," will be received at this office until 16 o'clock on **Tuesday, July 29th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque for the sum of $1,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES.
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 25th June, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—44228. 27-28

Sealed tenders addressed to the undersigned and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m., on **Monday, July 21, 1913,** for the construction of a Public Building at Lakefield, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—42451. 27-28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received until 4 p.m., on **Monday, July 21, 1913,** for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signatures, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—42596. 27-28

Sealed tenders addressed to the undersigned and endorsed "Tender for Supplying Coal for the Dominion Buildings," will be received at this office until 4 p.m., on **Monday, July 14, 1913,** for the supply of coal for the Public Buildings throughout the Dominion.

Combined specification and form of tender can be obtained on application at this office and from the caretakers of the different Dominion Buildings.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the contract. If the tender be not accepted the cheque will be returned.

By order
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 14, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—42889. 26-27

TOWN OF WALKERVILLE

Tenders for Pavements

Sealed tenders will be received by registered post, addressed to the undersigned, up to **Friday noon, the 11th day of July, 1913,** for the construction of concrete pavements on the following streets in the town of Walkerville:

On Huron street from Walker Road to Monmouth Road.

On Windermere Road from present pavement to Ottawa street.

On Alley south side of Sandwich street to north side of Assumption street.

On Victoria Road from Huron street to Ottawa street.

On Devonshire Road from Ontario street to Devonshire Court and Devonshire Court from Argyle to Kildare Road.

On Ottawa street from Argyle Road to Windermere Road.

On Argyle Rd. from Huron street to Ottawa street adn from Essex Terminal Company's land northerly to present pavement on Argyle Rd.

On Kildare Rd. from Huron St. to Essex Terminal Railway.

On Ontario street from Devonshire Road to Windermere Road.

On Huron street from Monmouth Road to Lincoln Road.

On Ontario street from Walker Road to Monmouth Road.

On Alley west of Kildare Road from Assumption street to Brant street.

Plans and specifications may be seen on application to Mr. Owen McKay, C.E., Walkerville.

Tenders must be accompanied by a marked cheque, payable to the Town Treasurer, equal to 2½ per cent. of the amount thereof.

Should any party whose tender is accepted fail to execute the necessary contract and bond for the due fulfilment of the same, his deposit will be forfeited to the Town.

Deposits of unsuccessful tenderers will be returned.

The lowest tender not necessarily accepted.

The names of two responsible persons willing to act as sureties must accompany each tender.

CECIL H. ROBINSON,
Town Clerk.
Walkerville, Ont.
26th June, 1913. 27

VILLAGE OF MERRITTON

SIDEWALKS

Sealed tenders, marked "Tender for Sidewalks," addressed to R. Clark, Municipal Clerk, Merritton, Ontario, will be received until six o'clock p.m., **July 10, 1913**, for approximately 150,000 square feet of Concrete Sidewalks.

Plans, specifications, and forms of tender, may be obtained on application to the Municipal Clerk, Merritton, or at the Engineer's office, St. Catharines.

An accepted bank cheque for the sum of **$500**, made payable to the Corporation Treasurer, must accompany each tender.

The lowest or any tender not necessarily accepted.

R. CLARK, Clerk,
Merritton, Ont.
F. N. RUTHERFORD, C. E.,
26-27 24 Queen St., St. Catharines, Ont.

TOWN OF THOROLD

Province of Ontario

PAVEMENTS

Sealed tenders will be received by the Town Clerk until 8 p.m. on **Friday, July 4th, 1913**, for constructing permanent pavements on portions of the following streets:—

(a) Regent Street and Front Street, Brick Pavement with Concrete Curb.
(b) Pine Street, Bitulithic or other pavement, with Concrete Curb and Gutter, and brick on railway track allowance.
(c) Vine street, Clairmont street, and Portland street, Bitulithic or other pavement, with Concrete Curb and Gutter.

No tender necessarily accepted.

Plans, specifications, etc., may be seen at the Town Hall, Thorold.

For further information address the Engineers, Mail Building, Toronto.

JOHN BRODERICK, Esq., Mayor.
D. J. C. MUNRO, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.
26-27

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, July 8th, 1913**, for the construction of the following sewers:—

Lane 1st N. Dale ave., Glen Rd. to east end.
Columbine ave., Rainsford Rd. to Kingston Rd.
Columbine ave. Rainsford Rd. to Woodbine ave.
Jones ave., Danforth ave. to 1407 feet north.
Braemore Gardens, Christie St., to Christie St.
Lane 2nd N King St., Princess St. to West End.
Clara St., Conduit St., to Quebec ave.
Beresford ave., Bloor St. to north end.
Wheeler ave., Queen St., to 1350 ft. north.
Morley ave. 250 ft. S. Gerrard St. to Gerrard St.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

The tenderers shall submit with their tender the names of two sureties approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto, or in lieu of said sureties, the bond of a guarantee company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, June 26th, 1913. 27

Tenders Wanted

Tenders will be received by the undersigned up to 5 o'clock p.m. on Monday, the 7th day of July, 1913, for the construction of a system of sewers on the following streets, in the Town of Petrolia.

1. For digging the trench, laying tile, and filling in the trench.
   (a) On West street, from Petrolia street to Jennie street.
   (b) On Jennie street, from West street to Maud street.
   (c) On Maud street, from Jennie street to outlet at Trunk Sewer.
   (d) On Maud street from Petrolia street to Jennie street.
   (e) On Dufferin avenue, from a point 75 feet west of Princess street to Maud street.
   (f) On Huggard street, from Petrolia street to Jennie street.
   (g) On Station street, from Petrolia street to a point 230 feet north.
   The Corporation to furnish the Glazed Tile.
2. Separate tenders may be submitted for any of the above sections, or any one tender may cover the whole work.

Tenders may also be submitted for digging the trench, furnishing the tile, laying the tile, and filling in the trench.

Plans and spectifications of the work may be seen at the Clerk's office.

The lowest or any tender not necessarily accepted.

27 J. McHATTIE, Town Clerk.

CITY OF REGINA

SIDEWALKS

Sealed tenders addressed to the City Commissioners, Regina, will be received up until 12 o'clock noon, **July 9th, 1913**, for the following works:—

Construction of approximately 500,000 sq. ft. of concrete sidewalk.

All information regarding the above may be obtained on application to F. McArthur, City Engineer.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The city reserves the right to divide the work into two or more contracts, and to reject any or all tenders.

J. MARTIN, Mayor.
L. A. THORNTON,
J. A. REID, City Commissioners.
26-27

TENDERS

Concrete Bridge at Saskatoon

Sealed tenders will be received up to 16.30 o'clock on **Tuesday, the 15th day of July, 1913**, for the under-mentioned work:—

Construction of a concrete bridge over the South Saskatchewan River at Saskatoon.

Tenders for this work must be accompanied by accepted cheque on a chartered bank, or other satisfactory deposit for the sum of $15,000. Deposits of unsuccessful tenderers will be returned when contracts are signed.

The right to reject any or all tenders, or to waive any defects or irregularities therein is to be at the discretion of the Chairman of the Highway Commission.

Plans, specifications, forms of tender and all information may be obtained on application to the undersigned.

A deposit of $50 must accompany each request for copy of plans and specifications; this amount will be refunded on the return of the plans.

The unauthorized insertion of this advertisement will not be paid for.

A. J. McPHERSON,
Chairman, Board of Highway Commissioners.
Regina, Saskatchewan.
June 20th, 1913. 26-28

EXTENSION OF TIME

Tenders For Bridge

Sealed tenders will be received up to 5 p.m., **July 9th, 1913**, for the erection of a Warren Truss Steel Bridge to be built over the Sauble River between the Townships of Arran and Sullivan, and for concrete abutments for same, and also for steel piling which may be used instead of concrete. Plans and specifications may be seen with James Warren, Engineer, Walkerton, or with the undersigned.

(Signed) S. K. EWART,
Chesley, Ont.
Walkerton, June 13, 1913. 26-27

Tenders for Dredging

Sealed tenders will be received at the Clerk's office, Chatham, Ont. (where plans and specifications can be seen) up to 12 o'clock noon, on **Thursday, July 31st, 1913**, for dredging about 9 miles of drainage work in the Township of Dover, County of Kent. The work to be let subject to the final passing of the By-law.

The lowest or any tender not necessarily accepted. Tenders must be marked "Tenders for Dredging," and each accompanied with a marked guarantee cheque for $2,000.

Dated, June 17th, 1913.

H. M. BEEHARD, Reeve.
JOHN WELSH, Clerk,
26-30 Chatham P. O.

Department of Railways and Canals, Canada

WELLAND CANAL

Broad Creek Culvert

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Broad Creek Culvert, Welland Canal," will be received at this office until 16 o'clock on **Thursday, July 10th, 1913.**

Plans, specifications and form of contract to be entered into can be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, St. Catharines, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque for the sum of $1,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 30th June, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—44379. 27

Tenders for Sewers

Sealed tenders addressed to John Morrison, City Clerk, Woodstock, Ont., will be received up to **Thursday, the 10th day of July at 6 p.m.**, for the construction of about 2,800 lineal feet of sewers. Plans, specifications and forms of tender at the City Engineer's office.

JAS. MITCHELL,
Chairman, Board of Works.
F. J. URE, City Engineer. 27

To Contractors

Concrete Paving

OAKVILLE, ONT.

Sealed tenders addressed to the Chairman of Committee, will be received until noon on **Thursday, the 10th day of July, 1913**, for laying approximately 12,800 square yards of armoured, reinforced concrete pavement and 9,000 lineal feet of curbing.

Plans and specifications can be seen at The Star Office, Oakville, and at the office of J. A. Bell & Son, C. E., St. Thomas.

The committee do not bind themselves to accept the lowest or any tender.

C. H. CROSS,
Chairman Streets Committee, Oakville, Ont.
27

Department of Railways and Canals, Canada

Beauharnois Canal

Protection Work for Valleyfield Government Dam

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for works for protecting the Government dam at Valleyfield," will be received at this office until 16 o'clock on **Friday, July 18th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, Montreal, Que.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque for the sum of $3,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering decline entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, June 25th, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it. 44229. 27-28

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Tenders for Pumping Station at Foot of Woodbine Avenue

Bulk tenders only will be received by registered post only, addressed to the undersigned, up to noon on **Tuesday, 8th July, 1913**, for the above building.

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering as prescribed by city by-laws must be strictly complied with, or tenders may not be entertained.

Tenderers shall submit with their tender the names of two personal sureties or the bond of a Guarantee Company approved by the City Treasurer.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman of the Board of Control.
City Hall, Toronto, June 21st, 1913. 27

TENDERS
FOR
Concrete Conduit

Sealed proposals will be received at the offices of the Water Commissioner, City Hall, until 12 noon, July 15th, 1913, for the fabrication and laying of about 27½ miles of reinforced concrete pipe and appurtenances on the line of the Sooke Water Supply gravity conduit, and in accordance with the requirements of the general specifications prepared by Wynn Meredith, Consulting Engineer, for such construction, pursuant to the provisions of By-law No. 814, and adopted by the Council.

Plans and specifications can be seen, and forms of tender obtained, at the Sooke Water Supply Office, 1414 Douglas street, Victoria, B.C.

The lowest or any tender not necessarily accepted.

C. H. RUST,
Water Commissioner.
Victoria, B.C., June 14th, 1913. 26-28

Tenders Wanted

Tenders for the construction of Cement Abutments for a proposed bridge across Big-Creek, lot 11, Con. 12, in the Township of Burford, will be received by the undersigned up to and including the **14th day of July, 1913.**

Plans and specifications may be seen at the home of Mr. Burtis (Deputy Reeve) Hatchley (on Tilsonburg Branch G. T. R.)

F. W. TAYLOR,
27-28 Township Clerk.

To Contractors

Sealed tenders, marked "Tenders for Work," addressed to the undersigned, will be received at this Department until **Tuesday, July 15th**, for all work, excepting heating, plumbing and wiring required in the erection of a Court House and Registry Office at Haileybury; a Court House at Fort Frances; Poultry Building at the Ontario Agricultural College, Guelph; Dormitory Building at the Ontario Institution for the Blind, Brantford, and Dormitory Building at the Ontario Institute for the Deaf and Dumb, Belleville.

Plans and specifications can be seen at this Department and at the above named Institutions, and by applying to the Sheriffs at Haileybury and Fort Frances.

No tender will be considered unless accompanied by an accepted bank cheque, payable to the Honourable J. O. Reaume, Minister of Public Works, for 5 per cent. of the amount of tender, and the bona fide signatures and addresses of two sureties or the name of a Guarantee Company approved by this Department, willing to furnish bonds for the due fulfillment of the contract, must accompany each tender.

The Department is not bound to accept the lowest or any tender.

By order,
H. F. McNAUGHTEN,
Secretary, Public Works Department.
Department of Public Works, Ontario,
Toronto, June 30th, 1913.

Newspapers publishing this advertisement without authority, will not be paid for it. 27-28

Tenders for Dredging

Sealed tenders, **addressed** to the undersigned and endorsed "Tender for Dredging, Collingwood, Ont.," will be received until 4 p.m. on **Monday, July 7th, 1913**, for dredging required at Collingwood, Ont.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date when they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price (no cheque to be for less than $15,000), which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, 28th June, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 27

CITY OF REGINA, SASK.

TENDERS

Sealed tenders will be received by the City Commissioners at Regina, Sask., up until noon of July 12th for the supply of: Two vertical shaft, motor driven, centrifugal pumps to operate against 22 foot head, capacity 12,500 gallons per minute each.

Tender to be accompanied by a marked cheque for 5 per cent. (five per cent.) of the amount of tender.

Further particulars may be obtained from E. W. Bull, Superintendent of Light & Power Department, Regina, Sask. 25-28

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, July 12**, for the construction of the substructure of a subway to be built at Yonge Street, at North Toronto.

Plans and specifications can be seen at the office of the Engineer of Grade Separation at No. 262 Avenue Road, Toronto, where proposal forms can also be obtained.

B. RIPLEY,
Engineer of Grade Separation.
Toronto, June 26th, 1913. 27-28

For Sale

300 tons new No. 30 rail and plates.
2 Porter Locomotives, 15-ton, standard gauge.
50 4-yd. one-way Dump Cars, standard gauge.
1 pile Driver, 35 ft. Leads, 2600 lb. Hammer.

Apply, J. J. GARTSHORE,
26-27 58 Front St. W., Toronto, Ont.

Piles For Sale

A carload of piles 30 to 40 ft. in length not needed on present. Will sell lot cheap.

BISHOP & BUCHANNAN,
24-27 Owen Sound, Ont.

BARGAINS!

1	Thew Steam Shovel, used less than 90 days, shop number 690; like new	$3,300
30	1½-yd. dump cars, 36-in. gauge; practically new. Each	30
1	American Well Air Compressor, 12 x 12 x 14, 340 ft. capacity, new	440
1	Rand Belted Air Compressor, 10 x 14; A.1.	240
1	Buckeye Trenching Machine, steam driven; cuts trench 27-in .wide to 8 ft. deep. Overhauled and A.1.	2,500
2	American, 6¼ x 10, D.C., D.D. Hoisting Engines with boilers and boom swingers, A.1. Each	725
1	Three-drum Stronsburg 7 x 10 Hoisting Engine with boiler; practically new.	725
1	Gates No. 5 Crusher, 2 arm Spider, rear drive (Rebuilt B.) Exceptionally low price.	

For anything else second-hand, write

WILLIS SHAW MACHINERY CO.

New York Life Building, Chicago, Ill.

Residences

(Continued from page 71)

Residence, cost $5,000, Melrose, for G. L. Robertson, 10 Chestnut ave. Architects and builders, Robertson Bros., 10 Chestnut ave. Two storeys, 25 x 45, concrete foundation, brick construction, felt and gravel roofing.

Residence, cost $11,300, Wood and Holton. Owner and builder, Mr. Jno. Allan, 300 Atwater ave. Two storeys and basement, 26 x 65, cement foundation, brick construction. Excavating started.

Cottage, cost $15,000, Outremont (Maplewood), for E. J. Chapleau, 147 Laval ave. Architect, G. A. Monette, 260 St. James. Brick and masonry, Martineau, Bisson & Lawrence, 643 Berri St. Carpentry, Special Construction Company. Heating and plumbing, Belisle & Frere, 808 Papineau. 2½ storeys, 33 x 57, cement foundation, buff brick construction, copper cornices.

Residence, cost $6,000, Brock, for G. M. Wynn, 2422 Park ave. Builder and general contractor, C. E. Deakin, Sommer Bldg. Two storeys and basement, 25 x 50, brick and terra cotta construction.

Residence, cost $7,000, Fenwick, for Capt. A. Reid, 163 Mansfield street. Builder and general contractor, J. J. Kirkpatrick, Montreal West. Frame construction.

New Hamburg, Ont.

Residence, cost $7,000. Builder and owner, Ed. Merner. One storey, brick and frame construction.

Ottawa, Ont.

Apartments, cost $10,000, Clarence, for O. Gallie, 206 Clarence. General contractor, E. Monette, 60 Stirling. Three storeys, 64 x 40, solid brick construction, Foundations in.

Port Stanley, Ont.

Rooming house, cost $6,000, for Littlejohn & Dyker, Aylmer. General contractor, Samuel Wilson, Port Stanley. 2-storeys, frame construction.

Toronto, Ont.

Addition to residence, cost $20,000, 84 Queens Park, for E. R. Woods, 84 Queens Park. Architect, E. G. Bird, King and Bay streets. General contractors, Norcross Bros., King and Bay. 1-storey, 25 x 40, structural steel, art stone and brick construction.

Residence, cost $5,000, Wells Hill. General contractor and owner, J. Singer, 133 Queen west. Heating, wiring and plumbing not yet awarded. 2½-storeys, 22 x 36, brick construction.

Residence, cost $25,000, Nina and Wells Hill, for J. Dinwoody, 28 Bracondale Ave. Architects, Harvey & Haffa, Bay street. Mason, F. & A. E. Ham, 83 Salem Ave. 2½-storeys. Other contracts to be awarded shortly.

One detached residence, cost $5,000, Braemore. Builder and owner, R. C. Bustard, 7 Queen east. 2½-storeys, 22 x 34, brick construction.

Detached residence, cost $5,000, Briar Hill road, for R. Woods, 32 Briar Hill road. Architect and builder, R. Fry, 52 Castlefield Ave. 2½-storeys, 24 x 36, brick construction.

Westboro, Ont.

Residence, cost $5,000, Cole. General contractor and owner, W. Peart, Cole Ave. 2½-storeys, solid brick construction.

Winnipeg, Man.

Two residences, cost $6,000, Beresford Ave., for J. W. Parker, 473 Beresford Ave. Two storeys, 24 x 38, stone foundation, frame construction.

Residence, cost $10,000, Harvard Ave., for Western Builders, Ltd. Architect and builders, Owner. 2½-storeys, stone foundation, frame and brick construction.

Apartment block, cost $30,000, Furby, for D. A. McArthur, 56 Furby. Architect, J. D. Atchison, Trust & Loan Bldg. General contractors, Claydon Bros., Furby Place. Three storeys, 49 x84, stone foundation, brick construction.

Apartment block, cost $35,000, Young street, for Johnnesson, 675 McDermot Ave. Architect and builder, Owner. Three storeys, 33 x 52 ft. 5 in., stone foundation, pressed and common brick construction.

Apartment block, cost $30,000, Balmoral street, for A. McBean, c/o Architect. Architect, F. R. Evans, 506 Somerset Bldg. Owner will do work by day labor. Three storeys, 51 x 103.

Five residences, cost $20,000, Clifton, for Hancox Land & Bldg. Co., 208 Nanton Bldg. Architects and general contractors, Owner. Two storeys, 20 x 28, stone foundation, frame construction.

Residence, cost $5,000, Ruby, for J. Farquhar, 269 Balmoral St. Architect and builder, Owner. 2½-storeys, 24 x 30, stone foundation, frame construction.

Two residences, cost $15,000, Grosvenor St., for Western Mutual Investment Company, 242 Somerset Bldg. General contractor, W. W. King, 358 Rosedale Ave. Three storeys, 33 x 33, stone foundation, frame and brick construction.

Power Plants, Electricity and Telephones

Brampton, Ont.

Town Council contemplate extension to lighting system. Clerk, W. H. McFadden.

Drumbo, Ont.

Council plans to instal a hydro system. Clerk, J. S. Cowan.

Flett Springs, Sask.

Telephone system, cost $22,000, for Flett Springs Telephone Co., Sec., R. R. Amber, Norwich. Contracts awarded to Northern Elec. & Mfg. Co., 599 Henry St., Winnipeg, for apparatus and to Harold Bailey, Fleet Square, for installing.

Goderich, Ont.

Electric lighting. Mayor, Chas. A. Reid. Clerk, L. L. Knox. Council contemplates installing lighting system for park and all bridges.

Montreal, Que.

Electric lighting, Pointe Claire. Engineer, V. H. Dupont, 225 St. James St., Montreal. General contractors, Laurin & Leitch, 5 Beaver Hall Square, Montreal. Sub. contractor, Mr. Cam, 3 Beaver Hall Square, Montreal.

Saskatoon, Sask.

Addition to power house, cost $13,000, for city council. Architect, T. J. O'Leary, Willoughby Summer Block. General contractor, Jas. Priel, First Ave., at

$13,008. Three storeys, 30 x 80, cement foundation, Portage la Prairie, brick construction.

Miscellaneous

Lindsay, Ont.
Fire protection system is contemplated for Canadian Boving Co.'s plant. Clerk, D. Bay.

Ottawa, Ont.
New steamer, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders will be called shortly for a new steamer for navigation on St. Lawrence River.

Toronto, Ont.
Fire apparatus, for Board of Control. Tenders received by Mayor, H. C. Hocken, until July 8th for fire hose, hook and ladder truck and motor driven combination hose wagon and chemical engine. Specifications, etc., at office of Fire Dept., 152 Adelaide west.

Vancouver, B.C.
Three gasoline launches, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The Vancouver Ship Yard, Ltd., 1877 Georgia st., will build 3 launches, 50 ft. long.

Business Notes

Balcarres, Sask.
Two storey warehouse of Forbes & Eby, Balcarres, value, $10,000, damaged to extent of $6,000.

Montreal, Que.
Sash and door factory, 228 Duvernay, owned by Sarrasin & Fils, 61 Levis St., burned. Loss, $45,000. Not decided whether to rebuild.

Laundry and factory, 43 Dorchester, owned by T. M. Morgan, 370 Wood Ave., burned, loss, $5,000. Repairs will start at once. Builder, Jos. Gilletz, 29 Duluth Ave.

Marmora, Ont.
Royal hotel building, barns, sheds and laundry, destroyed by fire. No insurance.

Oshawa, Ont.
Building occupied by Messrs. Geo. Copeland & Sons, and owned by M. Moses was destroyed by fire. Loss $5,000.

Walton, Ont.
Saw mill, owned by John McDonald, destroyed by fire.

New Companies

Beaver Realty Company, Limited, has been incorporated with a capital of $40,000 to carry on business as general contractors, to erect buildings and deal in building material, with head office at Toronto. The provisional directors are E. C. Ironside, W. J. McLarty, barristers, and Isidor Finberg, law student, all of Toronto.

The Tweed Realty, Limited, incorporated with a capital of $40,000, to carry on a general land and building business, with head office at Toronto. The provisional directors are A. S. Lown, solicitor, W, J. McWaters. gentleman, and C. R. Munro, broker, all of Toronto.

The Innisfil Telephone Company, Ltd., has been incorporated with a capital of $12,000 to carry on the general business of a telephone company, with head office at Lefroy. The provisional directors are Ebenezer Todd, W. J. Ralston, and G. C. Allan, all of the township of Innisfil, County of Simcoe, Ont.

The London Development Co., Ltd., has been incorporated with a capital of $32,500 to carry on business as a general land and building company, with head office at New Hamburg, Ont. The provisional directors are D. P. Smith, real estate broker, H. W. Schweitzer, agent of London, and Dr. R. T. Winn, of New Hamburg.

Sutherland Construction Co., Ltd., has been incorporated with a capital of $40,000, to carry on business as a land and building company, with head office at Toronto. The provisional directors are R. W. Hart, barrister, G. M. Miller, law student, and C. H. C. Leggott, accountant, all of Toronto.

Mabees, Limited, incorporated with a capital of $40,000 to erect buildings and deal in building materials and to carry on business of a general land and building company, with head office at Toronto. The provisional directors are E. W. Mabee, David McGill, real estate agents, and J. W. Payne, all of Toronto.

The Beaver Lumber Company, Ltd., has been incorporated with a capital of $75,000 to carry on business as lumbermen, saw and planing millers and manufacturers of lumber, woodenware, etc., with head office at Toronto. The provisional directors are W. J. Mitchell, Ernest Constant, W. S. Thomas and R. J. Christie, brokers, all of Toronto.

The Consolidated Stone Company
Quarries and Mills at Bedford, Indiana, and Bloomington, Indiana
Producers of Dark Hollow Buff and Blue
Hunter Buff and Blue Oolitic Limestone

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Bedford Stone
from our quarries has been used in many of the largest public buildings, churches, etc., in the United States and Canada.
Mill blocks, sawed, planed and turned stone of every description furnished on short notice. Write for information.

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Northwest Sales Office—326 Monadnock Bldg. Chicago

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto ...... Ontario

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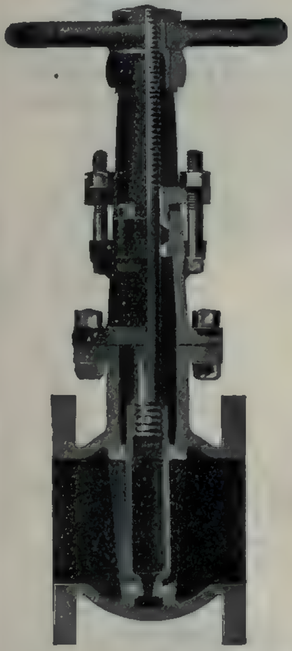
are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.



They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

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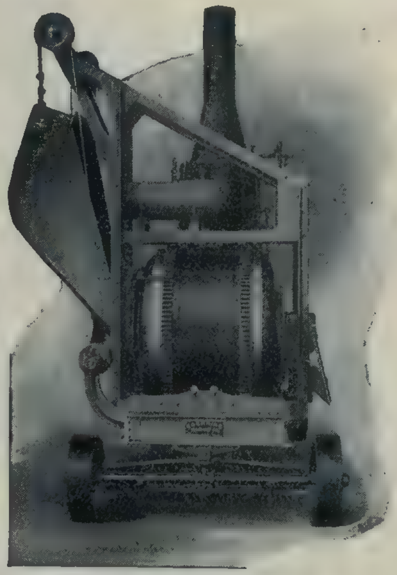
The Koehring "3 in 1"



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We do it by putting the right kind of material into every part of THE KOEHRING—and *enough* material.

Its truck, for instance, is very rugged; it is made with a full 100% safety factor of strength.

Then here are features of design that add greatly to its lasting qualities.

For instance the rollers in THE KOEHRING are keyed onto the shaft *exactly as in a railroad truck*, preventing rapid wear of trunnion rollers and runaways and disalignment of drum, the cause of so many mixer troubles.

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Don't buy until you have investigated all these detailed superiorities of THE KOEHRING. The few points outlined here are but indications of the many you should know about.

The Koehring "3 in 1" Mixer Book No. 18 Gives Full Details

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Exclusive Sales Agent for Canada: CANADA FOUNDRY CO. LIMITED—Toronto, Montreal, Halifax, Ottawa, Cobalt Winnipeg, Calgary, Vancouver, Nelson.

Current Prices of Building Material.

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	26 00	30 00
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	24 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 10 per cent.; lead waste, $9.00, less 10 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 35 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ½-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, 9.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor Brand, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil in bbls., 63c. per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 60c. per gal. of 9 lbs.

Turpentine, in barrels, 60c. per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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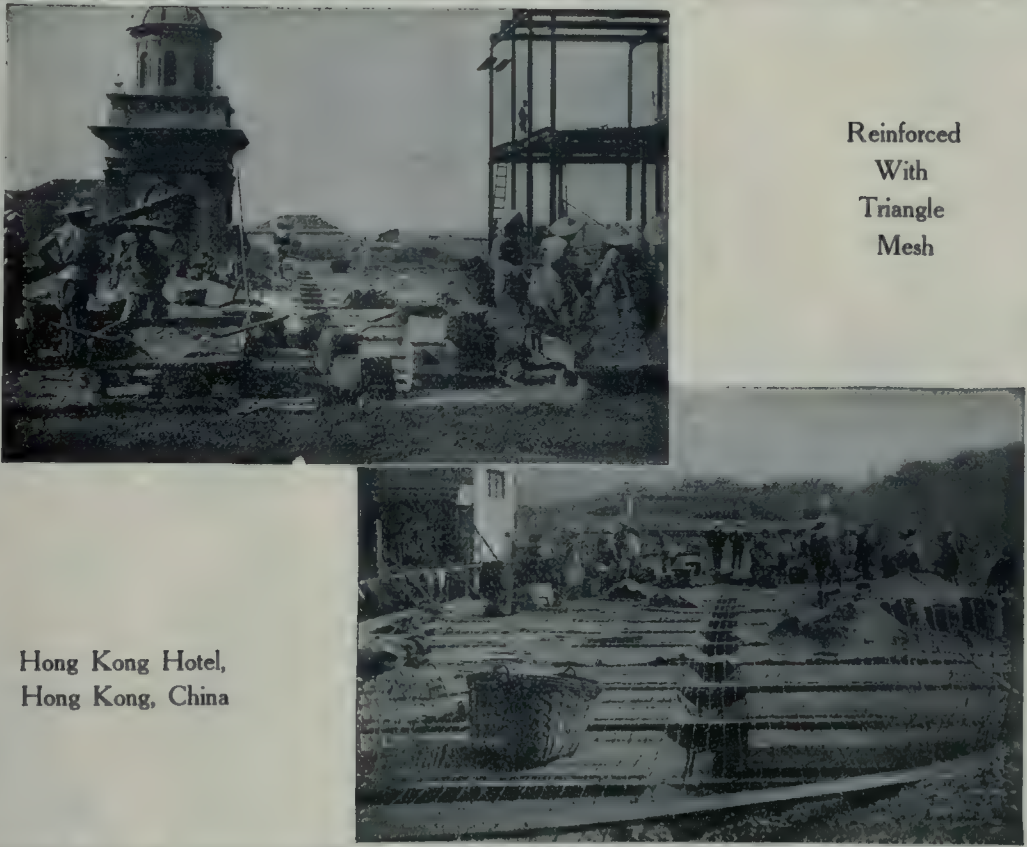

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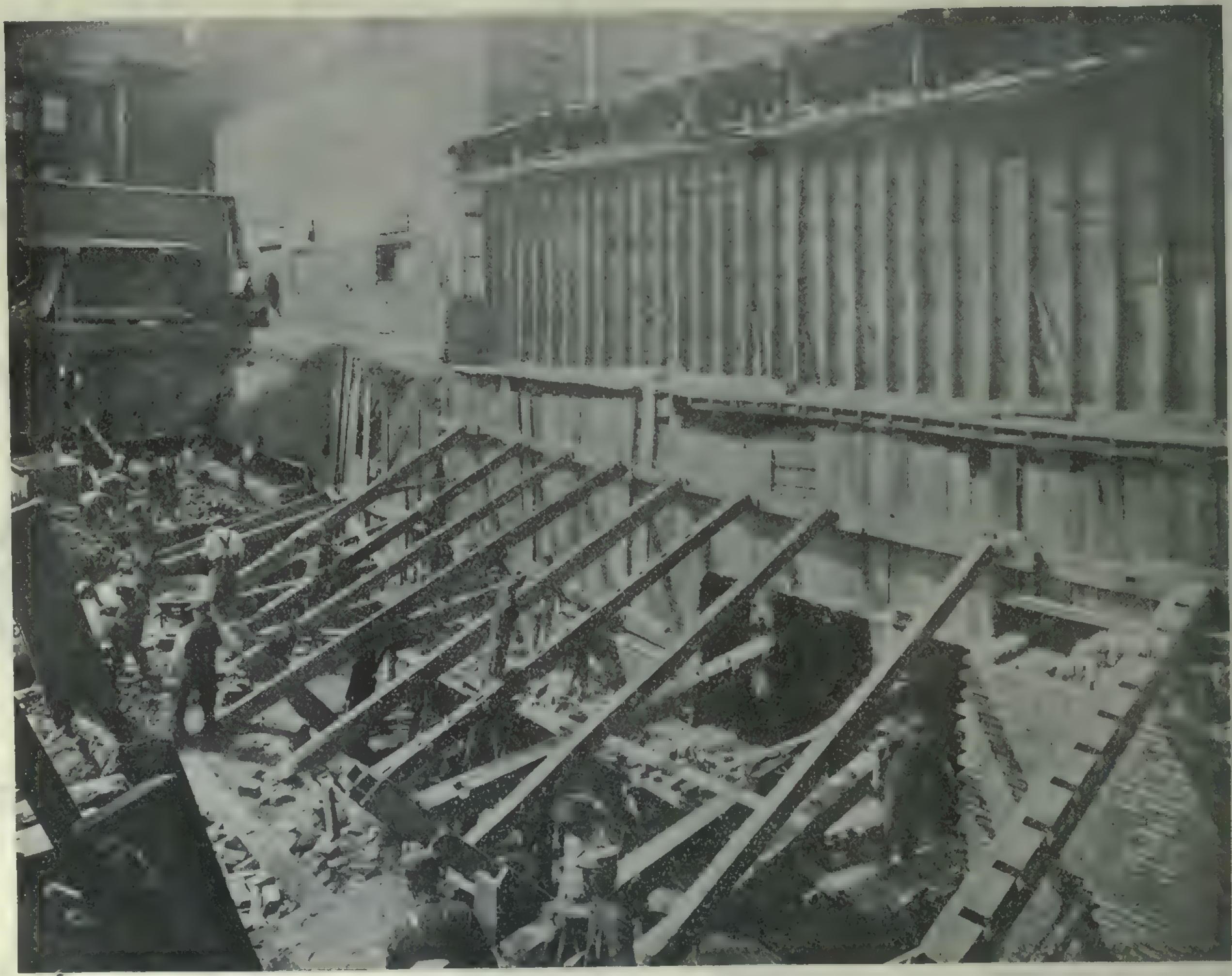
Let Us Tender on Your Roofing and Waterproofing Specifications

We supply roofing, waterproofing and insulating materials of all kinds and undertake contracts for roofing and waterproofing, our complete equipment enables us to execute the work in accordance with Architects' and Engineers' specifications.



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Our work on many notable Canadian buildings is a guarantee of our ability to successfully carry out the most important contracts.

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Structural Waterproofing Engineers and Contractors

Roofing, Waterproofing and Insulating Material

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CASCO WEATHER PROOF PRODUCTS

GOODYEAR

HOSE

For Greater Protection---For Longer Wear

¶ The Goodyear Hose-making equipment is the most up-to-date in Canada. We have the latest improvements known to the trade. Every process is under the control of experts, who know the Goodyear requirements and see that a uniformly high standard of quality is kept up.

¶ We take no chances with the raw materials. A stringent laboratory examination determines the quality of the raw rubber. The hard long-fibre cotton which is specially woven for Goodyear Hose-making is submitted to tests for strength and weave.

¶ The walls of the hose are composed of long strips of cotton fabric thoroughly impregnated with rubber or friction. And cut on the bias to resist expansion, bursting and elongation. This friction-impregnated fabric is rolled under great pressure, which ensures a perfect union of the plies.

SUCTION HOSE

¶ We build into Goodyear Hose the same strength and indestructibility as have made Goodyear Rubber Belts famous. Goodyear Suction Hose is steel-wound internally to guard against collapse. The coil is of round or flat wire, and round it the hose is built up, ply upon ply of rubber-permeated cotton fabric. This fabric is made from special hard-staple long-fibre cotton, and is cut on the bias to give strength and hard wear.

¶ Goodyear Suction Hose is made for every purpose - and can be had rough or smooth bore. Is in service throughout Canada—on wrecking and dredging contracts—in factories and mines—on farms and in saw-mills. Special hose made for sand-sucking, oil, gasoline, vinegar and acid, wine, etc.

STEAM HOSE

¶ Steam Hose gets more hard usage than any other hose. In the Boiler Room it lies around near the furnace and is scorched—a hot firing tool is carelessly thrown down upon it—oil is spilt over it.

¶ Goodyear Steam and Hot Water Hose is made with special heat resisting lining, which keeps the extreme heat from the friction fabric. This gives the extra durability—it will stand up well under hard usage. In its manufacture the materials undergo special treatment to resist oil—so destructive to common hose. The rubber and duck used in Goodyear Steam Hose are specially tested for service under high pressure of steam and hot water. We supply it steel wire wound or marline jacketed.

GOODYEAR RUBBER HOSE

AIR HOSE

¶ With fair usage Goodyear Air Hose will be found proof against internal decay from oil—breaking away of pieces of the tube—and clogging of the machinery. The lining is made from selected rubber and cured to prevent hardening from the heat and pressure.

¶ Goodyear Air Hose will give good service under intermittent pressure.

¶ In mines, engine and boiler works, steel construction contracts—wherever pneumatic tools are being operated you will find Goodyear Air Hose. Wire or marline winding or marline jacket.

THE GOODYEAR TIRE & RUBBER CO. OF CA
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THE GOODYEAR TIRE

GOODYEAR MILL HOSE

¶ When Mill Hose is wanted it is wanted badly. To find that your Mill Hose has cracked and rotted while lying idle is serious. **"Goodyear Underwriters"** is always ready for effective service. We build this hose to meet the requirements of the Associated Factory Mutual Fire Insurance Companies. It bears the required stamp of approval "tested to 200 lbs. pressure." The inner tube is made from NEW Rubber of the highest grade, uniform in thickness and quality. The cotton fabric is of special circular web woven to the Underwriters' specifications for a minimum of expansion or elongation under pressure. It is antiseptically protected against rot and mildew.

¶ For Factories and Mills the "Goodyear Underwriters" is a hose which will lower insurance rates, and cannot be excelled in durability and strength. You see it everywhere—the hose with the black and yellow stripes.

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Each line a leader

We specialize on the following:

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ESTABLISHED 1886

Contract Record and Engineering Review

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Alphabetical Index of Advertisers
Page 16

Vol. 27 July 9, 1913 **No. 28**

The Third International Road Congress

DURING recent years no subject has assumed greater importance with municipal authorities than highway construction and maintenance. The most convincing evidence of the truth of this assertion was provided in London, Eng., on the occasion of the Third International Road Congress (June 23-28) reported elsewhere in this issue.

Within the last decade, self-propelled traffic has called for new methods of construction, while the cost of maintenance has advanced by leaps and bounds. Immense strides have been made in both construction and maintenance since the Brussels Congress in 1910, and the years which have intervened have been consistently progressive. Especially has this been so in connection with the bituminous treatment of roads, which has advanced from the experimental to the practical stage in an inconceivably short space of time. And this improvement has not been confined to one or two countries. The whole civilised world has been experimenting in the field of road reform, and the fact that no less than thirty-nine Governments appointed delegates to attend the London Congress bears striking testimony to the international character of the movement. Papers were contributed by engineers from Canada, the United States, Great Britain, Australia, Germany, Austria, Belgium, Denmark, France, Hungary, Italy, Russia, Holland, the Argentine, Switzerland, Egypt, Bulgaria and Monaco.

Meetings such as the London Congress have been criticised as being fruitless in regard to technical achievement. These international road conventions, however, are arranged primarily with the idea of affording engineers the world over the opportunity of comparing notes, and in this respect the London Congress, attended as it was by upwards of three thousand engineers from all parts of the globe, was singularly successful.

Having regard to the polyglot nature of the assembly and the wide range of subjects discussed, it is not to be expected that any one congress can arrive at definite conclusions in the various branches of highway engineering. The divergence of opinion among the representatives of one nation alone would render such conclusions improbable, and when some forty nations are engaged in lively discussion in three "official" tongues, the impossibility becomes apparent. The London Congress can but do what its forerunners have done and that is provide a mass of material for engineers to wrestle with pending the next gathering. Much that is presented in the form of papers at these congresses may be summarily dismissed from consideration as being of no importance; much is merely ephemeral, or of local application only; but there is always a residuum of sound material deserving of the earnest attention not only of the engineer but of all engaged in the administration of our roads.

There can be but one result from these periodical meetings, and that must be beneficial. The universal interest awakened must stimulate the energies of engineers the world through, while the friendly rivalry encouraged among divers nationalities will work wonders both in perfecting existing systems and in creating new and improved methods.

The ultimate aim of these Congresses is necessarily the perfect road. This attained, further deliberations may cease for all time. The perfect road, however, is not to be found outside Utopia, and interest in road congresses will not cease until such time as humanity takes finally to the air as a medium for locomotion.

Much might be said anent the receptions and entertainments, which were enjoyed to the full by the Canadian delegates and those from the United States. For most of us, at any rate, it was a red-letter day to be entertained within the historic precincts of the Guildhall and to be received by the Lord Mayor and the Corporation of the City of London It is not an everyday occurrence, either, to visit Windsor Castle upon the invitation of His Majesty the King. But these things, perhaps, will provide subject matter for a later chapter, it being the intention of the editor in the material published in this issue to present a timely and concise account embodying such notes as will be found generally informative by the technical man.

A Wider Interest in Sanitation Required

THE inhabitants of this vast continent have been a spendthrift people. That they should be is very natural. In any large area not thickly peopled and teeming with wealth, there is bound to be no husbanding of resources. In smaller and more densely crowded regions the sustaining of life makes necessary a utilization of every available product. Of no wealth has the world been more improvident than of the asset expressed in human life. This improvidence has manifested itself not only on fields of blood, but in our lack of knowledge of the laws of sanitation, our indifference concerning their acquisition, and our lethargy in conforming to those coming within the range of our information.

To the medical profession and to the civil engineer, we owe a great debt. Theirs has been a hard struggle and the battle is but begun—a battle against the superior ignorance of those who refuse to be taught and the prejudice of those who interpret the efforts of the two professions, as being just a fad affording another opportunity to squeeze money out of the unsuspecting. Humanity has to be saved from itself in spite of itself.

In the larger cities, of necessity, there must be considerable attention to sanitation. Not because of any superiority on the part of the citizens, but because each must live in proximity to his neighbor and accumulations of vegetable refuse, of litter and of the wastes of life soon become a nuisance and their removal is demanded. Moreover, the rapidity with which disease spreads in crowded localities, the high mortality rate arising from enfeebled resistance through over-crowding, impure air, confinement and often improper nourishment, has taught city officials the need of effective sanitation. But in the face of the best intentions and efforts there is much to be desired. In the smaller urban communities and in the rural districts danger arises from the fact, that the privilege of larger space afforded each citizen permits the continuance of the accumulation unmolested, perhaps throughout the whole summer season, thus furnishing a breeding ground for disease bearing insects and a culture for pathogenic germs.

There is much to be accomplished. A knowledge of the science of the preservation of human life must be more generally spread. It should be known that the house mosquito, one of many species, develops in all forms of standing and filthy water, both indoors and out; that the larvae feed upon the micro-organism found therein and that the fluid injected into the body when the house mosquito bites is a salivary distillation from this filth. It should be pointed out, that the common house fly is by some called the typhoid fly; that it spreads disease; that it has a power of regurgitation which enables it to eject the content of its stomach upon any substance it wishes to dissolve, and that this ejected fluid may have been gathered in any filthy matter impregnated with disease-causing bacteria. Householders should know the dangers of heaps of decaying vegetation and piles of animal litter. Civic officials and gardeners should be acquainted with the fact that faecal matter merely trampled into the dust or spread upon the fields to dry does not destroy the germ life, but merely leaves it to be scattered broadcast with every wind. Sanitation is a most important science.

The work of arousing a wider spread interest in this subject may be accomplished by a variety of agents acting in conjunction, education by means of schools, by lecturers engaged by the Provincial Board of Health, through the efforts of the local doctors and by pamphlets sent out to the public in larger numbers. A step forward was taken when the province of Ontario was divided into health districts. These districts might be reduced in size and hence increased in number and a permanent expert placed in charge of each. By this means the local medical officer in smaller communities could be largely relieved of his duties, as dependence upon the locality for medical practice militates against efficiency. There must be continued work on the part of engineers to provide reasonable and effective garbage destruction and sewage disposal in less thickly inhabited districts. Not the least important factor in safety is the hearty co-operation of the people to be benefitted.

Improved sanitation will cost money. The state of New Jersey spent $350,000 to drain 400 square miles of salt marshes and saw results before the work was half done, in the greatly diminished mosquito pest. If the taxpayer once becomes seized of the fact, that increased care and cleanliness tend to greater physical comfort and better health, to greater business efficiency and longevity, the money will be forthcoming.

Important Railway and Civic Projects

THE confidence of Sir Thomas Shaughnessy, president of the Canadian Pacific Railway, in Canada's ability to pass through the present stringency without serious result is most marked. Speaking of the present conditions, he says: "So long as immigration continues at the present rate, the highest ever known, Canada's progress cannot be retarded". In fact, he forecasts that in two years from now there will be even more accelerated expansion.

The president of this great corporation claims that there has been no over-expansion in Canada and points out that in the matter of steel rails alone the Canadian manufacturers, while able to supply a large quantity, were not able to meet the demand, and this necessitated the purchase of 45,000 tons from American makers. The company is in a very strong position financially. The recent issue of $105,000,000 of common stock will give plenty of available cash and their land assets are enormous and increasing in value. At the present time the Canadian Pacific Railway has 1,800 miles of road under construction and $75,000,000 of equipment placed. Added to the large sums involved in these operations comes the announcement of the intended expenditure of $100,000,000 in the coming year. This sum is intended to cover railway extension, the building of hotels, steamers and rolling stock. These undertakings are rendered necessary by the increased growth and demands of the Dominion.

The railways and the city of Toronto have at length arrived at an agreement with regard to the viaduct. The work involved in the harbour improvements and the construction of the Esplanade viaduct and the new Union Depot will now be pushed vigorously. The city itself has plans for extensive municipal improvement. The waterworks pumping and distributing plant is to be extended; a drainage system for North Toronto and Moore Park is to be installed; the filtration is to be enlarged and a garbage and refuse disposal plant to be built. In all there is to be an immediate expenditure of about $100,000,000 in the provincial capital in the construction of large works by the city and the railways.

The confidence manifested in these projects and the magnitude of the expenditure involved should go a long way to remove any feelings of hesitancy or uncertainty regarding the immediate future. As we pointed out in our last issue, these undertakings should provide sufficient labor both in manufacture and construction to prevent any serious check to Canada's trade and expansion.

THE Provincial Government of Ontario is entering upon a new field of operations. An asylum composed of a large group of important buildings is under way at Whitby, Ont. It was found impossible to procure an acceptable roofing tile within the province. For the purpose of meeting this requirement and providing the necessary brick for public buildings an extensive factory is being opened at Mimico by the Department of Public Works.

The Third International Road Congress

Great Gathering of Highway Enthusiasts at the World's Metropolis—Delegates of Forty Nations Present—Canada and the U. S. Well Represented

(Staff article direct from the Editor)

London, Eng., June 28, 1913.

THE Third International Road Congress was inaugurated at the Central Hall, Westminster, London, Eng., on June 23rd, and many hundreds of delegates, representing governments and institutions from all parts of the civilized world, attended. The Congress, of which the King was Patron, was held in London by invitation of the British Government, and was organized by a council elected from numerous bodies, administrative, scientific and professional, interested in the roads of this country, with Sir George Gibb, chairman of the Road Board, at its head, Lord Montagu of Beaulieu, Mr W. Joynson Hicks, M.P., and Mr. F. H. Berryman as its vice-chairmen, the Hon. Arthur Stanley as hon. treasurer, and Mr. W. Rees Jeffreys as hon. general secretary. The council acted in co-operation with the Permanent Committee of the International Commission of Road Congresses. An exhibition of road-making appliances and materials and held concurrently with the Congress and a large number of interesting excursions, visits to works and so forth; was planned not only for the Congress week but for the preceding and following weeks.

Canadian and U. S. Members

Canada and the United States were well represented, as may be gathered from the following names taken from the membership list:

Balch, W. H., M. Am. Soc. C. E., Director-General of Public Works, San Domingo.
Bellisle, J. A., Secretary of the Hon. C. R. Devlin, Quebec.
Blanchard, A. H., Professor of Highway Engineering, Columbia University, New York City.
Bowman, H. J. (Berlin, Ont.), Canadian Society of Civil Engineers, Montreal. Delegate of the Society.
Carpenter, H. S., Superintendent of Highways, Saskatchewan.
Church, S. R., Manager, Research Department, Barrett Manufacturing Co., New York City.
Clarke, A. R., Ontario Motor League, Toronto.
Cochrane, Hon. Frank, Minister of Railways and Canals, Ottawa.
Cook, J. H., Montgomery, Alabama. Delegate of American Automobile Association.
Cornell, Col. E. S., New York.
Crosby, W. W., Consulting Engineer, Baltimore.
Darlington, N. D., Los Angeles, California.
Devlin, Hon. C. R., Minister of Colonization, Quebec. Delegate of Quebec.
Durham, H. W., Chief Engineer of Highways, New York. Delegate of New York.
Fletcher, A. B., Highway Engineer, California.
Fuller, A. H., Professor of Civil Engineering, University of Washington, Seattle.
Gillette, H. P., Consulting Engineer, Chicago.
Goodsell, D. B., Assistant Engineer, Department of Public Works, New York.
Haag, J., Secretary, Board of Estimate and Apportionment, New York City.
Hill, S. Delegate of American Road Builders' Assn.
Kennedy, E. J., Boston, Massachusetts. Delegate of American Automobile Association.
Kenyon, C. A., Indianapolis.
Laing, A. T., University of Toronto, Toronto.
Lewis, N. P., Chief Engineer, Board of Estimate and Apportionment, New York City.
McLean, W. A., Member Canadian Society Civil Engineers, Chief Engineer Department of Public Highways, Toronto. Delegate of Ontario.
Nelson, G. A., Decatur Chamber of Commerce, Alabama. Delegate of Chamber of Commerce.
Page, L. W., President of American Highway Association, Washington.
Rehill, J., Superintendent of Construction, Maryland State Roads Commission.
Sharp, C. H., Electrical Testing Laboratories, 80th St., New York City.
Smith, F. P., Chemical Engineer, East 23rd street, New York City.
Stone, W., Manufacturer, Oakville, Ont.
Thomson, R. H., Chief Engineer, Strathcona Park Government Building, Victoria, B.C.
Tillson, G. W., Consulting Engineer, Offices of the President of the Borough of Brooklyn.
Travilla, J. C., Commission of Highways, St. Louis.
Turner, H. A., Road Superintendent, Okanagan Valley, British Columbia.
Washington, W. DeH., New York. Delegate of State of New York.

Inaugural Ceremony

The Chancellor of the Exchequer presided at the inauguration, and in a short characteristic speech welcomed the delegates He claimed that the roads of England were the best in the world. With the coming of the railroads, many of the roads of the country had fallen almost into desuetude. Then came the great revolution effected by the pneumatic tire, and road-making became once more an important social, economic and financial question. In 1892 the roads of England and Wales cost $42,500,000 to maintain; twenty years later they cost practically double.

Sir George Gibb, in expressing to the Chancellor the thanks of the Congress for his welcome, referred to the great improvements which had been effected in road-making since the Brussels Congress of 1910. Dust might be said to have been conquered, for it did not exist to any appreciable extent on roads which had been properly treated with tar or bitumen. In Great Britain the general trend of engineering opinion was undoubtedly in favor of the use of tarry or bituminous substances in road-making, and in England, perhaps to a greater extent than in any other country, macadam so treated had, not only experimentally, but definitely and practically, taken the place of water-bound macadam for roads of any importance.

Addresses and responses to the welcome were delivered by M. Preadeau, president of the Permanent Committee of the International Commission, and by representatives of the Governments of Canada, the United States, Germany, Austria, Hungary, Belgium

France, Italy, Monaco, Holland, Norway, Russia, Spain and Switzerland.

The 1916 Congress

Herr Lewald, on behalf of the German Government, extended a cordial invitation to the Commission to hold the next Congress at Munich in 1916. This invitation was warmly endorsed by the head of the Bavarian delegation, and Sir George Gibb announced that the council had that morning discussed the invitation and recommended its acceptance.

Mr. W. DeH. Washington said that he had come there to bring them the invitation of the Governor of New York State to hold their meeting in the United States, and he would have brought the invitation of the President, but for a rider in a bill which forbade the President to send delegates to any international congress. In the States they were deeply engaged in the work of road-building The State of New York was now ready to spend a sum of nearly $100,000,000—perhaps the largest public expenditure possible in the world to-day, and they had come to England to hear all they could, and he was sure they would gain in their endeavor to make smooth the path of humanity. In building good roads they were working for man and for God. They had 2,200,000 miles of roads in the United States, but only 190,000 miles had been improved.

Later in the day, the Exhibition was opened by Earl Beauchamp, H. M. First Commissioner of Works, President of the Exhibition Committee, while in the evening the members of the Congress were received at the Guildhall by the Lord Mayor and Corporation of the City of London, some 2,400 guests being present.

Proceedings of the Congress

Opening, as has been said, on June 23rd, the Congress continued until June 28th. The programme was a full one every day, and lasted from ten o'clock in the morning until often quite late at night. Practically only three days were devoted to actual business (in the way of discussion of the papers and reports submitted) the remainder of the time being spent in visits, excursions, receptions, and the inevitable final banquet, which last-named was given at the Hotel Cecil and followed by a full reception.

The papers and communications submitted for the consideration of the Congress embraced a wide variety of subjects, but it was somewhat difficult to understand precisely what constituted a "paper" and what a "communication." The only difference between the two appeared to be (according to the official programme) that whereas the discussion of questions was compulsory, the discussion of the communications was qualified by the phrase "if time permits." The following are the headings of these questions and communications:

Questions

1. Planning of new streets and roads.
2. Types of surfacing to be adopted on bridges, viaducts, etc.
3. Construction of macadamized roads bound with tarry, bituminous, or asphaltic materials.
4. Wood paving.
5. Methods of lighting public highways and vehicles.
6. Observations noted since 1908 as to the various causes of wear and of deterioration of roadways.
7. Regulations for fast and slow traffic on roads.
8. Authorities in charge of the construction and maintenance of roads, functions of central authorities and local authorities.
9. Finance of the construction and upkeep of roads—provision of revenues.

Communications

1. Improvements adopted since the second Congress in machinery used in the construction and maintenance of macadamized roads.
2. Tests of materials used in the construction of macadamized roads.
3. Construction of water-bound macadamized roads.
4. Technical and economic study of the comparative advantages of different types of roads.
5. Various types of stone paving in use.
6. Direction and distance sign posts.
7. Development since the second Congress of self-propelled public service vehicles.
8. Qualifications of engineers and surveyors in charge of the construction and maintenance of roads—wages and conditions of service of foremen and roadmen.
9. Statistics of cost of construction and maintenance.
10. Terminology adopted or to be adopted in each country relating to road construction and maintenance.

It will be apparent that with no less than eighteen nations contributing, coupled with the fact that when a speaker used a language other than one of the three official languages of the Congress—English, French and German, to wit—his words had to be translated forthwith, there was some little confusion in the discussions. The time was short enough as it was, and to cut it still shorter the discussion at each meeting was preceded in the case of each question by a brief summary of all the papers to be considered in such section. Properly, to follow the whole of the proceedings, a man would have had to possess a distinct dual personality—two meetings being held at different places at the same time—to know thoroughly three languages, to have a nodding acquaintance with half a dozen more, and to be able to take a rapid shorthand note in all of them. Happily for the peace of mind of our representative, the discussions were not of the highest importance, the cream of what was really valuable being set down in the 123 papers and communications which were printed and circulated among the members before the commencement of the actual business of the Congress and in the resolutions which were put to each meeting. Some explanation of the procedure is perhaps necessary here. In the first place, certain papers are submitted to a Congress, and are then printed and circulated, so that those attending may prime themselves in order to be able to join in the discussions. The papers duly discussed, certain resolutions (based to some extent upon the discussions) are put to the meeting and are adopted or not, with or without amendment, as the case may be. These resolutions, it must be noted, apply only to the nine "questions" submitted and not to the commmunications. In our next issue we shall give the full text of the resolutions, and we hope to present our readers with an intelligent abstract of the more valuable of the papers and communications submitted. Some of the papers we shall necessarily publish in extenso, but there will be a vast overplus, dealing in the main with foreign practice, which, like the curate's egg, will be found to be good only in parts. This overplus will be severely cut and precised, in order that there may be no undue waste either of our space or of our readers' time.

Visits and Excursions

A great number of these were arranged for the Congress week and the weeks preceding and following, the price per head per attendance ranging from one shilling to ten pounds. Strangely enough the shilling excursion—it was really a free excursion and the shilling was for "registration fee"—was that to Windsor by special train, where the members visited the historic Windsor Castle and were entertained to tea in the Castle grounds by the King. Other visits during the Congress week were to the Garden City at Letchworth, the Marconi Wireless Works, the National Physical Laboratory at Teddington, and Hampton Court Palace. There were also various inspections of roads in the "Home Counties," by which terms the counties continguous to London are known, and other parts of the country. Trips were arranged for Eastbourne, Brighton, Folkstone, Chester, North Wales, the Midlands, the English lakes and Scoltand for the week following the Congress, and in every case a series of interesting visits had been planned, with receptions and so forth galore.

Mention has already been made of the reception at the Guildhall on the opening day and of the final banquet and reception at the Hotel Cecil. Other receptions and conversaziones were those at the Albert Hall, by invitation of the Institution of Civil Engineers, at the Royal Horticultural Gardens (a garden party) by the Surveyors' Institution, and at the Royal Automobile Club by the Committee of that Club.

Foremost among the excursions was the daily one, spread over the whole three weeks, to the typical roads through South London and the trial lengths laid in various materials by the Kent County Council under arrangement with the Road Board, in 1911. There were 23 of these trial sections, and an interesting Interim Report of the behaviour of the materials and methods represented by these has been published by the Road Board That the test to which these have been subjected is a severe one is evidenced by the fact that a traffic census taken in August last year recorded an aggregate weight of 3,547 tons per day.

Exhibition of Road-Making Appliances and Materials

A comprehensive exhibition of road-making appliances and materials ran concurrently with the Congress. It was international in character, and was undoubtedly the most representative exhibition of its kind that has ever been held in England. The exhibits were divided into two broad sections, materials and light machinery being shown at the Royal Horticultural Hall, Westminster, and heavy machinery on adjacent ground in Vincent Square. We propose to give just what notes space will allow upon the more important of the exhibits.

Binders, Grouts and Asphaltes

Bituminous binders were well to the fore and mention may be first made of "Camarco," (The Canadian Mineral Rubber Company) a material peculiarly suited to the formation of asphaltic macadam. It is introduced as a binder for the actual road metal, and may also be used as a top dressing for water-bound macadam roadways. The Anglo-American Petroleum Products Company market under the names of "Mexphalte" and "Fluxphalte" two materials refined from Mexican bitumen. Mexphalte has good cementing powers and is used largely in the grouting or mixing method, while Fluxphalte has been designed to supersede tar as a dressing. "Tarco" (R. S. Clare & Company) is a material for surface treatment, "Bi-Tarco" for tar macadam manufacture, while "Bituflex" and "Solta" (Standard Tar Co.) form binders and dressings. Asphaltes were represented by the Val de Travers and the Limmer Companies, while midway between asphaltes such as these and the bituminous binders may be placed "Roadamant" (made by the company of that name) composed of Rock asphalte, bitumen and granite chippings, (applied as a road carpet) and "Cormastik" (The British Trust Corporation) a bituminous road covering, composed of granite chippings, sand, rock asphalte and cement. "Ferromac" (Roadite Ltd.) and "Rocmac" (Rocmac Ltd.) are distinct from the foregoing inasmuch as they are not of a bituminous nature. Ferromac consists of a special cementitious powder and two chemical solutions, and the resulting mixture will, it is claimed, thoroughly bind all broken stone and leave a hard, waterproof, non-slippery surface. Rocmac is described as "silico-saccharate-carbonate" and makes much the claims of the other material. Both are largely and successfully used in England.

Granite and Reinforced Roads

"Clinton Fabric" is a steel wire mesh, made by the British Reinforced Concrete Engineering Company for the reinforcement of road foundations. Among the company's exhibits were two sections of concrete foundations: a 12-in. plain concrete and a 5-in. reinforced. The reinforcement serves to carry the road over soft spots, prevents cracking, and acts as a weight distributor. "Durax" stone, laid on the system of the continental "Kleinpflaster," formed an interesting exhibit, but the material is too well known to our readers to need description.

Mixers, Boilers and Sprayers

Five exhibits may be noticed under this head: the tar and bitumen macadam mixer of the Ransome-ver-Mehr Machinery Company, which may be worked in combination with the firm's stone dryer; the "M.S." tar and bitumen boiler and stone drying and coating machines (Murphy, Steadman & Co.); Johnston's double furnace tar boiler, with preliminary heater, and Waithman's reservoir tarring apparatus for hand-painting; the automatic pressure tar spraying machine and various types of painting machine of W. Weeks & Son; and the spraying and spreading machines and boilers (including the "Farnham" hand spreading machine) of the Phoenix Engineering Company.

Road Rollers

The exhibits in this section were specially good, with no less than six firms contributing. Petrol-driven rollers were much in evidence, together with a number of handy machines of a light type for tar-macadam work. Special mention may be made of the patching roller (with a short wheel base) of Mann's Patent Steam Cart & Wagon Company and the water ballast roller (workable by petrol or paraffin) of Barford & Perkins. The other firms were Aveling & Porter, Clayton & Shuttleworth, Thos. Green & Son and Ruston Proctor & Company, all makers of machines of the highest grade.

Sundry Machinery and Appliances

A few words must now suffice, owing to pressure of space. Stone-breaking machines were exhibited by Hadfield's Steam Foundry Company, H. R. Marsden, and the Patent Lightning Crusher Company. An excellent type of motor street-sweeping broom was shown by Thomas Green & Son, while outside the hall one of J. & P. Hill's motor vacuum road-cleansing machines (which are now largely used on the Continent) was at work. An exceedingly interesting exhibit was that of A. C. Wells & Company, consisting of appliances for drying road surfaces before pitch grouting and for warming asphalte or similar surfaces before applying sealing coats.

(Concluded in next issue)

Personal and Other Notes From the London Road Congress

(By the Editor)

Lord Montagu of Beaulieu, one of the vice-chairmen of the organizing council of the Third International Road Congress, held recently in London, Eng., and reported elsewhere in this issue, is one of the most prominent men in the good roads movement in England. He is well known as the founder and editor of The Car, and he is the President of the Association of Bituminous and Other Paving Manufacturers. He has taken a keen interest in the betterment of the condition of highways, while he has followed with untiring zeal the developments in all transport matters. At Oxford University he is stated to have been "prominent in athletics, engineering and science."

Sir George Gibb, who filled the distinguished office of General President of the Third International Road Congress, is Chairman of the Road Board, in which capacity he has to allocate over the United Kingdom for the purpose of road improvements the sum of approximately $6,250,000 annually. He is a solicitor by training and profession and was formerly a managing director of the North-Eastern Railway Company and Chairman of the Metropolitan District Railway Company. In the important government department which he now controls, he has made a great reputation for himself as an administrator. He has awakened great enthusiasm in good roads in England, a country which possesses some of the oldest and best highways in the world.

Sir Herbert B. Mackworth-Praed, Bart., was one of the most active members of the General Committee of the London Road Congress. He was one of the organizers of Taroads Syndicate, Limited, a company which possesses a fleet of tar-spraying machines, which annually spray with tar the surface of many hundreds of miles of highways in England. Last year he formed the Praed Road Construction Syndicate, Limited, to undertake the bituminous construction of roads.

Sir Maurice Fitzmaurice, C.M.G., formerly Chief Engineer to the London County Council, but now in private practice, was one of the most effective workers on the Executive Council of the Third International Road Congress. He was one of the two representatives of the Institute of Civil Engineers, Mr. Alexander Siemens being the other. Sir Maurice will be remembered as a former contributor to this journal, he having been the author of a detailed description of the Rotherhithe tunnel work, published in our issue of April 24th, 1912.

The Right Hon. Earl Beauchamp, K.C.M.G., H.M. First Commissioner of Works, received the members of the Third International Road Congress at the opening session in London. Earl Beauchamp was President of the Exhibition Committee, whose activities and enterprise were reflected in the representative machinery and equipment show at the Royal Horticultural Hall.

Mr. W. A. McLean, Provincial Engineer of Highways for Ontario, was ubiquitous at the Road Congress in London. The editor of this journal had the pleasure of meeting him at the Surveyors' Institute, Westminster, in company with Mr. E. L. Powers, Editor of Good Roads, New York. Mr. McLean was one of those who contributed a paper on the construction and maintenance of roads, in particular relation to administrative methods and the functions of central authorities. As evidence of the international character of the Congress it may be of interest to state that in this department alone communications were received from representatives of Canada, the United States, Great Britain, Germany, Belgium, Bulgaria, France, Austria-Hungary, Italy and Russia.

Messrs. W. A. MacLean, H. S. Carpenter, W. G. Trethewey and H. T. Bowman were among the Canadians who attended the reception of Members of the Third International Road Congress by the Lord Mayor and Corporation of the City of London at the Guildhall on June 23rd. It is of interest to recall that many of London's most historic associations are connected with the Guildhall. The building is the scene of an annual banquet to the Members of His Majesty's Government. It is here, too, that foreign potentates and other distinguished persons are entertained on the occasion of state visits to the city. Many scenes and incidents, of course, in the past history of the city, are intimately connected with this imposing building. It was here that the Duke of Buckingham assembled the citizens in 1483 and induced them to pass over the children of Edward IV. and to elect Richard of Gloucester as King. Here, too, in the 16th century, the trial was held of Lady Jane Grey and her husband, Lord Dudley, with Archbishop Cranmer and others. Perhaps the most important historical fact of all, however, in the history of the Guildhall was the election here of William, Prince of Orange, to the British throne, an event which took place in 1688.

Mr. Samuel Hill, of Seattle, President of the American Road Builders' Association, entertained the members of the Third International Road Congress to dinner at the Hotel Metropole, in London, on Thursday, June 26th.

Mr. W. Rees Jeffreys, Honorary General Secretary of the Third International Road Congress, entertained the members of the Congress at an At-Home on Sunday, June 22nd. The reception was held at Mr. Jeffreys' beautiful country seat at Guildford, Surrey. Many Canadian and United States delegates attended.

Mr. Francis Wood, M. Inst C.E., Borough Engineer and Surveyor of Fulham, London, Eng., was awarded the Prize of the Second International Road Congress held in Brussels, 1910. The announcement was made at one of the inaugural meetings of the Permanent International Commission. In making the announcement, Mr. Mahieu, General Secretary of the Executive Committee, expressed his gratification that the award to an English engineer should coincide with the opening of the London Congress.

The Fourth Congress will be held at Munich in 1916, on the invitation of the Federal Government and the Royal Bavarian Government.

An enterprising feature of the Third International Road Congress was an official journal printed in English, German and French, and issued daily to all members.

Galt on Saturday will vote on a by-law to raise $70,000 for waterworks extensions. The mistake common to growing towns and cities was made of providing inadequately for the future in the original plans. The new 18-inch main contemplated for the older part of the town will cost one-half the sum mentioned, and the balance is needed to extend the service to newer districts.

It is pointed out, to overcome opposition, that the by-law will not add a cent to the general taxes, and that the debentures will be fully taken care of by waterworks revenue.

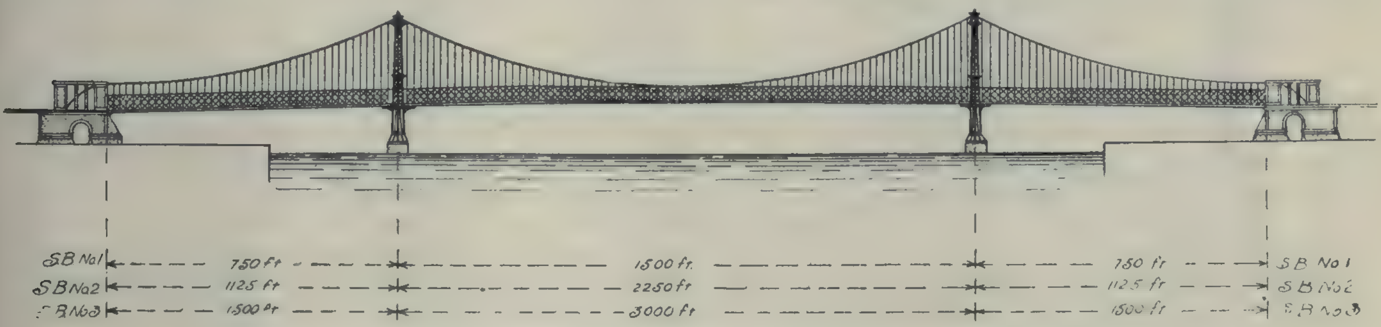
Suspension and Cantilever Bridges*

Limit of Each—Types of Suspension Bridge—Cost and Maximum Span—Greatest Practicable Span—Cost and Conclusions

At the annual Congress of Engineering and Scientific Societies held in Spokane, Wash., in February, a discussion by Prof. D. B. Steinman, University of Idaho, of span lengths of cantilever and suspension bridges merited particular attention. We print the discussion in full as follows:

Each type of bridge construction has some limiting span-length which it cannot exceed. This "limiting span" may be defined as the length at which the ratio of the intrinsic weight to the applied weight becomes infinite. In other words, it is the length at which the structure would be just capable of holding its own weight without carrying any live or moving load, any attempt to increase the load resulting in members of infinite cross-section. Under the stress of necessity, the span of any type of bridge may be pushed as close as may be desired to this theoretical limit; but this can be done only at a very great sacrifice of economy, as the cost of the structure increases very rapidly when the span approaches the limiting value.

The longest span at which the cross-sections of the principal members will not exceed an assigned maximum value, determined by the limitations of design, fabrication, transportation and erection, will be termed maximum span. The length of the maximum span for any form of bridge may be determined with sufficient definiteness from theoretical considerations applied to the data of actual designs; but it must be borne in mind that the results of such determination are subject to expansive revision when the methods of design or the materials of construction undergo improvement.


SB No1 ← 750 ft → ← 1500 ft. → ← 750 ft → SB No1
SB No2 ← 1125 ft → ← 2250 ft → ← 1125 ft → SB No2
SB No3 ← 1500 ft → ← 3000 ft → ← 1500 ft → SB No3

General elevation of suspension bridges employed in comparative study of span length.

In addition to the above span-limits, each bridge type has an economic range of spans, within which it will be less costly than any other form of construction. If, for any two comparable types of structure, a span of equal cost be determined, that span will be the inferior economic limit for one of the bridge-types and the superior economic limit for the other.

The term economic span will be used to designate the limit above which the cost of a bridge would exceed the capitalized value of its usefulness to the builders. Although this is a problem of great practical significance, it does not readily lend itself to accurate treatment in any general manner on account of the large possible variations in local conditions, such as the magnitude and financial importance of the traffic expected, the cost of real estate for land spans and approaches, and the difficulty encountered in locating suitable foundations. By adopting the most favorable assumptions for these varying conditions, a maximum value for the economic span may be established.

The maximum and economic span-lengths for bridges of ordinary span have been fixed pretty definitely by the results of numerous designs and comparative estimates. We may take our values of these limiting lengths from the consensus of opinion among engineers as evidenced by their uniformity of practice. Thus the ordinary truss bridge finds its range of usefulness between the limiting spans of about 120 and 550 feet, there being but three truss spans exceeding the latter value. Below this range, the steel girder or concrete arch is more economical; above these limits the steel arch enters into competition. The latter construction, in turn, ceases to be economical at about 800 feet, although the proposed Hell Gate arch is to have a span of 1,000 feet.

For longer spans the selection of a bridge structure narrows down to a choice between the suspension bridge and the cantilever. The relative economy of these two forms of construction has long been a mooted question. Although comparative designs have been prepared in individual instances for the particular local conditions obtaining, the author has been unable to find any general comparison of the two bridge-types for the purpose of establishing their relative economic or limiting spans. He has therefore undertaken the determination of these values for the suspension and cantilever bridges, namely:

(1) The limiting spans, or the greatest spans which can be designed.

(2) The maximum spans, or the greatest spans which can be built.

(3) The economic spans, or the greatest spans which it would pay to build.

(4) The span of equal cost for the two types; in other words, the span at which the cantilever ceases to be economically superior to the suspension bridge.

The method proposed for the solution of these problems is to prepare designs and estimates of a wide range of cantilevers and suspension bridges and to deduce therefrom the laws of variations of weight and cost with length of span. The relations between span and weight, thus established, fix the limiting span for each form of construction. The cost curves of the two types indicate their comparative economy at different spans as well as the critical span of equal cost. Finally, an estimate of the maximum probable traffic returns, compared with the costs of different spans, determines the economic limiting length for each type.

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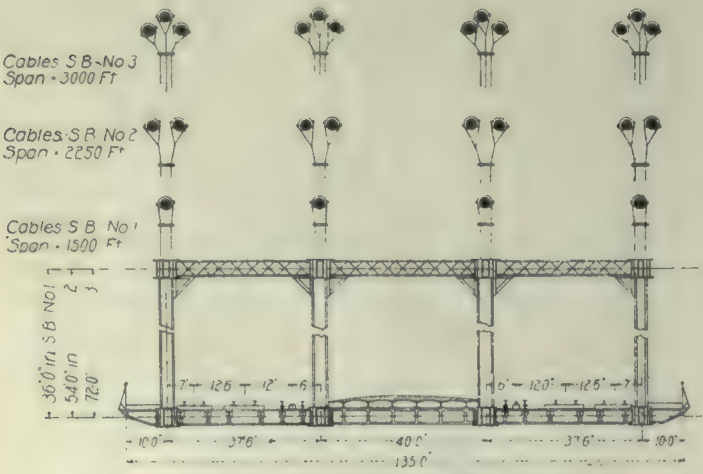
* Engineering and Contracting.

With the above objects in view, the author has prepared complete designs and estimates of three suspension bridges of 1,500, 2,250 and 3,000 feet span, and of three cantilevers of 1,000, 1,500 and 2,000 feet span respectively. To justify the large expenditure involved in structures of this magnitude, they will be assumed to be railroad bridges, with additional provision for electric cars, driveway and foot-walks, making a total live-load capacity of 18,000 lbs. per linear foot.



Cross section of suspension bridges.

The cost of a structure for a given span will, of course, be affected by local conditions such as prices of material, specified unit stresses, depth of foundations, etc. In order that the comparison between the cantilever and the suspension bridge may be an absolutely fair one, it is essential that all such arbitrary or varying factors be chosen with extreme care and be kept exactly the same for both types of construction. Furthermore, in order that the results for the limiting spans may be the true maximum values, it is necessary to carefully determine and use the most favorable proportions, material and form of construction for each design.

SUSPENSION BRIDGES

One of the first questions to be decided in the design of the suspension bridges was the choice between a steel-wire cable and a chain of eye-bars for the principal carrying member. The latter enables the bracing for the prevention of deformation under moving load to be incorporated in the cable system; the other requires a separate stiffening truss for the reduction of these deflections. Omitting from consideration the possibility of using the overhead bracing in conjunction with a wire cable—a construction which would combine the essential advantages of both systems but of which the feasibility has not yet been demonstrated, and without presuming to decide between the relative advantages of the two types of cable construction, the author adopted the "wire-cable type" in the present investigations for the following reasons:

(1) As both types are practically equal in cost, this choice would not affect the results for the economic lengths of span.

(2) As the wire cable affords a great saving in weight, it would yield a larger value for the maximum practicable span.

(3) As this choice conforms with the accepted past and present practice in suspension bridge design, and as no radical changes need be expected in the proximate future, the results obtained are better adapted for comparison with the data of existing structure and of greater value in estimating future designs.

The next question to be investigated was the economic ratio of cable-rise to length of span. By expressing the costs of the different parts of the structure in terms of this rise-ratio (n), the author found that the total cost of a suspension bridge of span l would be a minimum for n = ⅛ (very closely) for all spans from l = 1,000 ft. to l = 4,000 ft.

The depth of stiffening truss was next investigated. The minimum depth of truss is determined by the requirement of limiting the deflections so that the resulting gradient in the roadway should never exceed a specified amount (r), With r = 1 per cent. as a maximum limit, it may be shown that Minimum d/l = 1/45

By expressing the total weight of material in terms of the truss-depth, the economic depth of stiffening truss was found to be given by d/l = 1/40. This value is somewhat higher than the average of past practice, probably because most designs have been a compromise between the demands of economy and those of aesthetics. The Williamsburg Bridge is the only long-span structure conforming with the above economic ratio, but its appearance is undoubtedly marred by the excessive depth of the stiffening truss. For the purpose of this investigation, economy of weight and cost is of greater significance than any aesthetic considerations. The above depth-ratio is therefore adhered to, even at a sacrifice of appearance.

Estimate of Cost

In order to establish an equitable schedule of unit prices for the two types of bridges, a critical study was made of the different bids received by New York City for the Williamsburg, Manhattan and Queensboro bridges. These structures were selected as combining the qualifications of recentness of date with similarity of construction and magnitude to the designs under investigation. The prices of the successful bidders were adopted except where they differed so widely from the following bids as to indicate their having been unbalanced for some special reason. The unit prices determined by this comparison are incorporated in the following estimates of cost:

TABLE I.—PRINCIPAL DATA FOR DESIGN OF SUSPENSION BRIDGES.

	No. 1. Ft.	No. 2. Ft.	No. 3. Ft.
l = span . .	1,500	2,250	3,000
l_1 = side-span = ½ l . .	750	1,125	1,500
f = versed sine = 0.12 l....	180	270	360
f_1 = versed sine in side-span = f/4	45	67½	90
d = depth of truss = 0.024 l.. .	36	54	72

Type: Stiffening truss hinged at the towers.
Suspension rods in side-spans

Loading.	Lbs. p. l. f.
4 railroad tracks at 3,000 lbs.	12,000
2 lines of cars at 1,000 lbs.	2,000
40 ft. of roadway at 75 lbs.	3,000
20 ft. of roadway at 50 lbs.	1,000
Total congested load......	18,000

The total substructure, including all work in preparing for and installing the tower foundations and anchorages, $3,757,640. The steel work, including cables, suspended structure, towers and anchorages,

$7,887,300, or a grand total of $11,644,940 for the 1,500-foot span suspension bridge.

For the 2,250-foot span these figures are respectively $6,008,940 and $17,750,590, giving a grand total of $23,759,530.

The substructure for the 3,000-ft. span would cost $10,011,820, while the steel work would amount to $36,772,710, making a grand total of $46,784,530.

Empiric Formulas for Weights

From the results of the preceding designs, we may construct semi-empirical formulas for the weights of the different parts of a suspension bridge. Such formulas will be useful in preparing estimates for other spans and loadings; also in drawing general conclusions as to maximum and limiting spans.

Let the weights (per linear foot) of live-load cable, suspenders, truss (including bracing) and floor be represented by L, C, S, T and F respectively. The weight of the cable is evidently proportional to the total load it sustains and to the length of span, provided the rise-ratio remains unchanged. The weight of the suspenders is likewise proportional to the load they carry and to the span, as a longer span requires a proportionally greater average length of suspenders. The weight of the truss may be considered in two parts; the larger portion provides for the live-load and is proportional to that load and to the span length, if the depth ratio remains constant; the other part of the truss-weight represents the contribution of the wind-stresses and will vary with the square of the span if the width of bridge remains constant. The weight of the floor system is evidently proportional to the assumed live-load, and is practically independent of the length of span. Introducing the empirical constants from the preceding designs in those relations, we obtain the following formulas for suspension bridges:

$$C = .068 \ (C + L + S + T + F)\, l$$
$$S = .0075\, (L + S + T + F)\, l$$
$$T = .35\, L\, l + 105\, l^2$$
$$F = .84\ L$$

From these equations we find that the cable-section becomes infinite or C = infinity for a "limiting span" of

$$\text{Limiting } l = \frac{1}{.068} = 14{,}700 \text{ ft.}$$

This is the upper limit of feasible spans for suspension bridges and represents the span at which the suspension bridge would cease to be self-supporting.

Maximum Span for Suspension Bridges

Although the above is the limiting feasible span, defined by C = infinity, it is evident that the sections will become too large for practical construction long before that length of span is reached. In order to determine the practical maximum span, a value for the maximum cable section must first be fixed.

The cables of the three largest suspension spans, viz., the Brooklyn, Williamsburg and Manhattan bridges, are 15⅝ ins., 18¾ ins. and 12½ ins. in diameter respectively. Cables with a diameter of 24 ins. were used in one of the designs in this investigation, but it is doubtful whether any larger diameter can be put together without excessive difficulty of manipulation and uncertainty of proper distribution of stress among the different strands. With the exception of some old chain bridges, there is no bridge on record with more than six cables. Twice that number, or four groups of three, were used in one of the writer's designs, but it is extremely improbable that a greater number than 16 could be practically combined in one structure.

Assuming, then, a section of 16 cables of 24 ins. diameter for the bridge of maximum span, we have

Maximum C = 20,000 lbs.

Substituting in the preceding equations this maximum value of C, and assuming different values of the live-load (L), we obtain the following values for the maximum span:

For L = 10,000, max. l = 4,900 ft.
L = 15,000, max. l = 4,000 ft.
L = 20,000, max. l = 3,500 ft.

It is hardly probable that a structure of the magnitude under investigation would ever be planned for a lighter loading than about 10,000 lbs. per lineal foot, particularly when it is remembered that this would require about 10 lbs. of steel for every pound of useful load. It will therefore suffice to restrict the conditions of the problem to the practical limits of L = 10,000 to L = 20,000 lbs. of live-load per linear foot. We thus find that the maximum practicable span for suspension bridges ranges from 3,500 to 4,900 feet, depending upon the assumed live-load.

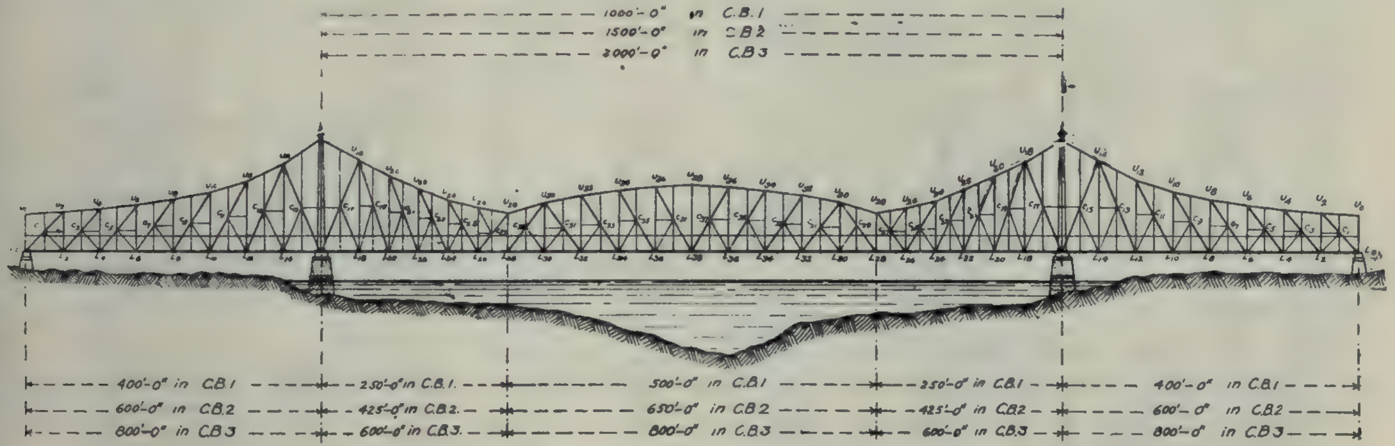
Economic Span for Suspension Bridges

The expression for the cost of any span (C) will be assumed of the general form.

$$C = al + bl^2 + cl^3 \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

From the results of the preceding estimates we have

C = $11,645,000 for l = 1,500 ft.



Central elevation of cantilever bridges employed in comparative study of span length.

$C = \$23,760,000$ for $l = 1,250$ ft.
$C = \$46,785,000$ for $l = 3,000$ ft.

Substituting these values in (1), and solving the resulting three equations for the unknown coefficients, we obtain

$$C = 8,900\ l - 3.77\ l^2 + .0020\ l^3 \quad \ldots\ \ldots \quad (2)$$

as the general cost-formula for suspension bridges. This gives the combined cost of steelwork and substructures for any span for an assumed live-load of 18,000 lbs. per linear foot. For any other loading, the above coefficients should be changed in proportion.

Of the above cost, about 65 per cent. represents the steel work and all the remainder provides for the masonry and anchorages.

A study of the contracts for recent long-span bridges shows an additional cost of about 20 per cent. for pavements, tracks, railings, ornamental work, electrical lighting, etc. To this must be added the cost of terminal structures and real estate for the approaches. In a city structure the last item, as in the case of the Manhattan Bridge, may amount to more than the cost of the bridge itself; a fair average value would be about 100 per cent. Adding the above items, we find

Total first cost of bridge = 220 per cent. C.

The rate of interest will be assumed at 5 per cent. The annual cost of maintenance including repairs, painting, lighting, etc., averages about 4⅛ per cent. of the cost of the superstructure. In addition, a certain annuity must be set aside for periodic renewal. The foundations may be permanent, but the steelwork has a limited life. The life-periods of numerous suspension bridges, or the periods before reconstruction or removal, whether terminated by failure or increased traffic demands, have been compiled by the author and found to average 31 years. This value, or 30 years in round numbers, will be adopted as the probable life of the steelwork of a suspension bridge. At five per cent. compound interest a sinking fund to meet the cost of renewal in thirty years will require an annuity of 1.505 per cent. The annual charge against the bridge will therefore consist of the following items:

	% C
Interest charge = 5% × 220% C	11
Repairs and maintenance = 4.5% × 65% C.	3
Depreciation = annuity for renewal in 30 yrs. = 1.505% × 65% C	1
Total annual charge	15

The limiting economic span is that at which the revenue from traffic (T) just balances the annual cost of the structure. We may therefore write

$$15 \text{ per cent. } C = T \quad \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (3)$$

as the defining condition for the economic span.

In the absence of any better guide, let us take the amount of travel on the Brooklyn Bridge as the maximum traffic to be expected on any other long-span structure. This value may justly be augmented by 50 per cent. for the greater capacity of a six-track bridge, but to compensate for the early years of undeveloped traffic this additional profit will be disregarded. We will therefore assume 118,000,000 passengers using the bridge in a year. For a span of the length under consideration, a toll of 5 cents per passenger would be an equitable rate. The same charge is now made for ferry or tunnel-transportation across the Hudson River, and bridge travel would surely be preferred for its greater speed and comfort.

At night, when the passenger traffic is a minimum, the tracks can be used for the transportation of freight. We may safely count on at least 1,500 cars of freight daily crossing a six-track bridge over the Hudson River or any similar location.

The total annual traffic over a long-span bridge may therefore attain the following value:

118,000,000 passengers at 5 cents	$5,900,000
547,500 cars of freight at $4	2,190,000
T = total annual revenue	$8,090,000

Substituting this value in equ. (3) we obtain $C = \$54,000,000$ as the maximum justifiable expenditure for a long-span bridge. With this value of C, the solution of equ. (2) yields Economic $l = 3,170$ ft.

In the case of the proposed Hudson River bridge of somewhat shorter span, calculations indicated a profit of less than 1 per cent. on the investment, thus confirming the above result.

Conclusion

The limiting economic span for suspension bridges is about 3,170 ft., and will be less wherever the probable traffic returns are smaller than assumed in this investigation.

CANTILEVER BRIDGES

In adaptability to long-spans and possibility of erection without falsework, the cantilever is the sole competitor of the suspension bridge. Both of these types have attained prominence by remarkable examples of design and construction. The suspension type, however, with but one exception has never been employed for fast railway traffic. Its use has been confined to highway bridges or wherever aesthetic requirements prevailed. The banner bridges of the suspension type, those over the East River, have been attributed to "an ingrained fad of the New York Department of Bridges." For long railway spans the cantilever has almost invariably been given the preference on account of its superior rigidity at a given cost. The longest span in the world (Forth Bridge = 1,710 ft.) is of the cantilever form, and the Quebec Bridge, now under construction, will raise the record for length of span to 1,800 ft.

TABLE II.—PRINCIPAL DATA FOR DESIGN OF CANTILEVER BRIDGES.

	No. 1. Ft.	No. 2. Ft.	No. 3. Ft.
L = total span = m + l + m	1,000	1,500	2,000
l = suspended span	500	650	800
m = cantilever arm	250	425	600
n = anchor arm	400	[illegible]	800
w = width c. to c. of trusses	50	60	80
d = depth of suspended truss	50-85	75-110	110-135
h = depth at towers.	150	225	300

Load: L L = 18,000 lbs. per ft. Wind = 30 lbs. per sq. ft.

Working stresses:	Tension.	Compression.
Structural steel	20,000	$\dfrac{20,000}{1 + \dfrac{l^2}{8,000\ r^2}}$
Nickel steel	30,000	$\dfrac{30,000}{1 + \dfrac{l^2}{8,000\ r^2}}$

For erection of stresses. the above may be increased by 20%.

Before proceeding with the designs, the author made a special study of the problems of economic span ratios and width-ratios for cantilevers. The results are incorporated in Table II. In the estimates of cost, the same unit prices are used as in the case of the suspension bridges.

Estimate of cost

The result of the author's designs of the above cantilevers are summarized in Table III of costs.

Empiric Formulas for Weights of Cantilever Spans

Let T_1, T_2, T_3 = truss-weights per lineal foot in suspended span, l, cantilever arm, m, and anchor arm, n, respectively.

F = Weight of floor, per lineal foot.

L. L. = Live load per lineal foot.

We may then construct semi-empiric formulas for the truss-weights from the results of the preceding designs as follows:

Suspended Span.—The weight per lineal foot of a simple truss, if the relative dimensions are kept fairly constant, is proportional to the span and to the total load carried. Introducing a factor of proportionality, a, we have

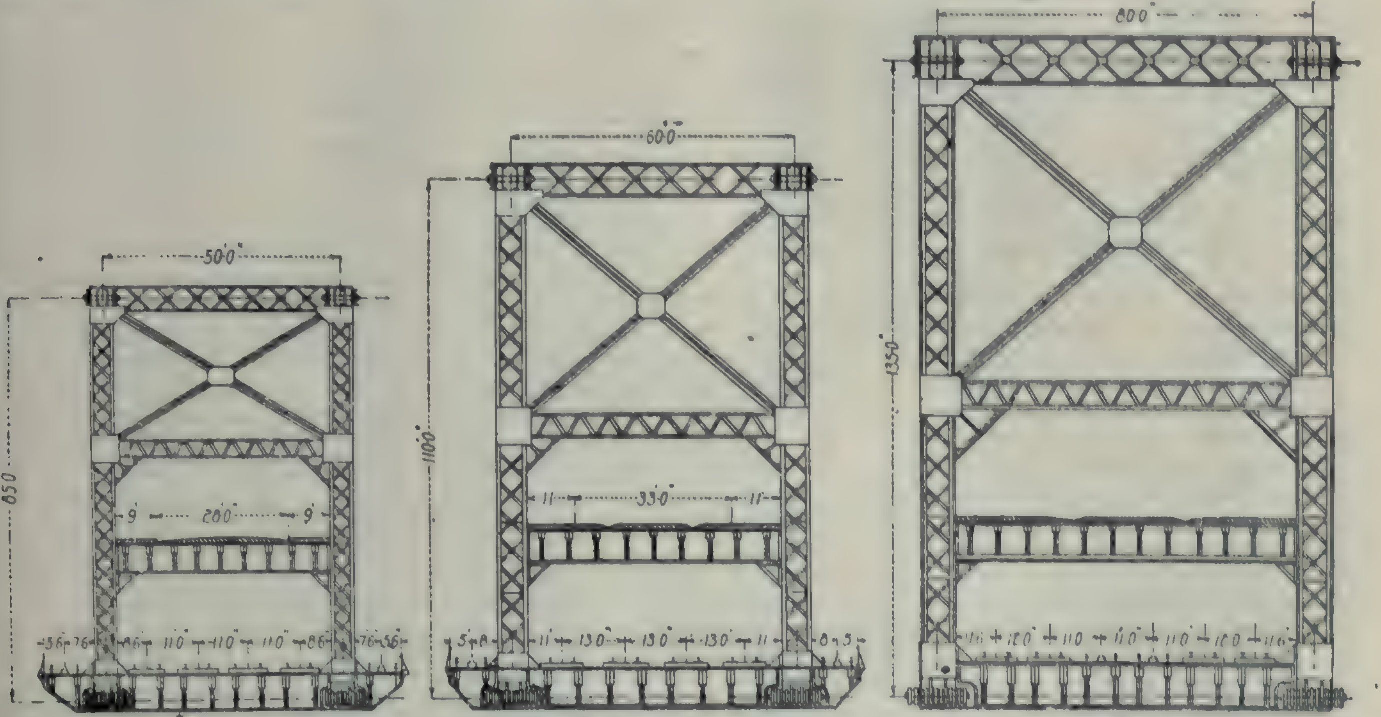
$T_1 = a\,(T_1 + F + L.\,L.)\,l \ldots\ \ldots\ \ldots\ \ldots\ (1)$

Applying this equation to the preceding designs, we find

a = .00056, .00053 .00053;

or, as a mean value,

a = .00054.



Cantilever Bridge No. 1
Span - 1000 Ft

Cantilever Bridge No. 2
Span - 1500 Ft

Cantilever Bridge No 3
Span - 2000 Ft

Midspan cross section of three cantilever bridges being compared.

Cantilever Arm.—A simple formula, involving but one undetermined coefficient, may be constructed from the observed fact that the weight per lineal foot of the cantilever arm varies with the total loading and with the square root of the channel span, or

$T_2 = b\,(T_2 + F + L.\,L.)\,\sqrt{L} \ldots\ \ldots\ \ldots\ (3)$

The constant of proportionality, b, is determined from the preceding designs, as

b = .0133 .0134 .0134

This close agreement between these values of b indicates the reliability of the above formula even under varying values of the suspended span ratio. Taking the mean value, we have

b = .0134

As the total amount of steel is not materially affected by limited changes in the form or proportion of the trusses, and as variations in the spans and in the loading are fully provided for in the above fomulas, they may properly be applied to any other cantilever bridges designed for any live-load, provided the same working stresses are used. Whenever improved material or construction justifies higher unit stresses, the empirical constants in the above formulas should be reduced in the inverse proportion.

Limiting Spans for Cantilevers

Limiting Channel Span.—A solution of the empiric formula for the weight T_3 of the cantilever arm, as established in the preceding article, yields

T_2 = Inf. for Lim. L = 5,600

Hence the limiting span for cantilever bridges is 5,600 ft. This value may be approached, but never exceeded, by increasing the ratio of dead-load to live-load indefinitely.

Note that the corresponding limiting span for the suspension bridge is 14,780 ft., or about 2.6 times as great as the above.

Maximum Practicable Span for Cantilevers

In the three cantilever designs executed above, viz.:

L = 1,000, 1,500, 2,000 ft.

the maximum required section is found in the lower chord of the anchor arm and amounts to

Max A = 574 1,302 2,338 sq. ins.

It will be observed that these cross-sections are almost exactly proportional to the squares of the respective channel spans. Considering also that the section must vary with the live-load for which the structure is designed, we may write the proportion

$\text{Max. } A = k\,(L.\,L.)\,L^2.$

Substituting the values of Max. A, L. L. and L from the above designs, and solving for the unknown coefficient, we find

k = .031 .032 .032

so that the above formula becomes

$\text{Max. } A = .032\,(L.\,L.)\,L^2 \ldots\ \ldots\ \ldots\ \ldots\ (1)$

where L is supposed given in 1,000 ft. units.

Hence the maximum practicable span for a cantilever is given by

$$\text{Max. L} = \sqrt{\frac{31.2\ \text{Max. A}}{\text{L. L.}}} \quad \ldots\ldots\ldots \quad (2)$$

Where Max. A is the greatest practicable cross-section in square inches, and L. L. is the assumed live-load in pounds per lineal foot.

Largest Cross-Sections in Actual Use

The values of the largest cross-sections ever fabricated are the following:

	Sq. ins.
Queensboro	1,120
Quebec	843
Beaver	639
Kansas City (truss)	485
St. Louis (truss)	441
Monongahela	348
Thebes	317
Memphis	228

All of the above chord-sections are of the multiple rib type. The number of ribs composing the section never exceeded four, that being the number used in the Quebec, Queensboro, Thebes, and Memphis bridges. Any larger number of ribs would make the action of the whole member as a unit extremely problematic; and, in the light of recent experience, no conservative engineer would propose such a section.

TABLE III.

Cantilever bridge.	L = 1,000 ft.	L = 1,500 ft.	L = 2,000 ft.
Suspended span..	$ 573,919	$ 1,030,039	$ 1,929,267
Cantilever arms.	874,266	2,261,308	5,308,402
Anchor arms.....	1,274,040	2,757,066	5,782,610
Towers	705,456	2,047,680	4,669,056
Anchorage steel..	78,500	179,410	337,430
*Total	$3,506,181	$ 8,275,503	$18,026,765
Main piers	876,164	1,261,720	2,153,040
Anchorages	524,160	1,032,480	1,944,000
†Total	$1,400,324	$ 2,294,200	$ 4,097,040
‡Total	4,906,505	$10,569,703	$22,123,805

*Steelwork. †Substructure. ‡Cost of bridge.

The greatest depth of rib is 5 ft. 6½ ins. occurring in the Beaver Bridge, followed by a depth of 4 ft. 6½ ins. in the Quebec and St. Louis bridges. In Lindenthal's design for the Hell Gate Arch (1,000-ft. span) a 10-ft. depth of rib is proposed. This is so far in advance of any previous design, and involves so difficult a problem of adequate stiffening and bracing, besides the difficulties of fabrication, that it may well be taken as the extreme limit for practicable depth of rib.

The greatest thickness of rib is 5¾ ins. in the Queensboro Bridge, followed by 4 7/16 ins., 4¼ ins. and 3½ ins. in the Monongahela, Hell Gate and Quebec bridges, respectively. On account of the extreme difficulty of riveting through so great a thickness, it is hardly probable that any greater thickness than the above, or say 6 ins. at the most, will ever be used.

Combining the above limitations, we find that the greatest practicable chord-section would consist of four ribs, 10 ft. deep and 6 ins. thick. Adding the largest angles obtainable for the flanges the total area will be, in round numbers,

Max. A = 3,000 sq. ins.

With the necessary diaphragms and lacing, such a member would weigh over 7 tons per lineal foot.

This value of Max. A. is nearly three times the cross-section of the largest member ever fabricated (1,120 sq. ins. in the Queensboro Bridge) and over twice the largest section to be used in the Hell Gate Arch (1,437 sq. ins.). A member of 2,300 sq. ins. occurs in the plans for the Hudson River Bridge of 2,160 ft. span designed by the Union Bridge Company in 1893, and a slightly larger cross-section (2,338 sq. ins.) is found necessary in the author's design of a 2,000-ft. cantilever bridge. But the above sectional area of 3,000 sq. ins. is far in excess of any chord section ever proposed.

Value of L

Substituting Max. A = 3,000 in. equ. (2) above, we find the following values of the maximum span for the different assumed live-loads:

For L. L. = 10,000 lbs. p. l. f. Max. L = 3,060 ft.
For L. L. = 15,000 lbs. p. l. f. Max. L = 2,500 ft.
For L. L. = 20,000 lbs. p. l. f. Max. L = 2,160 ft.

As it could hardly be considered practical to design a cantilever bridge of the magnitude under the consideration for a smaller live-load than about 10,000 lbs. per lineal foot, we conclude that the maximum practicable span for the cantilever type ranges from about 2,000 to 3,000 ft., depending upon the assumed live-load.

Comparing these with the corresponding values established long-span construction becomes apparent.

Economic Span for Cantilevers

As in the case of suspension bridges, the expression for the cost of any span (L) will be assumed of the general form:

$$C = a.L + b.L^2 + c.L^3 \quad \ldots\ldots\ldots \quad (1)$$

From the results of the preceding estimates, we have

C = $ 4,905,000 for L = 1,000 ft.
C = 10,570,000 for L = 1,500 ft.
C = 22,125,000 for L = 2,000 ft.

Substituting these values in equ. (1), the unknown coefficients are determined, giving

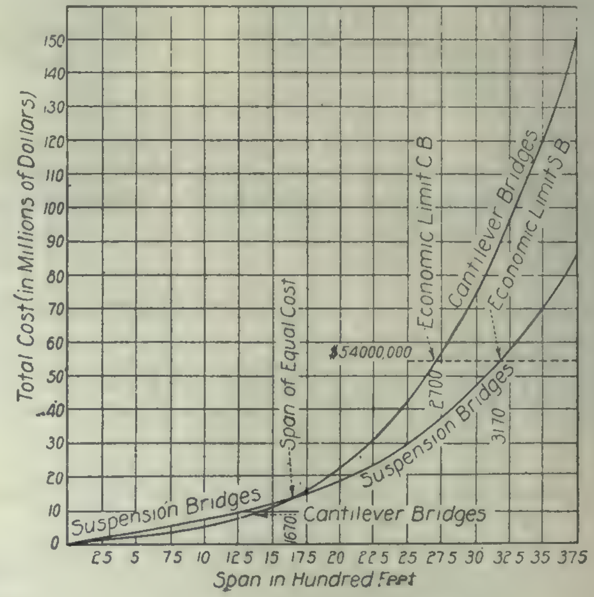
$$C = 6{,}350\ L - 5.25\ L^2 + .0038\ L^3 \quad \ldots\ldots \quad (2)$$

as the general cost-formula for cantilever bridges. This gives the cost of steel work and substructure for an assumed live-load of 18,000 lbs. per lineal foot. For any other loading, the cost may be taken as varying in proportion.

Assuming the same cost of approaches, volume of traffic, life of steel work, expense of maintenance and rate of interest as for the suspension type, the limiting economic span for the cantilever will be defined by the same total cost as in the case of the suspension bridge, viz.:

C = $54,000,000

As previously shown, this is the greatest expenditure for a long-span bridge, exclusive of approaches and



Curves showing respective costs.

accessories, that is warranted by the maximum traffic returns to be reasonably expected. Substituting this value in equ. (2) and solving, we find

$$\text{Econ. } L = 2{,}700 \text{ ft.}$$

as a maximum economic span for cantilevers.

Hence, the greatest span for which the cantilever type may be profitably employed is 2,700 ft. or less, depending upon the probable maximum traffic returns.

Span of Equal Cost

Plotting the costs for the three suspension spans designed above, a smooth curve passing through the three points and the origin constitutes a cost-graph for suspension bridges. In the same manner the graph representing the costs for different cantilever spans is constructed. The point where the two curves intersect marks the span of equal cost for the two types of construction, and is found at

$$l = 1{,}670 \text{ ft.}$$

Below this span, the cantilever bridge is cheaper; above this span, the suspension bridge exhibits the greater economy. As this value lies within the range of spans actually designed for each bridge, i.e., between the known points on each graph, the error of the above method, involved in extending the results of individual designs to other spans, is negligible.

The analytical equivalent of the above process consists in comparing the cost-formulae for the two types of bridges. Equating the respective cost-expressions, and solving, we find, for the span of equal cost,

$$l = 1{,}670 \text{ ft.}$$

exactly as before.

The above comparison is somewhat unfair to the suspension type, as the side-spans in the above designs were 0.51 in the suspension bridges and only 0.41 in the cantilevers. Assuming therefore, that steel viaduct approaches are added to the cantilever bridges to make up the difference in total length, and estimating the cost of such viaducts at $1,000 per lineal foot, the span of equal cost is reduced to

$$l = 1{,}626 \text{ ft.}$$

somewhat less than the value established above. If the comparison of costs had been made between bridges of equal channel span, the result would have been still more favorable to the suspension bridge, reducing the critical span to about

$$l = 1{,}500 \text{ ft.}$$

Neglecting these differences in favor of the suspension type, we conclude that $l = 1{,}670$ ft. is the extreme upper limit of spans at which the cantilever can compete with the suspension bridge, when economy is the sole criterion.

Conclusions

In the foregoing designs, special care was taken to proportion the depths of truss in both types for equal and ample rigidity, so that the single inherent advantage claimed for cantilevers, viz.: greater stiffness for railway traffic, is eliminated from consideration. Consequently no advantage remains to the cantilever type above the limiting span of 1,670 ft. The suspension bridge, on the other hand, is universally admitted to possess greater aesthetic qualifications; and for a long-span city structure, this is a factor of decisive importance. For this reason alone, the above value for the span of equal cost should be considerably reduced, in favor of the suspension type, to obtain the " span of equal merit."

The preceding investigations have been restricted to designs for heavy railway traffic. For highway bridges, a relatively lighter stiffening truss may be used in the suspension type, thereby causing a considerable reduction in the span of equal cost.

Confining our attention to economic considerations, our final conclusions may be stated as follows:

(1) The range of economic usefulness for cantilevers extends from the upper limit for the truss or arch to a span of 1,670 feet. Beyond this value, the cantilever would be more costly than the suspension type, although yielding a probable profit on the investment up to a span of 2,700 feet.

(2) The range of economic usefulness for suspension bridges begins at 1,670 ft. (or less in the case of highway bridges) and extends to the upper economic limit of 3,170 ft. Above this limit, the construction of suspension bridges would be practically feasible, but not as a profitable investment, up to an extreme limit of 4,000 feet.

Specifications for Concrete Road Work[*]

IN view of the increased interest now manifested on all sides in the question of good roads we are publishing the specifications for concrete road building as issued by the Illinois Highway Commission. The specifications are comprehensive and should ensure permanency.

Concrete Materials

Cement—Some standard brand of Portland cement shall be used which has been in practical use on public works and shall have proved satisfactory therein. No brand of cement shall be used which the engineer deems unfit for the work, nor shall any cement be used which fails to give satisfactory results according to the standard methods of testing as provided by the American Society for Testing Materials. The contractor shall provide sufficient means to protect the cement against dampness, and no cement shall be used which has become caked.

The contractor shall notify the engineer in writing what brand or brands he intends to use, and before ordering the cement shall receive the written approval of the engineer as to the brand selected. It is understood that such approval merely covers the selection of the brand; that the cement itself may be rejected if it fails to meet the requirements herein specified.

Coarse Aggregate—The coarse aggregate shall consist of clean, hard, sound flint or other hard siliceous pebbles, having a reasonably uniform graduation from a size which will pass through a 1-in. screen to a size that is retained on a ⅛-in. screen, and no gravel composed in part of slate, shale, disintegrated limestone, or other equally soft stone, can be used. Crushed granite or trap rock, graded to the size provided above, may be used. Crushed lime stone, graded to the size specified above, may be used only upon the approval of the engineer.

Fine Aggregate—The fine aggregate shall consist of clean, sharp quartz grains, and shall not contain over 2 per cent. of clay or loam. The fine aggregate shall be reasonably uniformly graded from a size which will pass through a ⅛-in. screen down. Sand containing disintegrated shale, slate or limestone shall not be used.

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[*] Concrete Age

Grading of Aggregate

The specification that the coarse of fine aggregates must be reasonably well graded shall be interpreted to mean that the percentages of the aggregates passing screens of various sizes shall be within the limits given in the following tables:

Table of Graduation of Coarse Aggregate

Size or screen	Allowable limits of percentage passing through
1-in. square mesh	100
¼-in. square mesh	Not less than 45 nor more than 60

Table of Graduation of Fine Aggregate

Size or screen	Allowable limits of percentage passing through
⅛-in. sq. mesh	100
1/16-in. sq. mesh	Not less than 65 nor more than 85

If the contractor desires to use aggregate which is not graded in accordance with the table, he must submit a sample of 50 lbs. of such material to the Illinois Highway Commission, Springfield, Ill., one week prior to the date of the letting of this contract. His sample of aggregate will be analyzed and, if found suitable, its use will be approved in writing and the amount of cement that must be used with the sample submitted, its use will be approved in writing and the amount of cement that must be used with such aggregate will be stated. The aggregate used in the construction work must then be graded in accordance with the sample submitted, and must be of the same kind and quality as the sample, and the amount of cement used must be the quantity required by the engineer in accordance with this paragraph instead of the amount provided in paragraph 32. (Proportions for concrete.)

Use of Gravel

The use of gravel made up of a mixture of the coarse and fine aggregates described above will not be permitted. If the contractor wishes to use such material, he must screen it to the sizes specified above before proportioning the aggregate for mixing.

Concrete Mixer

The concrete mixer used on the work provided for herein shall be a batch mixer of a type approved by the engineer. The concrete shall receive at least four complete turns of the drum before being discharged and if in the opinion of the inspector, a greater amount of mixing is required, this number of turns shall be increased until a thoroughly mixed concrete is secured.

Proportions for Concrete

The concrete for the work provided for herein shall consist of 1 part of cement, 2 parts of fine aggregate, and 3½ parts of coarse aggregate. The aggregate shall be placed in the mixer in such manner as to insure that a uniform amount of each class of aggregate is used in each batch of concrete; and the method of measuring the aggregate, whether in wheelbarrows or otherwise, shall be approved by the inspector, 1 sack of cement to be considered as 0.95 cu. ft., and all measurements to be by volume.

Water

The water used in mixing the concrete shall be clean.

Size and Kind of Roller

Wherever it is provided herein that rolling shall be done on the road bed or macadam shoulders, a three-wheel self-propelling roller, weighing not less than ten nor more than twelve tons shall be used.

Road Bed

The road bed will be considered as that portion of the road upon which the concrete roadway and macadam shoulder are placed. The road bed shall consist of the natural earth which has been brought to the proper elevation and cross-section and rolled until firm and hard. If sandy or other soil is encountered which will not compact readily under the roller, a small amount of clay or loam shall be added so as to secure a firm, hard surface after rolling. The road bed shall be thoroughly saturated with water immediately before concrete is placed.

Shoulders and Side Roads

After the completion of the concrete roadway and macadam shoulders, the side roads are to be shaped in accordance with the cross-section shown on the plans and shall be rolled, care being taken not to allow the roller on the edge of the concrete roadway. Upon completion, the cross slope of the concrete roadway, macadam shoulders, earth side roads and ditches shall be as shown on the plans.

Thickness of Concrete Roadway

The concrete roadway shall have, after completion, the thickness shown on the plans. If a greater thickness is said than that shown on the plans, no extra compensation will be made therefore.

Under Drains

An under drain 8 ins. wide and 6 ins. deep shall be constructed under each of the concrete roadway edges, the entire width of the drain being under the pavement. This under drain shall be filled with broken stone or coarse aggregate before the concrete is placed. At the end of each expansion joint or at intervals of not to exceed 50 ft., blind cross drains, not less than 8 in. wide, shall be constructed from the longitudinal drains before mentioned, to the gutter. These cross drains shall be of such a depth as to drain readily from the longitudinal drains to the gutter, and shall be filled with at least 6 in. of crushed stone or coarse aggregate, and then covered with earth, except that such part of the cross drain as lies under the macadam shoulder shall be filled with stone when the shoulder is constructed. The longitudinal and cross drains shall be completed before the concrete roadway is constructed.

Side Forms

The concrete roadway shall be placed between side forms of 2-in. plank. The side form plank shall be of a width equal to the thickness of the pavement at the edge. The side form planking shall be accurately set to the alignment and grade of the pavement, and shall be held securely in place by adequate stakes and bracing. Intermediate longitudinal form boards will not be permitted between the side forms to support the templet.

Placing Concrete Roadway

The concrete for the roadway shall be placed between the plank forms before described, the entire thickness of the concrete being placed at one time. After the concrete has been deposited between the forms, it shall be raked and tamped until the mortar flushes to the top, and the concrete shall be placed in such quantity that there will be a slight excess between the forms. The surface of the roadway shall then be shaped to conform to that which is shown on the plans by striking off with a templet cut to the proper shape. This templet shall be drawn along the forms, and shall be held securely against the top of the forms, and shall be moved with a combined longitudinal and crosswise motion which will prevent dragging the larger particles of the aggregate and marring the surface.

Finishing Surface of Concrete Roadway

After the surface of the concrete roadway has been stuck off to the proper cross-section, it shall be finished with wood floats. The wood floats shall be used only to flush mortar to the porous places in the surface, and great care must be taken not to rub hollow places in the surface. The wood float finish shall be made as soon after the concrete has been deposited as possible, and in no case shall the finishing be delayed until the concrete has taken a set.

Covering Concrete Roadway

After the concrete roadway has been finished as above described, the roadway shall be covered with suitable canvas as soon as this can be done without marring the surface, which shall be kept wet, and as soon as the concrete sets sufficiently, the canvas shall be removed and the concrete covered with earth. The earth covering shall be put on at least 1-in. thick and shall be kept constantly wet for two weeks. The roadway shall be kept closed to traffic for two weeks, or, if in the opinion of the engineer, the weather conditions make it advisable, the roadway shall be kept closed to traffic a longer period of time.

Expansion Joints

Expansion joint shall be provided and spaced as shown on the plans. The expension joints shall be set at an angle of 60 degrees with the center line of the roadway and shall be of the type shown on the plans. The expansion joints shall be constructed in such manner as to insure that the metal plates, creosoted blocks, or other device provided for the joints, shall conform to the cross-section provided for the roadway, and great care must be exercised in placing these joints to insure that there will be neither a depression nor a raised place at the joint.

Cleaning Finished Pavement

When the concrete roadway has been completed for a sufficient length of time to permit a proper setting of the concrete, it shall be cleaned and then opened to traffic.

Beveling Edges

If the plans shall provide that the edge of the concrete shall be levelled, then the plank forms shall be removed from the edge of the roadway before the concrete takes its final set, and the edge of the pavement shall be cut off by means of a shovel or other suitable tool so as to give the shape shown on the plans.

Macadam Shoulders

The macadam shoulders when completed shall be of the width and thickness shown on the plans. The stone for the macadam shoulders shall be deposited, spread and rolled at least twice over, and then covered with screenings or gravel, sprinkled and rolled. When completed the macadam shoulder shall be true to shape and shall be one-half inch above the concrete where it joins the concrete roadway.

Trimming Sides of Road

The slopes on cuts and fills shall be neatly trimmed to the slopes shown on the plans, and all detritus and surplus materials left after completion of the work shall be removed from the road.

New Terminal Railway

THE contract for the construction of the Halifax Terminal Railways, which was let in Ottawa recently, is the first step in the development of the harbor terminal scheme announced for that port some nine years ago.

Five miles of railway are to be built through the heart of the Halifax residential district to the city's southern water front, where a series of piers are to be constructed.

The scheme involves the eventual construction of berths for thirty ocean steamers and is to cost thirty-five million dollars, but this expenditure is to be spread over a considerable period of years.

The work to be carried out first includes the construction of the terminal railway, two piers and a union passenger station in the south end of the city. The project involves a complete revolution in the civic life of Halifax as much of what is now the best residential portion of the city will be utilized for railway purposes and this displacement of population has given rise to an era of real estate speculation.

Serious Forest Fires

NORTHERN Ontario has been visited once more by devastating bush fires. The fires covered a district two hundred and fifty miles wide and extending from a little north of Cobalt as far as Cochrane. The losses will reach into the millions and includes settlers' effects and homes, crops, standing timber, transmission lines, power houses and mining plants. So far no loss of life has been reported. The dry weather of May and June is given as the cause.

The passing of the special Irish Acts for the better housing of the agricultural labourer has been amply justified by results and we see no valid reason why the introduction of similar measures for England should not be attended with success. Not only is there a shortage of cottages in this country but a large number of those in existence are in a deplorable condition and ought to be demolished. The same remark applies with equal force to quite a number of our large towns. Many areas are unfit for habitation and stand urgently in need of condemnation but the authorities have to content themselves by wiping out single houses here and there, for the reason that other accommodation cannot be found for the families displaced. Overcrowding is very common, but while unemployment and high rents co-exist, all the by-laws and inspectors in the world cannot suppress this evil. A writer recently quoted a case where a widow, six sons, two daughters, the widow's mother and a male lodger—eleven souls in all—herded together in one living room and a divided attic. Physically, morally and mentally, what standard could be expected of the denizens of such a "Black Hole"? Well may it be asked if civilization is a failure when cases like this are brought to the light of day.—Slate Trade Gazette.

Wireless service between Norway and America will probably be provided shortly by the Marconi company, following the recent approval by a committee of the Norwegian Parliament of a contract under which the Norwegian Government is to spend $560,000 in the erection of a station at Stavanger which is to communicate with a station at Boston.

Building Operations in Calgary

Report on Power Question—Department of Natural Resources—Tenders for Cold Storage Building—New Factory

Correspondence of the Contract Record

THE fine weather of the past month has permitted great progress in the construction of all classes of buildings. Several large contracts have been let recently, and all architects seem to be busy. The contract for the new police station has been let to Thomas, Jameson & Mackenzie, of Calgary, for the sum of $103,520, exclusive of plumbing and heating, electric wiring, elevators, and the steel police cells. The building will be of the steel cage type, five storeys in height, with reinforced concrete floors, red pressed brick exterior, and cut stone trimmings. The architects are Lang & Major, of Calgary. The city of Calgary has let the contract for a power sub-station in North Calgary to Bennett & Debman Company, for the sum of $21,000 complete without transformer equipment

Power Question

Rapid progress is being made on an addition to the present municipal power house. During the early winter R. A. Ross & Company, of Montreal, were called upon to investigate the power situation in Calgary. They report to the effect that unless the Calgary Power Company, Limited, which has a large hydro-electric plant forty miles west of the city can guarantee service, that the city council should not enter into contract with them for the full amount of power required. The engineers estimate the present power demands of the city to be about 10,000 h.p. The Calgary Power Company has now under contract nearly 10,000 h.p., with no allowance for breakdowns, although they have under construction a new power station which will enable them to take care of local requirements by next year. Until this new installation is completed, they will be unable to guarantee the service the city of Calgary desires. Under the circumstances, arrangements have been made to add a power unit of 5,000 kw. to the existing power facilities, with provision for further additions as required. To this end the power house will be enlarged by an addition 118 feet in length, running the full width of 130 feet of the present structure. The municipal authorities have commenced excavations, and will place the concrete for the foundation walls and settings. A separate contract will then be entered into for the construction of the brick walls. The contract for the steel superstructure has been let to Phillips, Lang Company, of Chicago, for the sum of $22,425. This includes the erection of the 260 tons supplied. There will be seven roof trusses over the engine room with a span of 50 feet, the type being a modified Warren truss, carrying a skylight monitor. A double row of columns running the length of the boiler room will carry seven roof trusses and plate girders, on spans of 23 feet, the latter having to carry the coal hoppers for the automatic stokers. These roof trusses will carry a skylight monitor also, together with the coal handling conveyors. On either side, in the bays between these columns and the outside walls, will be fourteen additional roof trusses with spans of 28 ft. 6 in. All trusses are in general fabrication from 2½-in. x 2½-in. x ¼-in. angles. The roof will be wooden, built of 2-in. x 4-in. joists laid with shiplap boards to the weather. The first installation will consist of one 7,000 h.p. Allis-Chalmers steam turbine direct connected to one 5,000 kw. generator. The work is in charge of Mr. J. F. McCall, Chief Engineer for the city of Calgary.

C. P. R. Buildings

The Canadian Pacific Railway has about completed the larger portion of the improvements undertaken in this city, including the $1,500,000 hotel, the station and the offices of the Department of Natural Resources, the car shops in East Calgary, and the replacing of many bridges. Not the least of these has been the construction of the railway station, commenced two years ago and completed recently. So rapid has been the growth of the city that the company has been forced to begin additions to this building as fast as other portions were completed. It is made of reinforced concrete, with sandstone exterior, and has cost altogether about $325,000. Besides the necessary offices for the local and divisional point, the building accommodates the Dominion Express Company and the Telegraph Company. J. McDiarmid & Company, Ltd., of Winnipeg, were the contractors for the entire building. East of the station building, and at right angles thereto, stands the office building housing the C. P. R. Department of Natural Resources, which includes the forces in charge of the immense irrigation projects of the company. The building was commenced two years ago, and five storeys were completed, but it was found necessary to add another storey during the past winter and to install an elevator. This also is of reinforced concrete, the Kahn system being used, and is finished with limestone. The architects were Hodgson, Bates & Beattie, of Calgary, and the contractor for the original structure was the J. McDiarmid & Company, Limited, of Winnipeg. The railroad is now engaged in the process of completely interlocking all trackage facilities east of the station, including the car shops. There is a total of nearly eighty miles of track in the terminal district, this city being the junction of the Calgary and Edmonton Railway. The system will be operated by electricity.

Large Cold Storage Plant

L. R. Burn, of Calgary, has been awarded the general contract for the construction of the new $300,000 cold storage meat curing building for P. Burns & Company, Limited. The new building will replace the plant destroyed by fire during January last, and will be complete in all its details, and of fireproof construction. The plant will be served by the present boiler and engine house. The owners are to install piping and refrigeration machinery, and insulation is to be carefully looked after. The building will be 198 feet long by 125 feet deep and will be six storeys high, including the basement, or 60 ft. 6 in. high from basement floor to top of roof slab. The exterior will be of common pressed brick, the walls running the full height of the building entirely independent of the internal structure. There will be reinforced concrete columns inside these walls to carry all floor loads, so that the seventeen inch wall will be free from any but its own dead weight. On the east end of the building, adjoining the existing plant, there will be a team loading concourse, protected from the weather by a steel canopy 24 feet wide suspended from the face of the building, so that all columns will be eliminated. The main line of the Canadian Pacific Railway runs close to the north side of the plant, two sidings, inside a steel and concrete shed running the entire length of the building will be built. Overhead tracks from the shipping floor of the new plant will be used for loading the export cars.

The superstructure will be a flat slab system of reinforced concrete. This consists of a flat floor plate supported on the flaring column head by a square plate. The column spacing is seven bays of 17 ft. and thirteen bays of 17 ft. 6 in., and the one-half inch round steel for reinforcing is run in narrow bands of from twelve to sixteen rods in eight directions. The steel is supported at the column head by one ¾-in. round rod bent to a 5-foot square, and entirely within the floor slab. The steel from the column does not flare out as in most of such systems, the required support for the slab being gained by the 6-foot square plate of concrete on the column head, without the use of steel. The footings for the interior columns are all square, reinforced, involving nothing unique in the construction. The exterior columns and the enclosing walls are independent, the wall resting on a 17-inch concrete construction the height of the basement, and the columns carried on a reinforced concrete beam 37 inches wide and 36 inches deep, running the length of the walls, and monolithic at the ground with the concrete wall, which in turn is reinforced. The foundations will be in a very closely compacted gravel allowing of very high bearing stresses. The floor slabs in general are 8 inches and 7½ inches thick, except a portion of the loft floor, which is a combination terra cotta block and concrete floor 9 in. thick, the openings in this floor for the loft precluding the use of the flat slab system. The roof slab will be 6½ in. thick, and will be thoroughly insulated in the following manner: —over the roof slab there will be placed two layers of 2 in. cork board, then 2 in. of impregnated cork, next 2 plies of roofing felt. The cinder fill necessary to give the roof the proper pitch will be placed on top of this, followed by 2 inches of cinder concrete, over which will be laid the 5-ply tar and gravel roofing for the weather. The millwork throughout the building will be of white pine. Brill & Gardener, of Chicago, are the architects and engineers; Mr. F. G. Carpenter is the designing engineer for the owners.

Department of Natural Resources.

Plate Glass Plant

Hodgson, Bates & Beattie, architects, Calgary, have prepared plans for a large warehouse for Pilkington Bros., Ltd., the largest plate glass manufacturers in the world. The building will face 100 feet along 10th ave. east, and will be 117 feet deep, abutting on a siding of the C. P. R. A feature of the design will be the shipping and receiving floor, 42 feet wide and running the depth of the building, with a clear height of 35 feet to the bottom of the steel roof trusses. There will be seven of these trusses, of the deck Pratt type, weighing 209 tons, and they will support the reinforced concrete roof with skylight monitor, and will also carry, suspended below, one rail for a 2-ton crane. This crane will have a runway of 80 feet, with an 18-foot span, and will be used for unloading the plate glass from the cars, the crane covering the siding track in its runway. There will be a second crane spanning the floor which will have a capacity of one ton and will be used for transferring about the floor and for loading drays. This crane will have a 40-foot span, with a runway of 117 feet and will have pneumatic apparatus for dealing with polished plate glass. The remaining area of the warehouse will be covered by a structure four storeys high. The exterior will be of local pressed brick, with sandstone trimmings; the superstructure will be entirely of reinforced concrete except for the trusses and purlins over the shipping floor, as noted. The live loads used are very high, amounting to 500 pounds per square foot on the ground floor, reduced to 300 pounds per square foot on the upper floor. The roof will be of concrete with 5-ply tar and gravel covering. There will be a mezzanine floor for the local and shipping offices of the owners. The trim for these offices will be birch, all other trim to be B. C. fir; all windows are to be of rolled steel section; Corbin hardware is specified. There will be two elevators, one 7 ft. by 12 ft. and one 6 ft. by 12 ft. 6 in., the proportions being necessary for the commodity to be handled. The contract will be let shortly.

Building Material Prices in Calgary

The month of July opens with building material quoted as follows:—

Brick (enamel)	$14.00
Brick (pressed)	22.00
Hard wall plaster, per ton (sacks extra)	19.00
Hair (plaster), per bale	1.35
Keenes cement, per bag	2.50
Lime, per bushel	.40
Metal lath, per square foot	.22
No. 1 pine lath, per thousand	5.50
Wire nails, per keg	4.50
Plaster, per ton	22.00
Plaster paris, per barrel	4.50
Plaster board, per hundred square feet	22.00
Plaster bead, per foot	.07
Sand, coarse, per cu. yd.	1.75
Wood fibre plaster, per ton	19.00
Building paper, per roll	.90
Brick (kiln run)	9.50
Fire brick	$55.00 to 70.00
Fire clay, per ton	30.00
Flue lining	.40
Gravel, per yard	1.75
Hollow brick (per thousand)	13.00
Tar paper	1.00
Roofing felt, per thousand	1.60
B. C. shingles, No. 1, per thousand	4.50
B. C. shingles, No. 2, per thousand	4.15
Sewer pipe	.27½

Terra cotta, 4-in.	.10
Terra cotta, 3-in.	.09
Terra cotta, 6-in.	.12
Terra cotta, 8-in.	.14
Metal wall ties, per thousand	6.00
Gasoline in barrels, per gallon	.33

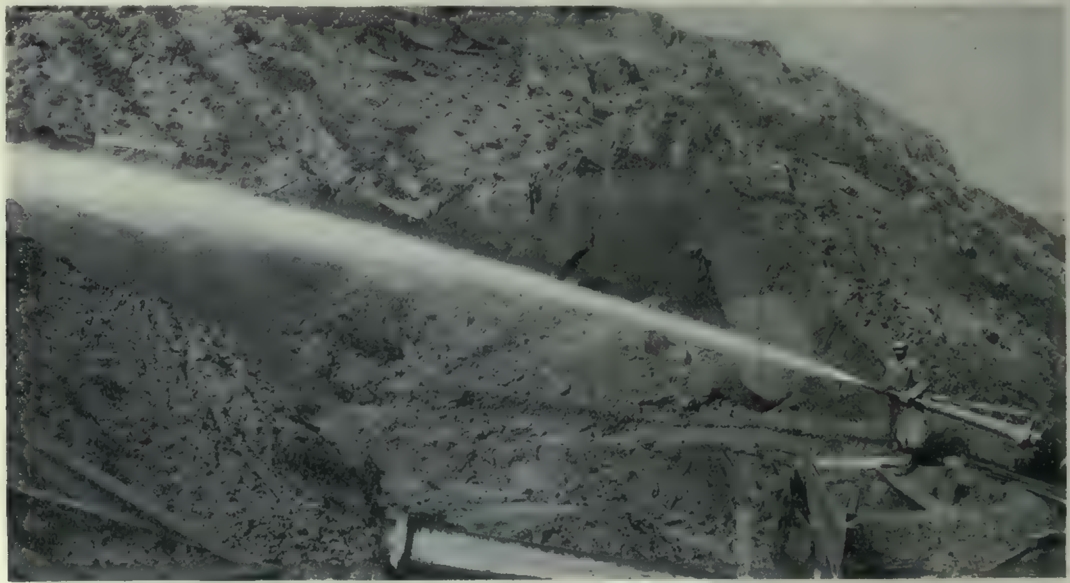
The only disturbing element is the uncertainty concerning the labor outlook. The plumbers of Calgary are on strike and unless the Builders' Exchange agrees to give the bricklayers 75c per hour it is likely that they will lay down their tools on July first. It is to be hoped that some agreement will be reached as strikes at this juncture would prove a serious drawback.

Preparations for Building by Means of Hydraulics

By W. W. Hay, B.Sc.

WHAT is believed to be the largest private property development in the Dominion of Canada is now under way in Calgary. F. C. Lowes & Company, Limited, of Calgary, owners of many large properties throughout Western Canada, and particularly in Calgary, are the owners of Roxborough Place, a sub-division comprising about forty acres situated on the south bank of the Elbow River and surrounded on all other sides by high ground rising abruptly from the flats. The high ground immediately west of this sub-division is the property of the same company, and they have been grading and terracing the flats by sluicing the earth from the upper levels by means of hydraulicking. The work has many points of interest, both in the amount of material moved and the low costs.

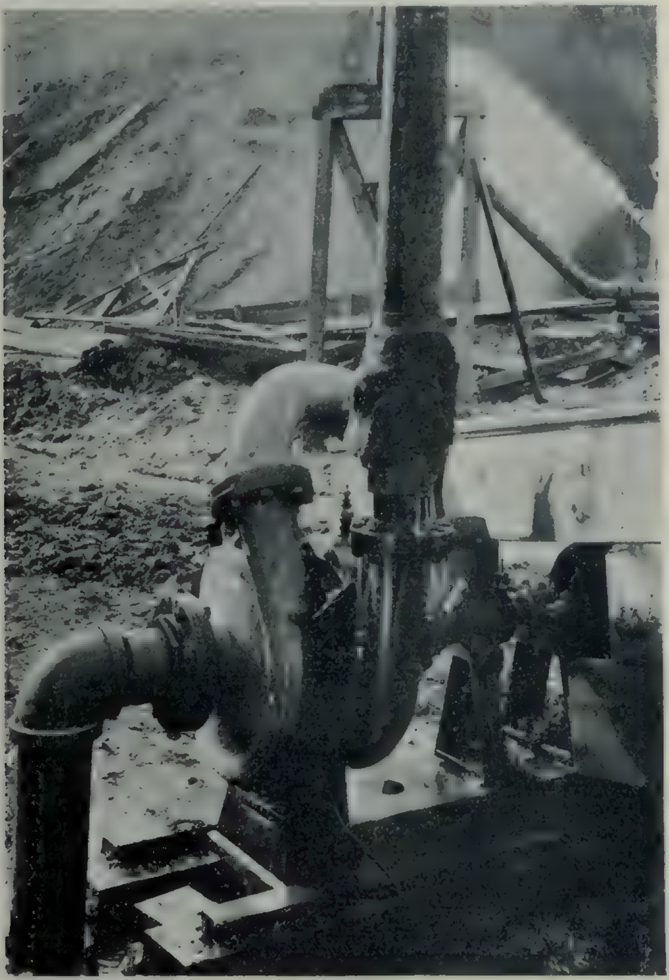
The surrounding high lands lie from eighty to one hundred feet above the plain, and the earth has been sluiced down from that height and distributed to points as far distant as 3,000 feet, filling and grading the property for streets and for buildings. The operations were carried on during five months of last year, during which time it is estimated that fully 400,000 cubic yards of material were moved and it is expected that an equal amount will be moved during the coming season. During the first year the water was pumped direct from the city water mains, but the pressure was so lowered for the residents on the upper levels that at the beginning of the present year's work the owners installed their own pump at the river's edge, 2,500 feet distant from the operations. A temporary submerged weir diverts the water towards a 2-stage "American" centrifugal pump operated by a 50 h.p., direct current, Westinghouse motor, forcing the water to a second pump, 25 feet above the river and nearly a half-mile distant. This second pump is the same as the first, though driven by a 100 h.p., direct current, Westinghouse motor, and delivers the water to the hydraulic giant nozzle 300 feet distant and 40 feet higher at the rate of 750 gallons per minute with a pressure of 102 pounds per square inch. Six-inch, extra heavy, cast iron pipe, with bolted flanged connections is used between the force pump and the nozzle, about 800 feet being used in all. The hydraulic monitor has a nozzle opening 1½ inches in diameter and is connected to the piping with a ball and socket joint.



Showing pressure of stream against bank.

The material excavated consists mainly of a sandy clay loam and the "giant" is capable of sluicing out from 150 to 400 cubic yards per 24-hour day, depending upon the amount of clay encountered. At one stage in the first operations a bed of blue clay was encountered which it was found impossible to sluice, necessitating its removal by teams. At another point a deposit of very excellent coarse sand was uncovered and the operations were diverted to allow the sand to be marketed. During the five months the operations were under way last year, upwards of 20,000 yards of this sand was sold and it is expected that the sales from the bank of sand will eventually offset all charges for the project. This sand lies 60 feet below the original ground surface and is at present exposed to a depth of from 15 to 30 feet, is at least 300 feet in length, and has not yet run out in the direction of the cutting. The better portions of the deposit consist of a good clean, sharp quartz sand, considered the best sand on the local market.

At the present date the operations are being confined to the building of two terraces, one 40 feet wide for a roadway, the other 160 feet wide for lots. These terraces run the entire length of the hillside and below the 100-ft. boulevard which runs up to the higher ground along the rear of the property. The earth is sluiced down beneath this road and across to the property, and is stopped at the edge of the required terrace by temporary bulkheads. A trench 2 feet wide and 20 inches deep is first dug on the proper alignment and 4 x 4 in. posts are driven at 6 ft. intervals. Shiplap boarding is then nailed on the inside of these posts and the whole filled with earth to form the bulkheads. The surplus water after depositing the major portion of the earth in suspension, drains off into the Elbow River, a distance of nearly 2,000 feet. When the grading was first commenced, a light timber flume 1,600 feet in length was used to carry the materials to the remote points of the property.



Showing two stage centrifugal pump attached to water main.

The operations have been carried on night and day, weather permitting, requiring a force of from ten to twelve men per shift, though at times there have been as many as forty men employed on the project. The hydraulic sluicing has covered to date an area of about 12 acres. Where particularly dense and compacted soil has been encountered, dynamite has been used to advantage to break the material into lumps small enough to be moved by the stream of water. The cost of moving 400,000 cubic yards of material during five months of 1912 is reported to have been but 6½ cents per cubic yard and it is expected to reduce this cost to 4½ cents per cubic yard during the remaining operations.

A Grouting Process for Preventing Slides on the Panama Canal

In the Culebra Cut on the Panama Canal serious difficulties are being experienced from slides, and the Isthmian Canal Commission's report for 1912 contains an interesting description of the geological formation and the cause of slides, by the geologist, Mr. McDonald.

The writer has reached the conclusion that the slides may continue to be a serious matter. Therefore it will be advisable to give consideration to any methods which will tend to prevent slides. A process used in shaft sinking and tunnel work suggests a method of erecting an underground retaining wall which (though not feasible for ground actually moving) will perhaps prevent the formation of a slide by taking care of the unbalanced pressures due to deep excavation.

Cementation Process for Sinking Shafts

While the method of filling cavities and rock crevices behind tunnel lining with cement grout has long been employed, a special application called the cementation process has been highly developed in France for sinking through porous and creviced water-bearing strata. Briefly, it consists of drilling a series of holes surrounding the shaft location through the porous strata to the more or less impervious coal measures, and pumping in cement grout under high pressure. The pumping may be either continuous, as the drilling proceeds, or (as in later undertakings was found to be better) in stages at intervals alternating with drilling every 16 feet. By this method a cylinder of cemented material is constructed within which the shaft can be sunk. In the earlier undertakings four drill holes were used, but for later shaft sinkings six holes were employed in a circle of 24 ft. diameter.

To prevent leakage to the surface of the injected grouting, a pit is first dug for each bore-hole through the loose earth and concrete placed tightly about a 12-in. standpipe, the top of which is capped. The cap has a stuffing-box, through which passes a grouting pipe that can be pushed to near the bottom of the hole. The pipe is connected with the pump, and the latter with the cement mixer. Before injection of cement begins, clear water is pumped through.

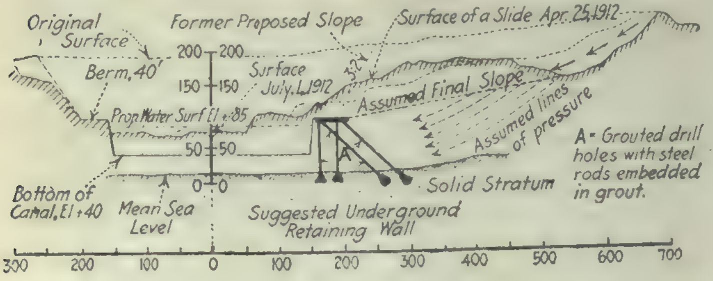
It has been found necessary to use only the finest ground cement, and employ pressures as high as 750 lb. per sq. in. to insure the thorough permeation of the cement into the small crevices and bedding planes of the strata. The cleaning out of all mud coating on the bore-hole is also found necessary. To this end it is the practice to drill the hole below the stand-pipe, about 7 in. diameter, and then ream to 10 in.

The water-bearing strata consist of marls or fissured chalks which are sometimes argillaceous. They are soft enough to be bored with an auger drill turned by power. The process has been so successful that it is supplanting the freezing system for sinking through highly water-bearing strata in northern France and Belgium.

Constructing Underground Retaining Walls

The success achieved with the above process appears to offer possibilities in solidifying the slopes of unstable strata, at least sufficiently to prevent movement from occurring. The holes filled with concrete,

A further development was to "spring" the holes at the bottom by shooting with dynamite. This would open up crevices, permitting a more extensive cementation, and would provide an enlargement which would furnish anchorage for the tie bars. The upper end of the tie bar is to be held by a concrete capping. Thus the combination of vertical concrete posts and inclined metal ties (going deep enough to reach solid strata), with the ground cemented between, would furnish a triangular dam, or retaining wall, which should have great strength against lateral pressure.



The nearer the holes, the more thorough would be the cementation. The only limit would be that of cost. The system, if applied extensively, would be costly. But it would only be considered where the cost of repairing damage to an engineering work by an extensive landslide would be vastly greater.

In proposing the scheme for checking, or rather preventing, slides, the writer has had three main thoughts in mind: 1, as far as possible there should be drainage; 2, there should be a subdivision of the slopes from which the slides are liable to come; 3, there should be formed an underground dam, to prevent the foot of a slope from moving, and also to keep the water of the canal from circulating through the material. It is very much more destructive to the somewhat soluble walls to have water constantly entering and leaving the crevices through wave action, than if the ground water is merely held quiescent.

The scheme is as follows, and is shown by the accompanying cut:

1. To drill a series of holes along lines parallel with the axis of the canal, these holes to be both vertical and inclined, and go deep enough to reach firm strata below the level of the bottom of the canal. The depth of the holes might need to be 100 feet or over 150 feet.
2. Cement grout to be forced into these holes under pressure of 750 to 1000 lbs. per sq. in., so that the cement will penetrate all the fissures, making the mass impervious to water, and also binding the rock together.
3. Steel rods, 3 in. diameter or more, to be grouted into the holes.
4. Before the steel bars have been placed, dynamite is to be fired in the bottom of each hole to make an enlarged space in the firm stratum which the holes should reach. These will provide anchorage at the bottom. The rods will thus act as reinforcements to the cemented zone; and the rods in the inclined holes will serve as tension members of the wall. The latter rods will therefore be made much heavier than the others. The rods are to have nuts and washers or to be upset at each end. The upper ends are to be fastened in a concrete capping over the top of the "dam."

In applying this method it must be done before the ground begins to move. It cannot be applied to ground that is actually moving. Moreover, the wall must go sufficiently deep to get into solid strata. But there is nothing except cost to prevent such an underground dam from going as deep as seems desirable, or to make the holes as large or the tie rods as heavy as desired. It would be desirable to try the method beyond the present slide areas in order to determine the obstacles and necessities of the case. The work could be pushed from either edge into the slide area. Intermediate ground walls could be constructed further up the slopes, so as to lessen the weight and also to prevent water which might enter above from working down into the larger mass below. Accompanying these dams, underground horizontal drifts might in some cases be put into the slopes to drain the ground.

Engineering News.

Selkirk Tunnel Under Way

THE actual work of boring the six million dollar tunnel for the C. P. R. railway through the Selkirk mountains on Rogers Pass has begun. Special trains carrying steam shovels and other equipment are on their way to the scene of operations. It is estimated by the contractors, Messrs. Foley, Welch & Stewart, that the plant necessary to perform the task will cost $500,000.

Work is to be carried on simultaneously from both sides of the mountains. Huge ventilating fans will supply the men at the headings with fresh air and for the first half mile of the tunnel compressed air locomotives will haul up the rock. As the work advances this work will be done by small steam locomotives. A new style drill is to be used and the importance of getting the most efficient type can be readily seen when it is understood that 250,000 cubic yards of rock must be removed.

A large force of men will work through the present summer and autumn preparing the actual approaches to the tunnel. Two miles of track at the east and three miles of track at the west end will lead to the approach cuts. The cuts themselves are about a quarter of a mile long. It is hoped that it will be possible to begin the actual boring by the autumn. The character of the rock and the quantity of water to be encountered are uncertain factors but the contractors look forward to finishing in three and a-half years.

Recent experiments at Boston, Mass., went to prove that sawdust is useful as a fire extinguisher. It was found to be very successful in quenching fires in oil, and much superior to sand for fires in tanks of inflammable liquids. Experiments were conducted with tanks of burning lacquer, though the same principles appear to apply largely to tanks of burning oil. The floating sawdust forms a blanket that shuts off the air from the flames; and sawdust itself catches fire only slowly, and then does not burn with a flame. The sawdust blanket was completely successful in putting out the fire in these tests. It made no difference whether the sawdust was wet or dry.

Letters Received for Publication

Municipal Engineering Society Proposed—A Complaint Registered—Boring Record

Editor, Contract Record:

The announcement of the annual meeting of the American Society of Municipal Engineers made me curious to know if there were organizations of similar character in Canada.

After glancing over a list of Canadian technical societies I was able to make a rough analysis of the professions they represent. Out of about seventy societies, sixteen are associated with general engineering, three represent electric engineers, etc., architects have seven societies, land surveyors have six, mining engineers three, gas engineers one, railway engineers three, chemists one, and the remainder are associated with builders, astronomers, stationary engineers, good roads, smoke abatement, peat, forestry, cement, and miscellaneous, numbering in all about eighteen. The Mayor, Aldermen, Councillors, and Town Clerks have ten societies organized to represent their views and wants. It is worthy of note that there is one Public Health Association in Canada, and this is said to consist largely of medical men.

Canada is a large country, with a population of about eight million people. The health of the communities, where human activities are so pronounced, is of vital importance, yet, the last named association is the only one which has been established in this country, primarily in the interest of public health. The municipal engineers, however, as an organized, coherent body of officials, do not exist at all. In Canada, therefore, at the present time, so far as I am able to ascertain, there is no organization which has specially the right to represent and voice the views of the important profession of municipal engineers.

Why is this so? Is there a good sound reason for the absence of such a representative society? Is the immensity of Canadian territory a deterent to a prosperous institution? After studying the situation, the writer was forced to the conclusion that it was because each municipal engineer had as much as he could do to carry on his own professional duties, and consequently, had but little time or occasion to think of such an organization. Furthermore, they dwell and work at distances, more or less great from each other, with the result that the engineer in British Columbia, for instance, rarely meets his confreres in the Prairie Provinces, much less have many opportunities of conferring with those in the East. If this applies to engineers working in the West, but whose native home is in the East, then it is still less probable that those living and working in the East get frequent opportunities for visiting works in the West. There is no inducement, at present, for them to make the trips. This, however, is not a strong reason for the absence of a Canadian institution of municipal engineers, but is a powerful argument in favor of its immediate formation. The vastness of this country renders it even more desirable that engineers should combine and by means of an organized effort, eradicate the present tendency to insularity caused by their isolation from engineers in other cities and provinces.

Many of these engineers have occasion at one time or another, however infrequent, to visit other towns and cities, and to inspect various works of interest to themselves, and by making the most of their individual opportunities, they are able to secure valuable information which tends to show them that different engineers have different ways of achieving similar results. But if an institution was formed and meetings were held at different centres, the benefits would be collective and not individual.

In the field of general engineering, there is probably an ample number of societies, and for almost every phase of engineering in Canada,—except municipal engineering—there is a representative organization.

According to the Dominion census of 1911, there were one hundred and seven cities and towns in Canada having a population of 4,000 and over. This was an increase of 45 per cent. over 1901. The increase in population has been much greater during the last five years than in any other similar period, and it is safe to reckon that the number of towns and cities of 4,000 inhabitants and over will by 1921 be about two hundred.

Most of these towns employ an engineer, some of them also have departmental engineers, and I may venture to estimate that there are at present from three to five hundred engineers engaged on municipal works in Canada, who owing to the non-existence of a distinctly representative society, common to practically every other class of men, are left to their own resources and initiative.

A Canadian Institution of Municipal Engineers might include city engineers, municipal, electric, water, drainage, road, street railway, gas and other engineers. Perhaps consulting engineers engaged on municipal undertakings would be allowed to join. The only qualification, which would probably be needed (especially at the commencement) would be that the applicants either hold principal civic appointments or are engaged on municipal works. The members could, of course, be divided into classes according to their individual qualifications and occupations, if it was thought desirable.

Such an institution would meet in different cities, at least once a year (the oftener the better) where papers would be read by the engineers describing the works undertaken by the city, and these works would be inspected and explained, questions would be invited and answered and a general discussion would take place.

It is often the case, in other societies, that a free discussion affords more useful and comparative information than is to be found in the paper itself. Such discussions are good, the weak and strong points of any scheme are brought out prominently, for in the multitude of counsel there is often much wisdom. Discussion also broadens the mind, enlarges the horizon of thought and develops the reasoning faculty; it is also educational to both the speaker and audience alike, it creates a healthy and generous rivalry, and establishes a standard of excellence which by mutual accord becomes higher each year and which will inevitably reflect credit on the profession generally, and give greater satisfaction to the public for whom we work. Such discussion would be of immense advantage to the engineers and to the authorities; the latter would not only secure an excellent advertisement, by virtue of the official visit of the society, but what is of even greater value, the town authorities would hear criticisms and obtain information useful for future operations.

Later on, the institution could, if it was deemed desirable, organize examinations in the theory and practice of municipal engineering and in municipal law.

Such a society would tend to weld together the band of municipal engineers to their own direct benefit, and the town authorities, by sending their engineers to the meetings, would in every way reap great advantages, because the educational and social aspects of such meetings would be conducive to mutual interest, efficiency, confidence, progress and esprit de corps among the officials.

As a former municipal engineer of thirty years standing, I heartily acknowledge that the many associations of which I have been a member for many years, have been of inestimable value, not only by virtue of the publications received, but also by the friendly, intellectual and social intercourse with brother engineers, and by the free interchange of ideas, thoughts and datas.

Considering that enormous sums of money are annually spent by municipal engineers, of various classes, and that so much depends on the efficiency of their works in the direction of public health, public utilities, and public amenities, it might seem strange that active steps to combine had not long since been taken. An official who is perforce to follow solely his own ideas—ploughing his lonely furrow—without seeing what has been done by others in the same sphere of operations, is apt to fall behind and develop the spirit and sentiment of the proverbial cobbler who never went beyond the confines of his own little village.

Whilst in the early stages, it might perhaps, be found possible to form only provincial institutions, the formation of a powerful Dominion institution should be advocated, for in union there is strength and in co-operation there is prosperity. The aim and object of the promotion should be to force it to become a power in the land and that the opinions, transactions and developments of the institution should carry weight and tend to create an appreciative public opinion on the inobtrusive work carried on by engineers in the Dominion. Such an institution, if rightly directed and loyally supported in its initial stages, would soon reach the position when its power and influence would be felt outside the circle of engineers.

At present if any Canadian engineer desires to meet in conference, men of similar vocation, he has to cross the International Boundary, where, of course, he will see much to his advantage, and though he will certainly receive a warm welcome and a great hospitality, he cannot help but feel a sense of loneliness in the crowd. If, however, a representative society were to make an official visit to the same town the members would not only receive even greater welcome and more bountiful hospitality, but the members would also not feel as if they were lost in the multitude but rather as if they were members of a great family.

From a national point of view, moreover, we should be patriotic enough to be in a position to announce that we have similar societies in Canada, for certainly we have much to be proud of in the number of municipal works, which we can visit. The suggested Canadian Institution of Municipal Engineers if formed, could occasionally pay an official visit to a city across the line, just as the gas engineers visited Toronto last year and the American Society of Civil Engineers visiting Ottawa this month. This is a graceful manner of recognizing the internationality of the engineering profession.

I do not know what are the views of the Municipal Engineers on this subject, I have spoken to a few and they appear to be favorable to the suggestion, but it will be advisable to have a free discussion before anything is done in the matter. Perhaps the Editor will throw open the columns of this journal for such purpose.

In conclusion, I have to state that I have had the privilege of assisting in the formation of at least three engineering societies in different parts of the British Empire. If I can be of any service in helping to form such an institution as I have endeavored to describe, it will afford me much pleasure to do so. I, however, fully believe that there are plenty of engineers who are willing to do what is required, when it is felt that there is a desire for such an organization.

Thanking you for the opportunity of presenting the foregoing plea for a representative organization of municipal engineers.

R. O. Wynne-Roberts,
Consulting Engineer, Regina.

(Editor's Note.—We quite agree with Mr. Wynne-Roberts as to the value and benefits of an organization of the nature described in his communication and should be pleased to publish any correspondence bearing on the question).

June 28, 1913.

Editor, Contract Record:

In your issue of May 28th there appeared an advertisement over the signature of the Mayor and the City Commissioners of Moose Jaw, Sask., for tenders for street pavements, concrete walks, curbs, gutters, etc., to close June 6th, one of the conditions being that a marked cheque for two and one-half per cent. should accompany each tender.

A tender for all the work at reasonable prices would amount to approximately two hundred thousand dollars, the marked cheque required would therefore be, say, $5,000.

In company with other unfortunates the writer wended his way out to Moose Jaw, paid his railway fare out, lived well at a first-class hotel—and by the way, they have a first-class hotel—and paid his fare back, without having the satisfaction of knowing whether his tender was low, high, or in the middle. Before going farther it might be pointed out that neither the railways or hotels in the west take "promises to pay," you must settle in cash, and it is surprising how many people seem to have the cash, although it is claimed that money is scarce. Well, the long and short of it is that the Moose Jaw Council a day or two after the tenders closed determined not to go on with the work after they had succeeded in bringing a number of paving men to their city to spend money on hotels, ball games and picture shows. Without further word of explanation the council decided to "return all tenders unopened." One representative with a little more nerve than the rest tried to get permission to address the Council, but was refused. He told me afterwards that he was going to ask them if they would recoup him for his expenses seeing that they invited him to come.

This is the point the writer wants to make: If City Councils are so anxious to have "marked cheques," "bonds," "guarantees," "retained payments," etc., etc., from prospective contractors on civic work, why do they not use more horse-sense in scattering their invitations to tender before they are ready to receive the tender either for financial or other reasons, thus eliminating the waste of time and money in figuring on work which cannot possibly be proceeded with, or have they the idea that the various paving contractors enjoy that kind of thing? If that is their idea of the paving business it might be suggested they call a convention of paving men, give them a good time showing them around the city, etc., and let them air their views on civic matters. Undoubtedly these city fathers would get some splendid ideas, especially upon the advertising for tenders, the methods of opening tenders, the awarding of contracts ,etc.

The writer has been in the paving business for about fifteen years, and has had experience in possibly a hundred cities and towns in Canada and the United States, but this last experience is a new one to him. It may be depended upon that he saw that his tender was "returned unopened," and if he tenders again in Moose Jaw, and he is fortunate enough next time to secure the contract, the citizens of that progressive burg will pay the expenses of both trips—do you blame him?

Did you ever attend a council meeting and hear the city fathers discuss and pass an item of a million dollars in two minutes, and then take an hour to decide the question as to whether they would rebate $3.00 collected for taxes in error? And then did you ever go home and wonder why it is that a city cannot be run the same way that any of our railroads, banks, manufacturing establishments, insurance companies, and steamship companies are run?

Some day I expect to write a book on this most interesting subject, so what is the use of further remarks?

Thanking you for the space, I am,

Yours very truly,

A Pavingman.

Brooks, Alta., June 28th, 1913.

Editor, Contract Record:

On page 45 of your issue of June 11th, you state that 810 feet of hard rock tunnelling in thirty days is the American record. Allow me to inform you that you are mistaken. The American record for hard rock tunnelling was somewhere about 900 feet a month made in very hard blue shale on the Gunnison Tunnel in Colorado built by the United States Reclamation Service, and if you will be good enough to write to the Director of the United States Reclamation Service, Washington, D.C., you can get the official record.

Yours truly,

E. E. Sands.

Reports from Western Cities

The city council of Regina has added to its already extensive programme of public works further improvements involving an expenditure of over half a million dollars. The greater part of this sum is to be spent on sewers and watermains. An incinerator is to be installed and sixteen specially designed cars for the conveyance of the garbage purchased. Street car lines are also to be extended. In addition to the civic work several large business firms have undertaken extensive work. Excavation has begun on the Sherwood departmental store. This structure when completed will cost $1,000,000. Excavation for the million-dollar Grand Trunk Pacific Railway hotel is practically completed and the construction of this 14-storey building will begin immediately. The city authorities have set aside a suitable site for the armouries and the work will begin immediately, at an estimated cost of $300,000. Among the other buildings now under construction may be noted the Winter Fair Building, at a cost of over $100,000, the Canada Life 6-storey building and two Roman Catholic churches.

Fort William

This important lake port continues its rapid growth. Mr. M. A. Ryan, president of the National Boiler Works Company, of Superior, Wis., has secured a site for the erection of a boiler manufacturing and structural steel industry. It is proposed to erect a building 140 by 260 feet and to give employment at the first to sixty men. The Dominion Government, which has already spent an enormous sums on Fort William harbour, has appropriated $2,000,000 for further harbour improvements. The Ontario Government is pushing the work on road building in the immediate vicinity. The Pigeon river road, which is to connect Fort William with Duluth, is the scene of great activity and the work will be carried to the international boundary line by fall.

Port Arthur

Building and engineering operations on a large scale are reported from Port Arthur. Work is to be carried on by the Dominion Government, the Provincial Government, the city itself and by private parties and business concerns. The Dominion Government will spend $3,000,000 in the constructive and engineering work required to improve the harbor and shipping facilities and $150,000 on a Customs Building and new Armouries. The Provincial Government is devoting itself to the improvement of the roads adjacent to the city and is spending a very considerable sum. The civic officials are adding ten miles to the street railway system to form what is to be known as the Belt Line, and have plans out for the extension of the sewer and waterworks system to the amount of half a million dollars. A large number of private residences are in course of construction. An office block, two large store blocks and the Oddfellows' Hall are also under way and represent an investment of nearly three-quarters of a million dollars. The city has just completed an agreement with a large company for the building of a flour mill and elevator, having a daily capacity of 2,500,000 barrels.

New Government Building at Ottawa

The Dominion Public Works Department in providing for the new Government buildings to be erected at Ottawa has decided to call for competitive plans. Mr. T. E. Colcutt, the British architect, has been appointed to collaborate with several prominent Canadian architects in arranging for the competition. Mr. Colcutt was nominated for this position by the Royal Institute of British Architects. This well known designer has had a wonderful career. In 1896 he was sent by the British Government to Johannesburg to arrange for the erection of a university. Later he aided in planning of the Palace of Peace at the Hague. In England his work is seen in the Imperial Institute at South Kensington, London, the Savoy Hotel and Lloyd's Registry Offices in Fenchurch street.

Mr. Colcutt is a past president of the British Institute, a member of the Society of Des Artistes Francaises and also a member of the Belgium Architectural Society. He is the holder of the King Edward gold medal and won the Grand Prix at the last Paris Exhibition for desiging artists. Mr. Geo. Moenton-Sharp, who was a successful competitor in recent important British Columbia work, is a pupil of Mr. Colcutt, while Mr. Leonard Stokes, who has been engaged by the Manitoba Government in connection with the new Provincial House of Parliament, is a partner.

The gentlemen collaborating with Mr. Colcutt at Ottawa are J. C. Marchand, of Montreal, and J. G. H. Russel, of Winnipeg. All are meeting to-day at Ottawa to settle the conditions upon which the competition, open to the British Empire, shall be conducted.

The new department buildings will be created on the bluff of the Ottawa River to the west of the present departmental group. The Government has accepted the ground plan prepared by the English landscape architect, Edward White. It now remains to prepare designs for the buildings which are to occupy the site already acquired by the government.

A prize of $3,000 will be awarded to each of the first five in the competition. For the $3,000 each of them will be required to prepare working plans. After this has been done the judges will go over the five sets of plans and to the one which is adjudged the most meritorious will award the great prize of the competition. This will be an order to supervise the construction of the building or buildings at the usual architect's fee.

Canadian and American Roads

The International Congress recently held in London, Eng., on the invitation of the British Government brought together many prominently interested in building and maintenmane of good roads.

Mr. Rees Jeffreys, the well-known secretary of the British Government Road Board, brought back some interesting suggestions from his recent Canadian trip. Here for instance is one of his comments:

"In Canada the unit of road administration is the County, which is, I understand, a poor authority. You must, I think, create authorities sufficiently large to command the services of competent officials. The second point to be insisted on is that the secret of good roads is continuous maintenance.

"I found that in the United States and in Canada good roads had been built and not maintained afterwards—a sheer waste of money. Roads need continuous attention, like machinery, or your original capital expenditure is wasted. If the provinces in Canada are going to provide for road construction, they must also take steps to secure their proper maintenance when made.

"The best roads I saw in the United States were in Massachusetts, where the State is the road authority and maintains the roads. In other states, where the state had built good roads and had handed them over to counties to maintain, the roads were often neglected. The result was that a large percentage of the capital expenditure had been wasted.

"It cannot be too strongly asserted that the supreme authority in the finances and supervisions of roads should be a large body. The tendency to-day is towards centralization, and the supreme authority should be a Government Department, composed of capable men chosen because of their ability and not by reason of their politics."

The Canadian representatives include the Hon. J. E. Caron, Quebec, Minister of Agriculture and Roads; a representative of the Saskatchewan Government; Mr. W. A. McLean, of the Ontario Government Engineering Staff; Mr. Howard A. Turner, Road Superintendent, Okanagan Valley, B.C.; Mr. George Janin, Chief Engineer of the Public Works Department of Montreal; Mr. G. W. N. Day, Editor of the Contract Record and Engineering Review, of Toronto, and Mr. Stanley D. Robinson, of Hamilton, Ontario.

Pedlar People Staff Changes

In keeping with the policy of this house as originated and developed by the late Mr. Geo. H. Pedlar, additions to the force at Oshawa headquarters have been made recently, which will further increase the efficiency of an already strong and capable organization.

Mr. W. R. Geikie, formerly branch manager of The Pedlar People, Limited, at Toronto, who possesses a thorough knowledge of financial matters gained through a long experience with the Dominion Bank as manager of various branches, will in his capacity of managing director, bring this ample knowledge into good use, together with his experience in selling sheet metal products as manager of the branch at Toronto. With this excellent business equipment Mr. Geikie should be able to gauge the situation correctly as applying to trade conditions in sheet metal lines.

The Operating Department has been strengthened by the addition of Mr. W. Loach, formerly connected with the management of Canada Foundries Limited, Toronto. This new official has a wide and varied mechanical and manufacturing experience in the United States and Canada. Several new developments are now under way, which will be of general interest to the trade when particulars are announced.

A further addition has just been made in the person of Mr. A. T. Enlow, now in general charge of sales and advertising. Mr. Enlow is a steel man of large experience, having been connected with the manufacture and sale of steel in the United States for the last twenty years. He was plant manager for the United States Steel Corporation, at Cambridge, Ohio, and later sales manager of Berger Mfg. Company, and general sales manager of The Stark Rolling Mill Company, both at Canton, Ohio, While acting in the latter capacity, Mr. Enlow developed and marketed the famous anti-corrosive Toncan Metal Sheets, for which The Pedlar People, Limited, are Canadian distributors.

Messrs. W. H. Hall and F. L. Mason, who were prominently associated with the late Mr. Pedlar in the development of the Pedlar People sheet metal products, have already proven their worth. It is quite safe to say that the addition of these three experienced men means the continuation of the policy which has kept the firm at the head of sheet metal working activities in Canada and abroad.

Famous Paintings from Germany, Britain, United States and Canada

The display of paintings at the Canadian National Exhibition draws lovers of the beautiful from all parts of America.

In the galleries are gathered the best works of Canadian and United States artists, and the great galleries of Europe loan their treasures to further enhance the value of the collection.

This year the galleries will be divided into four sections; British, German, American and Canadian, and the entire exhibit promises a distinct advance on the previous great collections that have featured the Canadian National.

Mainly Constructional

Mr. T. Aird Murray has prepared an exhaustive report on York Lake, Yorkton, Sask., as a probable source of water supply.

Building permits for the first six months of 1913 at Welland, Ont., amounted to $225,000, an increase of $100,000 over the same period of 1912.

A new building by-law is being prepared for Regina which, while not making many radical changes, will be worded in simpler terms so as to prevent misunderstanding.

For the month of June the Montreal building permits totalled $2,278,424, against $1,718,505 for the corresponding month last year. The figures for the half year show a value of $9,442,288 as compared with $8,065,993 in 1912.

On behalf of a company, Mr. P. W. St. George has made a proposal to the city of Montreal to take over the garbage. The idea is to utilise a portion of the garbage for generating steam for commercial purposes, and also to extract grease and fertilisers from other portions.

Hon. J. O. Reaume, Minister of Public Works, of Ontario, stated recently that no move would be made by the Government to outline its policy for the improvement of roadways in old Ontario until Mr. W. A. Maclean, Provincial Engineer of Highways, returns from his present trip to Europe, where he is attending the International Roadways Conference.

Judgment in favor of Messrs. Wills, the contractors for the Canada Central Railway, has been given by Mr. Justice Archibald, Montreal. There has been litigation between the parties concerning the construction of the line, and the result is that, by the ruling of the judge, the company are restrained from either undertaking the work on their own account or from handing it to another contractor.

The proposed new Registry Office for Toronto, which is to be erected in the block bounded by Chestnut, Louisa, Elizabeth and Albert streets, will be one of the finest on the continent. The proposed entire cost of the building, including heating, ventilation, plumbing, lighting, and architect's commission, is to be $350,000. It will be two storeys in height and be built in the centre of the block. The dimensions of the building cannot be determined until the drawing is made by the architect, but the dimensions will likely be about 120 feet on the south and north sides by 150 feet depth.

The Department of Public Works of the province of Quebec is constructing a new bridge over the Yamaska River at the city of St. Hyacinthe. This structure is intended to replace the old wooden bridge that spanned the river at that point and calls for an 18-foot roadway between wheelguards and two suspended sidewalks 4 feet wide outside each truss with steel lattice fence railings on the outer line of the sidewalks. The plans and specifications were prepared by L. A. & Ivan E. Vallee, engineers of the Department of Public Works and Labor. The Dominion Bridge Company is carrying on the work of construction.

The Department of Public Works, Ottawa, has received plans for the construction of the new entrance to Rideau Hall, the Vice-Regal residence at the capital city. There was some agitation for an entirely new residence on a new site at Rockcliffe but this was not favored by the Government at present. The addition in which is situated the new entrance will be 96 feet long and three storeys in height. The portion of the old building to the rear of the entrance is to be altered in layout and made fireproof and extending in height to three storeys. The suggested changes have received some adverse criticism on the part of architects.

A very large deputation representing counties on the south shore of the St. Lawrence have asked Sir Lomer Gouin, the Premier of Quebec, to aid in the construction of a national highway to link up Quebec, Sherbrooke and Montreal, passing via Sherbrooke and Richmond, and connecting with a link from Richmond to Sherbrooke with the proposed road to the American border, and another link from Sherbrooke via Magog and Waterloo to Granby, the whole road to be about 240 miles in length. The Premier stated that the Government approved of the road, but that aid would have to be given in turn with other road projects before the government.

In an action for damages against the City of Montreal, Mr. Justice Archibald has decided that a city is not obliged to construct sewers which will meet all possible contingencies; it is only bound when it constructs a sewerage system in any given locality, to do so in a careful way to the best of its judgment, after having secured the advice of qualified engineers. Owing to the insufficiency of the sewers to meet an extraordinary demand upon them a cellar was flooded, and $412 was claimed. It was also shown that the plaintiff's cellar was a foot deeper than was allowed by the city regulations and that the interior drainage was not equipped to meet an unusual flow in the sewers.

Western Pavers Limited were recently awarded contracts for approximately seventeen miles of curb and gutter construction in the city of Regina, having just completed a former contract. This company have also somewhere in the neighborhood of thirty miles of curb and gutter work in the city of Edmonton working steadily for four contractors, besides a $75,000 sidewalk contract in the city of Saskatoon and work of a similar nature throughout the Prairie Provinces. Western Pavers Limited is under the management of a former Torontonian, Mr. Chas. Curtis, having worked for a number of years in the City Hall and subsequently as secretary-treasurer for the Bitulithic Company.

The Cook Construction Company, of Sudbury, Ont., and A. B. Wheaton, of Amherst, are joint contractors for the Halifax Terminal Railway at a contract price of $1,500,000. The line is five miles in length, and is to run from Rockingham to the site of the proposed terminal works. It will in effect be part of the Intercolonial, but will be known as the Halifax Terminal Railway. The contract is to be in two sections, one at a million and the other at half a million. The two contracting firms are taking it over jointly. A great deal of excavation will be necessary, and it is the intention to use all the rock and dirt on the harbor work and in the construction of the sea pier which will be necessary in connection with the new docks.

A portion of the present old canal will be completely closed by the construction of the new Welland Ship Canal. A dam will be thrown across the old channel at Allanburg, and from this point to Marlatt's Bridge the old canal will be used as a dumping ground. Should navigation on the lower portion of the old canal be desired later, a cut thereto from the present canal at lock 25 could be made. The clay from the deep cut south of Allanburg will be thrown into the dump thus formed, and the stone from the rock will be utilized in building a great breakwater at Port Colborne. The harbor there will be deepened to meet the depth of the new channel, which will be 25 feet. The width at the bottom will be 200 feet.

After some delay, the Montreal Board of Control has awarded a contract for the widening of the city aqueduct to the Cook Construction Company, of Sudbury, Ont., at the price of $2,322,552. The next lowest tender was that of Quinlan & Robertson, of Montreal (who carried out a previous contract for work on the aqueduct), their price being $2,621,180. Representations were made in favor of the work being given to the local firm, it being suggested that the work could not be done at the price tendered by the Cook Construction Company. This was denied, but with a view to satisfy the council, the company have agreed to give further guarantee for the completion of the work in addition to the $200,000 originally deposited.

According to a controller of the city of Montreal, the engineers appointed by the city to carry out tests have reported in favor of the site selected by Messrs. Hering & Fuller, of New York, for the filtration plant. The contractor, Mr. N. McLeod, asserted that the ground was unsuitable—was in fact composed of a kind of sand—and his contention was backed up by four of the most eminent engineers in Montreal. It was also said that certain damage to a portion of the plant was due to this cause, while the city asserted that it was owing to the lack of precautions during the winter. The controllers thereupon appointed Messrs. Jamieson, Barbour & St. George to investigate, and the result of their tests is stated to negative the contentions of the contractor.

The new plans for the Gerrard street bridge, Toronto, call for a bridge of three arch spans whereas the first plan which was approved of in February was composed of an arch over the Don only with girder approach spans. The reason for the change in that in the investigations of the Works Department there it was found that the subsoil shows the former mentioned plan to be the most suitable. According to the Commissioner of Works the three arch span bridge practically eliminates any unbalanced thrust, whereas the former plan would be subject to this condition. "This is especially objectionable owing to the limited space available for the piers and the extremely loose material which these piers would have to support them near the top," says the Commissioner.

Under the ruling of Mr. Justice Demers, Montreal, the Association of Architects of the Province of Quebec is a closed corporation, and those practising without being registered members are liable to a penalty. Two test cases have just been decided. The defendants, Messrs. A. H. Paradis and A. Trudel, claimed that, being qualified architects by experience and training, they were not compelled to go through the formality of registering as members of the Province of Quebec Association. The law dealing with such registration, they maintained, applied only to those who, in the words of the article, "held their title in virtue of this law." Defendants represented that as they held their title of architect in virtue of certificates conferred by American Institutes of Architecture, they did not fall under the operation of this law.

The association, on the other hand, maintained that the architectural profession, in virtue of the law referred to, was placed on the same footing as the legal and medical professions. Thus, before a person could engage in practice, he must first be registered as a member of the association, which was a closed corporation.

His Lordship, in deciding for the plaintiffs, imposed a penalty of $1 and costs.

Canadian Railroad Development

The laying of steel has reached Whitby on the new Lake Shore line of the Canadian Pacific. This makes a continuous track from Agincourt. A large turnout of citizens witnessed its arrival and great interest was shown in the event.

Before winter the Canadian Pacific Railway will be running a double-track service between Toronto and Guelph Junction, a distance of 31 miles, and next year will see another lap covered on the way to Detroit, 189 miles farther west.

According to a statement by Mr. F. P. Gutelius, the general manager of the Intercolonial Railway, it has been decided to reduce the grade of the line. The work will be done at the rate of 100 miles per annum. Certain portions of the line will have to be reconstructed, and it is also intended to double track as required. Mr. W. A. Duff has been appointed chief engineer of bridges of the I. C. R., having just concluded an engagement on the Transcontinental as assistant chief engineer.

According to an announcement by Sir Thomas Shaughnessy, the C. P. R. will appropriate, in the current year, a hundred million dollars for the construction of additional railway mileage, for cars and locomotives, terminal facilities at St. John, Montreal, Toronto, Fort William, Winnipeg, Calgary, Vancouver and elsewhere, for ocean steamships and hotels, extensions of the telegraph system, shops, sidings, and improvements generally in Canada. This sum will not be all spent during 1913, but the improvements will be carried out as rapidly as possible.

Despite the statements of railroad officials that the Essex Terminal Railroad will not be extended to Amherstburg, the Ontario Government engineers making the preliminary survey are laying out a line to that place. The Government engineers have not received definite directions as to whether the railroad will go to the full length of their survey, but they are making it to be prepared if such should be the case. An earlier survey which brought the railroad close to the river at Ojibway is being run over again at a further distance from the shore. This would indicate that larger yards are wanted by the Steel Trust.

The Federal Government have decided to at once commence the public works promised for the city of Quebec, which include the building of a tunnel, with entrance at Wolfe's Cove to St. Malo, to connect with the Union passenger station; the Transcontinental Railway workshops at St. Malo; a grain elevator in the vicinity of Priest's wharf, Champlain street; docks for shipping accommodation, and a passenger and freight depot for local traffic. The tunnel will be through rock, a mile long, and will admit of a double-tracked railway. The contract will be carried out by Messrs. M. P. and J. T. Davis, who are building the sub-structure of the Quebec bridge.

A number of new ammendments to the original order of the Railway Commission in regard to railway fire protection were approved of at a meeting of the board this morning. The most important amendment, and practically the only one objected to by the railways, was that limiting the extent of territory on each side of a railway track within which railways would be responsible for fire to 300 feet. To this Mr. Flintoff, for the C. N. R., objected that it would make "beautiful ammunition for a jury trial." The Chairman pointed out, however, that up to the present the railway might be held responsible for an indefinite stretch of territory, which was now to be limited.

The new Canadian Northern line from Quebec, via Montreal and Ottawa, to Port Arthur will be ready for traffic by the time navigation closes this year. This will take the completed road through to the summit of the Rockies in British Columbia. The railway thence to Vancouver will probably be completed two or three months later. Something of the vigor and enterprise with which the railway is now pushing its great undertaking to an early conclusion may be seen in the following statement. The pay sheets of the week just closed showed that a total of 8,921 men and 1,249 horses were engaged on the various sections now knitting the line together to the summit of the Rocky Mountains. This already mammoth force the railway expects to further augment during the next two months.

The aim of the International Railway management is to create a six-tenth grade from the city of Montreal to Halifax and Sydney, and this change can be brought about at the rate of about one hundred miles each year, according to F. P. Gutelius, general manager of the Government Railway system, in his official statement, after a trip over the system, accompanying the Minister of Railways and Canals. The change of grade will be brought about on short stretches of the I. C. R. For instance, some twenty miles of the line from Point Tupper to Sydney will have to be rebuilt, but this would not be more than twenty-five per cent. of the distance from the Strait of Canso to Sydney. The big change will be made between Truro, N.S., and Amherst, which section takes in the famous Foleigh Mountain stretch.

Personal Mention

Before leaving for Ottawa, Mr. Archibald Currie, the late city engineer of Westmount, P.Q., was presented with a gold watch, locket and chain by the staff of the road department and engineers' office. Mr. P. E. Jarman, who has been appointed acting engineer, made the presentation on behalf of a committee.

Mr. Collingwood B. Brown, who has been appointed chief engineer of the Government railways, is a graduate in civil engineering of Cornell. He is a Canadian by birth, having been born in Kingston, Ont., 36 years ago. For 14 years Mr. Brown has been in the employ of the C. P. R., and now resigns the position of principal assistant engineer with that company to enter the Government service.

J. W. Orrock, divisional agent for the C. P. R. at North Bay, has been appointed to succeed C. B. Brown in the position of principal assistant engineer of the C. P. R. at Windsor Station. He will begin his duties here as soon as he can be relieved at North Bay. It is expected that a local man will replace Mr. Orrock. Mr. Brown has gone to Moncton to assume the position of Chief Engineer of the Government railways, to which he was recently appointed.

Mr. Albert Nuttall, formerly Erection Superintendent, Structural Steel Company, and for the last two years Superintendent of Construction for Canada of the Cleveland Bridge Company, has been appointed Superintendent of Erection, Bridge Department of Canada Foundry Company, Limited, with headquarters at Toronto.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Bracebridge, Ont.
Cement walks, for Board of Education. Tenders received by Sec.-Treas., Alex. C. Salman, until July 15th.

Guelph, Ont.
Drainage planned by City Council and G. T. R. G. T. R. Engineer, Mr. Mitchell. City Clerk, T. J. Moore.

Owen Sound, Ont.
Sidewalks, cost $2,280.20, for town council. Tenders received by Chairman of Commission, Jas. C. Grier, until July 11th. Plans at office of Clerk, Chas. Gordon.

Sewers, cost $1,270.40, for town council. Tenders received by Chairman of Commission, Jas. C. Grier, until July 11th. Plans at office of Clerk, Chas. Gordon.

Peterboro, Ont.
Paving, George and Charlotte. Plans in progress. Clerk, S. R. Armstrong. City engineer, W. R. Parsons, Simcoe St.

Stratford, Ont.
City Council plan pavements, curbs, excavation and base, on Caledonia St., Construction Service Co., Ltd., Quebec St. E., Guelph. Curbs, excavation, etc., on John and St. Vincent streets and Linton ave., to Board of Works. (Ald. Pauli, chairman). Engineer, A. B. Manson.

Toronto, Ont.
Sewers, cost $9,730, contemplated by Board of Control. Brandon, Lightbourne and Chandos avenues. Mayor, H. C. Hocken, City Hall. Clerk, W. A. Littlejohn.

Sewers, cost $45,360, for Board of Control. Mayor, H. C. Hocken, City Hall. Sewers on Glenmount, Park road, Brookside Drive, Beachview crescent, Firstbrook road, Burgess and Gibson Aves.

City will construct number of sewers in Glebe Manor Dist.; Oswald, Servington and Cuthbert Cres., Belsize Drive, Wharram Place, Wilfred and Thurloe Aves. Board of Control. Mayor, H. C. Hocken, City Hall.

Walkerville, Ont.
Concrete pavements, for town council. Tenders received by Clerk, Cecil H. Robinson, until noon July 11th, for pavements on a number of streets. Engineer, Owen McKay.

Welland, Ont.
Concrete walks on Myrtle, Maple, Cross, William and Asher streets, and Parkway Heights. Passed by council. Clerk, Geo. R. Boyd. Engineer, D. T. Black, Main St. S.

Winnipeg, Man.
Wells, for the Rural Municipality of St. Vital. Sec.-Treas., J. Desourdis. The digging of public wells for water supply by means of pump at the following places, N.E. corner of Guay Ave. and Rue des Meurons, S.E. corner of Rue Youville and Guary Ave., N.W. of Princess Ave. and Egerton road.

CONTRACTS AWARDED

Berlin, Ont.
Pavements, cost $51,628, for city council. Clerk, A. H. Miller. Engineer, Herbert Johnston. General contractors, Warren Bituminous Paving Co. of Ont., Limited, 103 Bay St., Toronto.

Bowmanville, Ont.
Sewage disposal works, for town council. Mayor, S. C. Hillier. Clerk, John Lyle. Engineers, Chipman & Power, Mail Bldg., Toronto. General contractor, John F. Connolly, 606 Avenue road, Toronto, Ont.

Montreal, Que.
Electric lighting, waterworks and sewerage planned by Town Council of Point Claire. General contractors, Laurin & Leitch, 5 Beaver Hall Sq. Steel pipe, Drummond, McCall & Co., 28 Victoria Square.

Malden Twp., Ont.
Tile drains and bridge, cost $4,000, planned. As a result of no tenders being received the council has instructed Councillor Pillon of Maden Centre to do the work by day labor.

Wingham, Ont.
Storm sewers, for town council. Mayor, Mr. VanStone. General contractors, T. J. McLean & Co. General contractors also awarded contract for cast-iron sewer on Catherine St.

Railroads, Bridges and Wharves

Addington, Ont.
C. P. Rly. Co. has been authorized to construct bridge No. 65.4 near Addington Station, Havelock Sub-Div., Ontario Division.

Calgary, Alta.
Canadian Pacific Railway Company has been authorized to construct spur for the Cockshutt Plow Co., Ltd. To be completed by Sept. 30, 1913.

Dundas, Ont.
Switches, etc., planned for Hamilton & Dundas, and Toronto, Hamilton & Buffalo Railways. Further information from George Waller, Hamilton and Dundas Railway Company, Hamilton.

Railroad construction, cost $50,000, planned by G. T. R. New freight and passenger yards, freight sheds, passenger station in West Flamboro Twp.

Galt, Ont.
G. T. Rly. Co. has been authorized to construct siding into premises of Galt Stove & Furnace Co., Ltd. To be constructed by Sept. 19th, 1913.

Huron County, Ont.
Four bridges planned by County Council. Clerk, William Lane, Waterloo St., Goderich, Ont. (a) bridge on line between Howick and Wallace Twps; (b) bridge on line between Turnberry & Culross Twps; (c) rebuilding bridge between Stephen and Bosanquet Twps; (d) "Corbett" bridge on line between Stephen & McGillivray, jointly with Middlesex Co. 20-ft. span.

Hamilton, Ont.
C. P. Rly. Co. has been authorized to construct bridge No. 1.1 on Hamilton Sub-Div., Ontario Division.

Normanby Twp., Ont.
Steel bridge, cost $16,000. Reeve, Mearns, Hanover, Ont. Plans in progress.

Osborne Twp., Ont.
Twp. council, Clerk, F. Morley. Whalen, Ont., contemplate repairs to bridges.

Oshawa, Ont.
Tunnel planned by Town Council and C. P. R., 30 ft. x 14 ft. 6 in., overhead bridge over C. P. R. Clerk, Thos. Morris. Town Engineer, Frank Chappell. Work done by owners.

Ottawa, Ont.
Steel pontoon gate lifter, for Dom. Govt. Dept. of Railways and Canals. Tenders received by Sec., L. K. Jones, Ottawa, until 16 o'clock July 29th. Gate lifter for Trent Canal. Plans, etc., at office of Chief Engineer Dept. Railways and Canals, and at office of Supt. Engineer Trent Canal, Peterboro, Ont.

Province of Quebec.
Bridge, cost $4,500, over Petite Riviere, for Municipal Council of L'Ange Gardien. Plans, etc., at office of Sec.-Treas., W. Chartrand. One span 40' x 17, concrete, steel and 4-in. red pine. Mayor, Octave Demers.

Bridge, cost $2,800, over Chicot Rover, planned by Municipal Council of Berthier. Plans, etc., at office of Sec.-treas., Theo Gervais. One span, 75 x 17, concrete, steel and 4-in. red pine. Mayor, Michel Desy.

"Morin" bridge, cost $4,900, over St. Peter Creek, for Municipal Council of St. Paul Joliette. Mayor, Jean M. Forest. Plans, etc., at office of Sec.-treas., Jos. Vennes. One span, 50 x 17, concrete, steel and 4-in. red pine.

Bridge, cost $2,000, over Mill River, for Municipal Council of St. Francois. Mayor, Ed. M. Roberge. Secretary-treasurer, F. X. Lepage. One span, 15 x 16, concrete, 5 12-in. I-beams, 40 lbs. 19-in. long 4-in. red pine. Plans drawn.

Bridge, cost $6,150, over Eusibe River, Demeules Twp., for Municipal Council of St. Felicien. Mayor, Flavien Coulombe. Plans, etc., at office of Sec.-Treas., Neree

Perron. One span, 50 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $4,700, over Coulie River, planned for Municipality of St. Jean Baptiste de Nicolet. Plans, etc., at office of Sec.-Treas. One span, 30 x 16, concrete, 5 18-in. I beams, 55 lbs., 34 ft. long, 4-in. red pine.

Bridge, cost $6,760, for Municipal Council of Twp. Shipton. Sec.-Treas., C. C. Brown. Engineer, L. A. Vallee, 80 St. Cyrille St., Que. One span, 166 x 17, concrete, steel and 4 in. red pine. Bridge over Little River Nicolet, at Nicolet's Falls.

Bridge, cost $2,900, over S. Branch of Yamaska River, for Township of Brome. Plans, etc., at office of Sec.-Treas., Geo. F. Hall. One span, 30 x 17, concrete, 5 18-in. I beams, 55 lbs., 34 ft. long, 4 in. red pine.

Bridge, cost $3,500, over River Veillette, for Municipal Council of Ste. Genevieve de Batiscan. Mayor, E. St. Arnaud. Plans, etc., at office of Sec.-Treas., W. T. Trudel. One span, 30 x 16, concrete, 5 18-in. I beams, 55 lbs., 34 ft. long, 4 in. red pine.

Sunnidale Twp., Ont.
Twp. Council plan culverts on the 9th, 10th and 11th concessions.

Valleyfield, Que.
Concrete wall, Beauharnois Canal, for Dom. Govt. Dept. of Railways and Canals. Tenders received by Sec., L. K. Jones, Ottawa, until 16 o'clock, July 18th. Plans, etc., at office of the Dept. of Railways and Canals, Ottawa, and at office of Supt. Engineer, Quebec Canals, Montreal, Que.

CONTRACTS AWARDED

Acton, Ont.
Bridge, for county council. General contractor, K. Cooper. 18-in. span cement arch bridge.

Ft. William, Ont.
Freight shed, cost $7,000, for Imperial Oil Co. Builder and general contractor, S. J. McQueen.

Montreal, Que.
Widening aqueduct, for Board of Commissioners. Sec., L. N. Senecal. General contractors, Cook Construction Co., Sudbury, Ont. Engineer, Geo. Janin, City Hall.

Ottawa, Ont.
Booster Bldg., cost $6,000, Centre, for Ottawa Electric Railway, Albert street. Architect, J. Albert Ewart, 193 Sparks street. General contractor, Geo. Crain, 285 Clemow. Solid brick construction, cement foundation.

Sandwich West, Ont.
Three bridges. Reeve, Reni Laframboise. Engineer in charge, M. N. Drouillard. General contractor, Wilfrid Renaud.

Public Buildings, Churches Schools, etc.

Brantford, Ont.
Dormitory building, for Prov. Govt. Dept. of Public Works. Tenders received by Sec., H. F. McNaughton, Parliament Bldgs., Toronto, until July 15th, for all trades except heating, plumbing and electrical wiring. Plans at office of Ontario Institution for Blind.

Calgary, Alta.
Locker room, cost $16,000, for County Club. Architects, Lawson & Fordyce, Norman Block. Plans ready.

Edmonton, Alta.
City market building, cost $110,960, 1st Street, for City Council. Architect, A. Jeffers. Market Supt., Mr. Robertson. One storey and basement, 32 x 100, brick and hollow construction, 2 refrigerators, projecting roof.

Guelph, Ont.
Poultry building, for Prov. Govt. Dept. of Public Works. Tenders received by Sec., H. F. McNaughton, Parliament Bldgs., Toronto, until July 15th, for all trades except heating, plumbing and electric wiring. Plans at office of O. A. C., Guelph.

Haileybury, Ont.
Court house and registry office, for Prov. Govt. Dept. of Public Works. Tenders received by Sec., H. F. McNaughton, Parliament Bldg., Toronto, until July 15th, for all trades except heating, plumbing and electric wiring. Plans at office of Sheriff.

Hamilton, Ont.
Labor temple, cost $30,000, for Trades of Labor Council. Sec., Walter Rolls. Plans under consideration.

Addition to school, cost $5,000, for Separate School Board, c/o Father Maloney, St. Mary's Presbytery. Architect, J. D. Corrigan, Catharine, N. Brick addition, general alterations.

Montreal, Que.
Diamond Hall, cost $10,000, Pt. St. Charles (Fortune ave. near Wellington), for Orangemen's Lodge. Architect, M. Campbell, C.E., P. O. Box 385. Foundation work, Dube & Marot, c/o architect. Three storeys, 23 x 75. Excavating started.

Kindergarten school, cost $50,000, Eleanor and Ottawa, for R. C. School Commissioners, 86 St. Catherine W. Plans in progress.

Oak Bay, B.C.
School, Willow District. Board have instructed Architect, P. L. James, to call for tenders for erecting a temporary school and shed.

Saskatoon, Sask.
Loft building, cost $250,000, for Dr. G. E. Holmes, 323 6th Avenue N. Architect, F. J. O'Leary, Willoughby Sumner Block. Six storeys and basement, reinforced concrete and brick construction, marble stairway, fireproof throughout. To be used for manufacturing purposes. Tenders will be called about July 14th to 20th.

Tillsonburg, Ont.
Carnegie library, for town council. Chairman of building committee, Al. Hogarth. Plans in progress.

Toronto, Ont.
School repairs. Tenders received by Secretary, W. C. Wilkinson, Board of Education, until July 11th. Full information from Supt. of Buildings.

School and offices, planned by Board of Education. Sec., W. C. Wilkinson. The Property and Advisory Committee have decided to recommend to the Finance Committee that an Administrative Bldg. and a combined public and open-air school be erected on the College-Orde street site.

Tenders received by Secretary, W. C. Wilkinson, Board of Education, until July 11th for steam boilers, also Fountain Taps, for Dufferin school.

Messrs. Stevens & Lee, College street, are preparing plans for the erection of the new Wingham Hospital, at Wingham, Ont.

Weigh scales, for Board of Control. Tenders received by Mayor, H. C. Hocken, City Hall, until July 15th, for weigh scales at St. Lawrence Market.

CONTRACTS AWARDED

Banff, Alta.
Bath house, cost $75,000. Dom. Govt. Dept. of the Interior. Sec., Lyndewade Pereira, Ottawa, Ont. Architects, Painter & Swales, 553 Granville St., B. C. General contractor, R. Brocklebank, Bell Block, Calgary.

Belleville, Ont.
Dormitory building, for Prov. Govt., Dept. of Public Works. Tenders received by Secretary, H. F. McNaughton, Parliament Bldgs., Toronto, until July 15th, for all trades except heating, plumbing and electric wiring. Plans at office of Ontario Institution for Deaf and Dumb.

Calgary, Alta.
Ranchman's club, 13th Ave. and 6th St. W., for Ranchman's Club. Architect, R. E. McDonnell, 11 Edge Block. Concrete work, Foster Cartage Co., 523 14th Ave. west.

Edmonton, Alta.
Plumbing for school, for Public School Board. Sec., M. Brady. Plumbing, Edmonton Metal Works, at $38,590.

Ft. William, Ont.
Addition to club house, cost $30,000, George street, for Kamistikwia Club. Architect, Carl Wirth. General contractors, Marsh & Powers.

Guelph, Ont.
Dining hall, cost $60,000, for Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Parliament Bldgs, Toronto. General contractors, P. H. Secord & Son, 137 Nelson street, Brantford. Dining hall in connection with Agricultural College.

Hamilton, Ont.
Alterations to church, cost $13,000, James street south, for James St. Baptist Church. Pastor, Rev. J. J. Ross, 85 Queen south. Architect, H. H. New, Spectator Bldg. Carpenter, Stewart Bros., Hyde Park Ave.

Addition to church, for St. Ann's R. C. Corporation. General contractor, T. J. Drake, 49 Earl street.

Macleod, Alta.
Addition to school, cost $15,000. Sec,-Treas., E. F. Brown. Architect, Mr. Whiddington, Lethbridge. General contractor, J. S. Lambert. Two storeys, 53 x 34, stone foundation, brick construction.

Montreal, Que.
School, cost $137,000, for Commissioners Scolaire St. Madelein d'Outremont. Architects, Viau & Venne, 76 St. Gabriel; General contractors, carpentry, iron and steel and painting, E. N. & M. Boileau, 374 Garnier. Roofing, heating,

plumbing and electrical work, G. Champagne & Bros., 78a Inspector.

School alterations, 696 St. Urbain, for Parish of Notre Dame Sisters, 696 St. Urbain. Mason and carpenter, M. St. Onge, 696 St. Urbain. Alterations to window frames and stone work.

Orillia, Ont.
Public building, cost $40,000, for Dom. Govt. Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractors, Simcoe Construction Co., Simcoe, Ont.

Ottawa, Ont.
The Department of Public Works, Ottawa, have awarded the general contract for alterations to Rideau Hall to Messrs. Peter Lyall Co.

Elevator, cost $8,250, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. General contractor, A. G. Marshall, 5 O'Conner St. New elevator for west block.

Saskatoon, Sask.
Exhibition building, cost $150,000, Fair grounds. Architects, Thompson, Daniel & Colthurst, Central Chambers. General contractors, Smith Bros. & Wilson, for 2 wings, costing $28,000, brick, tile and mill construction.

Scarboro, Ont.
School, cost $7,000, for Trustee Board. Architects, Munro & Mead, Chancery Chambers, Hamilton. General contractor, George Sainsbury, Weston, Ont.

Toronto, Ont.
Alterations to building for club quarters, cost $20,000, 19 Wellington west, for American Club. Sec., P. A. Fitzpatrick, 119 Wellington west. Architect, J. F. Wegman, c/o Darling & Pearson, 2 Leader Lane. General contractors for alterations, Standard Structural Company, Manning Chambers.

Walkerton, Ont.
Public library, cost $10,000, Durham. Builders and general contractors, R. E. Truax & Son. Mason, Obright Bros. Foundations started.

Winnipeg, Man.
Lockers, cost $4,736, for Public School Board, William and Ellen streets. Sec.-Treas., R. H. Smith. General contractor, W. T. Grose, 905 Elec. Rly. Chambers. For 320 double lockers for Kelvin and St. John High Schools.

School, Clifton street, for Board of Education. Architect, J. B. Mitchell, Commissioner of School Bldgs., William and Ellen street south. General contractors, Sutherland Construction Co., 512 Builders' Exchange. 30 rooms, brick construction.

Beef cattle barns, St. Vital, for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin H. Campbell. Architect, V. W Horwood, 261 Fort street, Winnipeg. General contractors, Cota & Bencit, St. Boniface. To be erected in connection with the Manitoba Agricultural College.

Westboro, Ont.
Church, cost $11,000, for Presbyterian Congregation. Pastor, Rev. W. H. Cram. Architect, J. P. MacLaren, 104 Sparks street, Ottawa. Mason, H. H. Cowan, 16 Armstrong, Ottawa. Carpenter, Low & Raitt, 148 Percy, Ottawa. Painting, P. Stewart, Bank, Ottawa. Electrical, Marchand & Donnelly, Sparks, Ottawa. Plasterer, Bowman & Son, Ottawa. Heating and plumbing not let yet.

Business Buildings and Industial Plants

Coquitlam, B.C.
Hotel, cost $60,000, for Coquitlam Terminal Co., 533 Granville St., Vancouver. Architects, Parr, MacKenzie & Day, Vancouver Block, Vancouver. Two storeys, brick veneer construction.

Edmonton, Alta.
Stables, 1st St., for city council. Architect, A. Jeffers. 38 in. wide and long enough to house 100 teams, brick construction. To be erected in connection with new market building.

Hamilton, Ont.
Store apartments and mill, cost $12,000, Barton E., for Dunlop-Magee Co., 125 John St. S. Architects, F. Jas. Rastrick & Son, 30 King E. Mason, R. Isbister, 125 Wellington S. Three storeys, 28 x 70.

Store, cost $4,500, Prospect street and Maple ave., for W. H. Hunter, c/o architect, L. A. Wardell, 110 Hunter St. W. Plans drawn.

Montreal, Que.
Store, cost $9,000, Mt. Royal, for O. Gratton, 323 Stuart, Outremont. Architects, Gauthier & Daoust, 180 St. James. Masonry, Paul Asconi, c/o owner. Iron, Phoenix Bridge Co., 83 Colborne. Owner will call tenders for plumbing, heating, electrical work, painting, etc., as work progresses. Three storeys and basement, 24 x 100, concrete foundation, brick construction.

Two stores and flats, cost $10,000, Notre Dame W., for L. Cohen & Son, 36 Prince street. Architect and builder, C. W. Strang, 76 Plymouth Grove. Steel, Dom. Bridge Co., Lachine. Plumbing, E. B. Rae, 1074 St. James. Builder will receive tenders for roofing, electric, galvanized iron and plastering.

Factory, contemplated, for Union Switch & Signal Co., 611 Canadian Express Bldg. Plans will be prepared.

Storehouse, 529 Ontario E., of Baillargeon Express Co., 329 Ontario E., destroyed by fire. Loss, $10,000.

The Forrester Co., 33 Notre Dame W., Montreal, contemplate building a factory.

Nelson, B.C.
Jno. Blemberg contemplates replacing the present frame hotel by a modern 4-storey structure.

Regina, Sask.
Straw board mill planned for the Flax Products Co., who will manufacture building paper, wall board, chip board and straw board.

Sudbury, Ont.
Bowling alley and pool room, cost $4,500, for D. Moren. Architects, Angus & Angus, North Bay. One storey and basement, 23 x 80, brick construction, cement foundation. Plans in progress.

Toronto, Ont.
Store and residence, cost $6,000, High Park, for J. M. Cowan, 65 Adelaide E. Two storeys, 26 x 38, structural steel and brick construction, stone foundation. Plans drawn.

Vancouver, B.C.
Hotel, Pender and Main. Architects, Parr, MacKenzie & Day, Vancouver Block. Architects will receive both general contract and separate tenders. Owner, name withheld.

West Lorne, Ont.
Creamery contemplated by John Skinner & Son. Equipment required. Plans will be prepared.

Windsor, Ont.
G. Adams contemplates erecting theatre and stores to cost $12,000 on Wyandotte.

E. Lyens requires complete interior equipment for new gents' furnishing store. Architects, Leybourne & Whitney.

Winnipeg, Man.
Bank, cost $25,000, Main street and Bannerman, for The Merchants Bank of Canada. Architect, Jno. D. Atchison, Trust & Loan Bldg., Portage Ave. General contractors, G. A. Fuller & Co., 1001 Union Bank Bldg. Steel, Manitoba Bridge & Iron Works, Logan Ave. W. Roofing, A. B. Ormsby Ltd., 677 Notre Dame. Electrical, Shipman Elec. Co., Ltd., 396 Portage Ave. Two storeys, 31 x 64, pressed brick and terra cotta construction.

CONTRACTS AWARDED

Amherst, N.S.
Drug store, Victoria, for Douglas Bros. Architect, J. L. Allen. General contractor, J. N. Fage. Three storeys, concrete and spruce floors.

Brantford, Ont.
Warehouse, cost $5,000, Elgin. Builder and owners, Ham & Nott Co., Ltd. One storey, 73 x 210, corrugated and structural iron construction.

Calgary, Alta
Motion picture theatre, 1st St. W., for Dr. Lindsay, c/o Architects. Architects, Hubbell Kelly Co., Centre street. General contractors, Fyshe, McNeill, Martin & Trainer, Loughead Bldg. Two stys., 50 x 100, fireproof construction throughout.

Edmonton, Alta.
Store, cost $4,000, 1st Ave. S.W., for S. Swarty, 136 1st Ave., N.W., South Edmonton. Architect and general contractor is owner. One storey, 30 x 40, concrete foundation, brick construction.

Fort William, Ont.
Starch works, cost $750,000, Island 2, for Ft. William Starch Co. Architects and general contractors, Canadian Stewart Co., Ft. William. Reinforced concrete, mill, iron and Soho brick construction. Foundations in.

Warehouse, cost $5,000, for D. W. Dwyer Ltd., Ottawa and Fort William. Builder, D. A. Gordon. One storey, frame and galvanized iron construction.

Drying plant, cost $8,000, Pacific, for N. M. Patterson & Co., Graham and Horne Block. General contractors, owners, day labor. Crib iron clad construction, cement foundation.

Hamilton, Ont.
Addition to building, cost $8,000, for Pure Milk Corporation, John Street N.

General contractor, George F. Webb, 136 Stinson street. Permit granted.

Alterations to hotel, cost $12,000, King street, for Staunton Bros., Revere House, King street east. Architect, A. W. Peene, King street west. Mason, Isbister Bros., 195 Wellington street south. Carpenter, J. F. Mercer, 125 Hunter St. S. Roofing, Dennis & Jocelyn, 13 Walnut street south. Painting, F. W. Kirk, 205 Carlton ave. west. Plastering, J. Clapham & Son, 69 Hughson St. N. Furniture required.

Addition and alterations to store, cost $15,000, for Dominion House Furnishing Co., 118 James N. Architect, W. A. Edwards, 2 Hughson St. S. General contractor, Geo. E. Mills, 614 King E. Stone foundation, brick construction, store front.

Addition to factory, cost $5,000, Barton E., for Malcolm Souter Furniture Company, Barton E. Architects, Stewart & Witton, H. P. & L. Bldg. General contractors, Mitchell & Riddell, 91 Peter St. Carpenter, Jno. Vogan, 280 Sanford Avenue N.

Addition and alterations to restaurant, cost $3,000, King St., for H. L. Bowles, 149 Yonge St., Toronto. General contractor, Samuel Howard, Mary St. White enamel bricks, tile floors, store front, billiard room, brick bakery in rear.

London, Ont.

Bake shop, cost $40,000, for D. S. Perrin Co. Manager, T. McFarlane. Architect, J. M. Moore, 435½ Richmond St. General contractor, J. Putherbough, 1002 Wellington. Five storeys, white brick construction, stone and cement foundation.

Montreal, Que.

Stores and flats, cost $10,000, St. Viateur and Esplanade, for S. Rosenveesen, 182 Peel street. Designer, C. Dupont, c/o owner. General contractor, M. Fromson, 68 Colonial ave. Foundations in.

Auto factory, cost $12,000, Maisonneuve, for Messrs. Pontbriand & Fils, Sorel, Que. General contractor, Mr. Wm. Boivin, Montreal. Two storeys, 100 x 60, steel and elastic brick construction.

Garage, cost $20,000, 789 Berri, for Lavoie & Lavoie, 789 Berri street. Builder, Cyclops Construction Co., 96 Notre Dame St. W. Four storeys, 51 x 67, cement foundation, brick construction.

Store alterations, cost $30,000, 483 St. Catherine W., for Fairweathers Limited, 487 St. Catherine W. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, M. F. Fromson, 68 Colonial ave. Four storeys, 30 x 85. Changing all interior and store front.

Warehouse, cost $5,000, Latour, for Geo. W. Reed & Co., Ltd., 37 St. Antoine. Owner doing all work. Three storeys, 46 x 46, concrete foundation, brick and mill construction.

Offices, alterations, St. Catherine and Parthenais, for Canada Linseed Oil Co., Ltd., 1224 Notre Dame E. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, E. Meloche, 304 Eighth Ave., Rosemount. Three storeys, 45 x 100, stone, brick and structural steel construction.

Garage and store, 668 St. Catherine W. for Stockwell Motor Co., St. Catherine and Crescent. Architect, J. A. Godin, 269 St. Denis. General contractors, Mount Royal Construction Co., St. Denis. Brick and masonry, John Dominique, 360 St. Antoine.

Store and flat, cost $4,500, Dandurand, Owner and builder, Arthur Clermont, 516 8th Ave., Rosemont. Two storeys, 25 x 40, cement foundation, brick construction. Excavating started.

Ottawa, Ont.

Warehouse, cost $63,000, York, for S. J. Major & Co., York street. Architect, C. P. Meredith, 126 Sparks street. Painting, J. Duford, Rideau street. Heating, plumbing and electrical not awarded yet. Plastering, Frank Hunt, 115 Arlington.

Stores and offices, cost $600,000, Sparks for Blackburn Estate, Sparks street. Architect, W. E. Noffke, Central Chambers. General contractors, Blackburn Bros., Sparks street. Ten storeys, store fronts and fixtures, bank and office fixtures, grill work, vaults, safes, vacuum cleaners, fire escapes, ventilating and annunciator systems.

Garage and alterations to residence, cost $10,000, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks street. Mason, F. McCullough, 181 Waller. Carpentry, Taylor & Lackey, 21 First ave. Solid brick construction.

Business building, cost $190,000, Queen, for Ottawa Evening Journal, Elgin St. Architect, A. L. Weeks, 75 Sparks St. General contractors, Shuttleworth & Black, Queen street.

Port Arthur, Ont.

Stores and offices, cost $425,000, for Jas. Whalen & Co., Port Arthur. Architects, Brown & Vallance, 32 Canada Life Bldg., Montreal. General contractors, Canadian Stewart Co., head office, Montreal. Seven storeys, 100 x 90, reinforced concrete, tile and pressed brick construction. Two passenger elevators, plate, prismatic and art glass, vaults, vacuum cleaners, fire escapes and extinguishers, ventilating system, boilers.

Quebec, Que.

Repairs to shoe factory, cost $7,500, 591 St. Valir, for Ludger Duchaine, 591 St. Valier street, Que. Architect and general contractor, Magloire Cauchon, Dorchester. Three storeys, 75 x 125, stone foundation, structural steel and brick construction.

St. John, N.B.

Warehouse and office, Prince Wm., for McClary Mfg. Co. Manager, G. S. Bishop, Chipman Hill. General contractor, owner.

Toronto, Ont.

Factory, Collier street, for S. G. Thompson (in trust) 793 Yonge street. Architect, H. G. Salisbury, 12 Adelaide E. General contractor, R. G. Kirby, 539 Yonge street. Three storeys, 50 x 65.

Theatre, cost $6,000, Dundas and Gilmour. Builder and owner, A. Rappaport, 2165 Dundas street. Architect, T. A. Fleming, 94 Laws street. Carpentry day labor. Heating, electric wiring, plumbing not yet awarded. Theatre to be opened Sept. 1st. 600 seats required. Owner wants prices.

Bank, cost $10,000, 442 Yonge St., for Royal Bank of Canada, Yonge St. Architect, F. S. Baker, Royal Bank Bldg. Masonry, Jas. Wickett, Ltd., 28 Toronto street. Carpentry, Walker & Roberts. Steel, Dominion Bridge Co., Imperial Life Bldg. Painting, J. McCausland & Son, 11 Nelson street.

Alterations to offices, cost $13,000, Bay and King, for Mail Printing Co., King and Bay. Architect, G. M. West, 78 Homewood. Carpentry, Geo. Henry & Son, 153 Rusholme Road. Painting, A. E. Phillips, 46 Richmond E. Heating & plumbing, Fiddes & Hogarth, King E. Plastering, Taylor & Nesbitt, 18 Havelock. Two storeys, structural steel, reinforced concrete and brick construction.

Addition to warehouse, King W., for Warwick Bros. & Rutter, 401 King W. Architects, Steele & Sons, Stair Bldg. General contractors, Harris & Harris, Confederation Life Bldg. Four storeys, 100 x 50, structural steel and brick construction.

Windsor, Ont.

Bank, remodelling, cost $15,000, Ouellette, for Royal Bank of Canada. Manager local branch, Geo. Mair. Architect, Kenneth G. Rea, 54a Beaver Hall Hill, Montreal, Que. General contractor, J. R. Sulland, Windsor and Sault St. Marie. Terrazzo floors and marble border, hot water heating, plumbing, plate glass, bank and office fixtures, grille work, two vaults.

Winnipeg, Man.

Stores, cost $8,000, Notre Dame, for A. E. Ewart, 208 Bank of Nova Scotia. Architects, Jordon & Over, 47 Canada Life Bldg. General contractors, Sutherland Construction Co., 211 Carlton Bldg. One storey, 60 x 50, brick construction and foundation. Excavating started.

Bank building, cost $35,000, Transcona (Regent & Vaughan), Bank of Commerce, Winnipeg. General contractors, Dominion Realty Co., Transcona. Two storeys, 35 x 47, brick, cement foundation.

Remodelling hotel, cost $10,000, Garry, for A. E. Hanna, 287 Garry street. Remodelling part of interior into an up-to-date cafe.

Addition to bank building, Main, for The Merchants Bank of Canada. Architects, Jno. D. Atcheson & Co., Trust & Loan Bldg. General contractors, Geo. A. Fuller Co., Ltd., 1001 Union Bank Bldg. Steel, Dominion Bridge Co., Canada Bldg. Tile floors, Dom. Fireproofing Co., 525 Union Bldg. Plumbing, Edmonton Metal Works, at $38,537.

Horse barns, St. Vital, for Provincial Government, Dept. of Public Works. Minister, Hon. Colin H. Campbell. Architect, V. W. Horwood, 261 Fort St., Winnipeg. General contractors, Carter-Halls, Aldinger Co., 1010 Union Bank Bldg., Winnipeg. To be erected in connection with the Manitoba Agricultural College.

Store and residence, cost $3,800, Redwood ave. Architect and builder, owner. One storey, 31 x 52, stone foundation, frame construction.

Residences

Calgary, Alta.

Two residences, cost $6,000, Roxborough Place, for Adanac Building Company. Architects, Burrows & Richards, Crown Block. Two storeys, 30 x 30, brick foundation, frame construction.

Residence, cost $6,000, 15th ave. W., for I. K. Kerr, 12th ave. west. Architects, Swanstrom Co., 323 Travis Block. One storey, 30 x 56, cement foundation, frame construction.

Hamilton, Ont.
Residence, cost $7,000, 369 Queen St. S., for Mrs. A. M. Adams, c/o architects, Stewart & Witton, 7 Hughson St. S. Brick construction. Plans drawn.

London, Ont.
Residence, cost $7,000, Oxford, for W. W. Gammage, 759 Maitland street. Architect, A. E. Nutter, Dom. Bank Bldg. Two storeys, white and pressed brick construction. Plans ready.

Mount Hamilton, Ont.
Residence, cost $10,000, for Adam Inch. Plans drawn.

Montreal, Que.
Residence, cost $16,000, Outremont (Hutchison near Van Horne), for H. Blais, 6526 Frimeau, Ahunstic. Three storeys, 50 x 77, stone construction.

Montreal West, Que.
Residence, cost $8,000, Wolseley, for C. S. Jones, Strathearn Ave., Montreal W. Owner will call private tenders for heating, plumbing and roofing. Two storeys and basement, 25 x 35, cement foundation, encased brick construction.

Moose Jaw, Sask.
Residence, cost $6,000, Alberta ave., for Arthur A. Frost, c/o architects, Reid & McAlpine, Howden Block. Two stys, 37 x 38, cement foundation, brick veneer construction.

Residence, cost $4,000, for Geo. Gledhill, c/o architect, T. Carmichael, Russell Block. Two storeys, 22 x 26, concrete foundation, frame construction.

Ottawa, Ont.
Residence, cost $7,000, First ave., for J. A. Grieson, 209 Centre street. 2½ stys., 35 x 35, brick construction, stone foundation. Plans in progress.

Residence, cost $5,000, Mutchmore, for Geo. H. Lett, 19 Ella. 2½ storeys, 19 x 35, brick veneer construction. Plans being prepared.

Sandwich, Ont.
Rectory for Central Methodist Church. Pastor, Rev. F. W. Hollinrake. Chairman of Commission, O. E. Fleming. Plans under way.

Toronto, Ont.
Four residences, cost $16,000, Gothic ave., for S. B. Read, Weston, Ont. Architect, P. H. Finney, 79 Adelaide St. E. 2½ storeys, brick construction and foundation. Plans in progress.

Residence, cost $6,300, Belsiz, for Mrs. F. S. Hodge, c/o architect, Allan George, 67 Victoria. Contracts not yet awarded. 2½ storeys, 24 x 38, brick construction and foundation. Tenders in.

Two detached residences, cost $7,000, Westmount, for R. L. McAffee, 338 Sunnyside. Architect, J. H. Stanford, Bloor and Ossington. 2 ½storeys, 20 x 42 and 20 x 38, brick construction. Plans ready.

One detached residence, cost $6,000, for J. A. Slade, 179 Bathurst street. Architect, L. Foulds, King and Leader Lane. 2½ storeys, 22 x 38, brick construction. Plans ready.

Three attached residences, cost $7,000, Givens, for F. Hunnisett, 214 Crawford street. Architect, J. B. Matson, 63 Argyle street. 2½ storeys, 47 x 42, brick construction. Plans ready.

Two detached residences, cost $8,000, Rosemount, for Fleischauer & Kappes, 93 Yonge street. Owners superintend all work. 2½ storeys, 22 x 36, brick construction.

Vancouver, B.C.
Apartments, English Bay, for Hampton & Edgar, 532 Granville. Eight stys., 132 x 90, reinforced concrete construction. Dennison block tile. Plans prepared.

Walkerville, Ont.
Residence, cost $8,000, Devonshire, for F. C. Thrall, c/o Wilt Twist Drill Co., Walkerville. Tenders received by architect, R. H. Marr, 1529 Ford Building, Detroit, Mich. Two storeys, 30 x 36, stucco, tile and structural steel construction.

CONTRACTS AWARDED

Calgary, Alta.
Two residences, cost $7,000, Missim, for P. Bersymann, Rohl Block. Architects, Alberta Investment & Insurance Co., 514 Burns Block. General contractors, owner. 19 x 38, cement foundation, frame construction.

Edmonton, Alta.
Residence, cost $12,000, Athabasca ave., for W. D. Ferris, 768 23rd street. Architect and general contractor, J. R. Ferris, 43 Jasper ave. east. Two storeys, 40 x 48, concrete foundation, frame construction.

Fort William, Ont.
Apartment block, cost $25,000, Brodie N., for Chas. G. Jenkins, 711 Victoria ave. Architect, R. E. Mason. Mason, D. Kendal. Three storeys, 50 x 55, pressed and common brick construction.

Apartment block, Brodie N., for Chas. G. Jenkins. Architect, R. E. Mason. General contractor, Chas. E. Ward. Three storeys.

Hamilton, Ont.
Two residences, cost $20,000, King St. E., for L. W. Ruduck, 37 Oxford street. General contractors, W. J. Workman & Sons, Bank of Hamilton Bldg. Brick construction.

London, Ont.
Residence, cost $6,000, Waterloo, for N. H. Keene, 186 Oxford street. General contractor, Jno. Nutkins, 721 Elias street. Two storeys, white brick and stucco construction, stone and cement foundation.

Two residences, cost $8,000, Richmond. Builder and owner, G. W. Kennedy, 326 St. George street. Two storeys, white brick construction.

Medicine Hat, Alta.
Twenty-five residences, for E. D. Bennett, Toronto street. Architect and general contractor, A. Dickinson, Hull Blk. is erecting 25 residences at Crescent Heights.

A. Dickinson, Hull Block, is erecting ten residences.

Montreal, Que.
Residence, cost $6,000, Oxford ave. Builder and owner, Henry Gaffney, Rm. 23, 204 St. James. Two storeys, 44 x 36, cement foundation, brick construction.

One pair residences, cost $18,000, Westmount (Roslyn ave.). Owner and builder, J. H. Hand, 609 Belmont ave. Two storeys and basement, 50 x 65, cement foundation, brick construction. Excavating started.

Residence, cost $6,000, Westmount (Western), for Dr. A. Munro, 61 Drummond St. Architect, D. J. Spence, 46 Beaver Hall Hill. General contractor, R. Manson, 381 Victoria. Two storeys and basement, 21 x 60, cement foundation, cut stone and brick construction.

Residence, cost $25,000, Westmount (Aberdeen ave.), for R. C. Patton, 421 Mackay. Architects, Cox & Amos, E. T. Bank, St. Catherine W. General contractor, D. M. Long, 39 Windsor. 2½ storeys and basement, 33 x 64, stone foundation, pressed brick construction.

Two flats, cost $8,000, King Edward ave. Builder and owner, Chas. M. Ward, 2168 Waverly. Architect, J. McDonald Aiken, 772 St. Urbain. Two storeys, 65 x 48, concrete foundation, brick construction.

Three flats, cost $7,500, 2nd ave., Rosemont, for Joseph Capistian, 2634 Drolet. Architect and builder, owner. Three storeys, 50 x 40, brick construction.

Flats, cost $10,000, Outremont (near 850 Durocher). Builder and owner, Lacasse Deslauriers & Bourgeois, 2224 St. Louis or 167 Cartier. Three storeys, 25 x 74, cement foundation, brick construction.

Residence, cost $15,000, Outremont (Durocher near Van Horne). Builder and owner, O. Briere, c/o P. P. Daunas, 1927 St. Urbain. Three storeys, 50 x 73, stone foundation, brick construction.

Residence, cost $15,000, Outremont (Ainslie), for A. S. Lavallee, 101 St. Lawrence Blvd. Architect, Chas. Bernier, 70 St. James street. Mason, J. Latreille, care owner. Roofing, heating & plumbing, T. Latourelle, 6 Craig St. W. Electrical and painting not let. Carpenter, P. Brouillet, 79½ Elizabeth.

Residence, cost $21,000, Westmount, (Sydenham), for E. E. Belcourt, 4371 Montrose ave. Architect, R. E. Bostrom, McGill Bldg., Montreal. General contractor, A. K. Hutchison, 4404 St. Catherine, is looking after the whole job. Two storeys and basement, 25 x 60, brick construction.

Residence, cost $20,000, Westmount (Redfern ave.), for Mr. Jas. Laurin, of Laurin & Leitch, 5 Beaver Hall Sq. Architect and builder, owner. 2½ storeys and basement, 33 x 80, cement foundation, brick construction. Excavating done.

Montreal West, Que.
Residence, cost $5,500, for W. T. S. Burnes, Builder and general contractor, L. R. Maurice. Two storeys, 25 x 55, cement foundation, brick construction.

Ottawa, Ont.
Residence, cost $7,000, Park, for W. G. Davis, c/o Architect, Albert Blythe, 80 Park ave. General contractor, W. C. Smith, 482 Kent. 2½ storeys, 32 x 36, brick veneer construction, stone foundation.

Residence, cost $6,000, Sweetland. General contractor and owner, Karl Cohen, 232 Somerset. 2½ storeys, 32 x 42, brick construction.

Residence, cost $7,000, Russell, for T.

(Continued on page 75)

Tenders and For Sale Department

CITY OF PRINCE ALBERT,
SASKATCHEWAN

Tenders will be received, addressed to the City Clerk, Prince Albert, Sask., until noon, Wednesday, July 16th, 1913, for the following contracts:

13 D—Laying approximately 22,000 feet of steel water main.

13 E—Laying approximately 25,000 feet of steel water main.

13 F—Laying approximately 26,000 feet of sewers.

13 G—Laying approximately 25,000 feet of sewers.

Plans and specifications are on file at the office of The Canadian Engineer, Union Bank Building, Winnipeg, and at the office of the City Engineer, Prince Albert. Instructions to bidders and form of tender may be had on application to the City Engineer. Plans and specifications not to be sent out.

The lowest or any tender not necessarily accepted.

M. H. BAKER, City Engineer.
N. W. MORTON,
H. E. M. KENSIT,
C. O. DAVIDSON, City Commissioners.
Prince Albert, Sask.,
June 23rd, 1913. 27-28

Department of Railways and Canals, Canada

TRENT CANAL

Steel Pontoon Gate Lifter

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tender for Steel Pontoon Gate Lifter, Trent Canal," will be received at this office until 16 o'clock on **Tuesday, July 29th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque for the sum of $1,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES.
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 25th June, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—44228. 27-28

Sealed tenders addressed to the undersigned and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m., on **Monday, July 21, 1913,** for the construction of a Public Building at Lakefield, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—42451. 27-28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received until 4 p.m., on **Monday, July 21, 1913,** for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signatures, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—42596. 27-28

Tenders Wanted

Tenders for the construction of Cement Abutments for a proposed bridge across Big-Creek, lot 11, Con. 12, in the Township of Burford, will be received by the undersigned up to and including the **14th day of July, 1913.**

Plans and specifications may be seen at the home of Mr. Burtis (Deputy Reeve) Hatchley (on Tilsonburg Branch G. T. R.)

F. W. TAYLOR,
27-28 Township Clerk.

TENDERS
FOR
Concrete Conduit

Sealed proposals will be received at the offices of the Water Commissioner, City Hall, until 12 noon, July 15th, 1913, for the fabrication and laying of about 27½ miles of reinforced concrete pipe and appurtenances on the line of the Sooke Water Supply gravity conduit, and in accordance with the requirements of the general specifications prepared by Wynn Meredith, Consulting Engineer, for such construction, pursuant to the provisions of By-law No. 814, and adopted by the Council.

Plans and specifications can be seen, and forms of tender obtained, at the Sooke Water Supply Office, **1414** Douglas street, Victoria, B.C.

The lowest or any tender not necessarily accepted.

C. H. RUST,
Water Commissioner.
Victoria, B.C., June 14th, 1913. 26-28

To Contractors

Sealed tenders, marked "Tenders for Work," addressed to the undersigned, will be received at this Department until **Tuesday, July 15th,** for all work, excepting heating, plumbing and wiring required in the erection of a Court House and Registry Office at Haileybury; a Court House at Fort Frances; Poultry Building at the Ontario Agricultural College, Guelph; Dormitory Building at the Ontario Institution for the Blind, Brantford, and Dormitory Building at the Ontario Institute for the Deaf and Dumb, Belleville.

Plans and specifications can be seen at this Department and at the above named Institutions, and by applying to the Sheriffs at Haileybury and Fort Frances.

No tender will be considered unless accompanied by an accepted bank cheque, payable to the Honourable J. O. Reaume, Minister of Public Works, for 5 per cent. of the amount of tender, and the bona fide signatures and addresses of two sureties or the name of a Guarantee Company approved by this Department, willing to furnish bonds for the due fulfillment of the contract, must accompany each tender.

The Department is not bound to accept the lowest or any tender.

By order,
H. F. McNAUGHTEN,
Secretary, Public Works Department.
Department of Public Works, Ontario,
Toronto, June 30th, 1913.

Newspapers publishing this advertisement without authority, will not be paid for it. 27-28

Tenders For Bridge

Tenders will be received for the erection of a steel bridge 45 ft. c. to c., 14 ft. roadway, at Lot 26 Town Line Arron and Elderslie. Tenders received up till noon 22nd July, and opened at the site at 3 p.m. A cheque for $100 to accompany each tender. The lowest or any tender not necessarily accepted. Plans may be seen with James Warren, Engineer, at Walkerton, or the undersigned.

Signed, S. K. EUART.

Chesley, July 7th, 1913. 28-29

CITY OF REGINA, SASK.

TENDERS

Sealed tenders will be received by the City Commissioners at Regina, Sask., up until noon of **July 12th** for the supply of: Two vertical shaft, motor driven, centrifugal pumps to operate against 22 foot head, capacity 12,500 gallons per minute each.

Tender to be accompanied by a marked cheque for 5 per cent. (five per cent.) of the amount of tender.

Further particulars may be obtained from E. W. Bull, Superintendent of Light & Power Department, Regina, Sask. 25-28

Department of Railways and Canals, Canada

Beauharnois Canal

Protection Work for Valleyfield Government Dam

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for works for protecting the Government dam at Valleyfield," will be received at this office until 16 o'clock on Friday, **July 18th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, Montreal, Que.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque for the sum of $3,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering decline entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, June 25th, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—44229. 27-28

Notice to Contractors

Sealed proposals will be received at the offices of the Water Commissioner, City Hall, until 12 noon, **July 31st, 1913,** for the fabrication and laying of about 10¼ miles of 36-in. rivetted steel pipe and appurtenances on the line of the Sooke Water Supply pressure conduit, and in accordance with the requirements of the general specifications prepared by Wynn Meredith, Consulting Engineer for such construction, pursuant to the provisions of By-law No. 814.

Plans and specifications can be seen, and forms of tender obtained at the Sooke Water Supply Office, 1414 Douglas Street, Victoria, B.C.

The lowest or any tender not necessarily accepted.

C. H. RUST,
Water Commissioner.

Victoria, B.C.,
June 27th, 1913. 28-29-30

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, July 12,** for the construction of the substructure of a subway to be built at Yonge Street, at North Toronto.

Plans and specifications can be seen at the office of the Engineer of Grade Separation at No 262 Avenue Road, Toronto, where proposal forms can also be obtained.

B. RIPLEY,
Engineer of Grade Separation.

Toronto, June 26th, 1913. 27-28

Town of Carlyle, Saskatchewan

Waterworks and Electric Lighting

Sealed tenders, addressed to the undersigned, will be received up till 18 o'clock on **Friday, 1st August, 1913,** for the following contracts:—

1. Construction of brick power house and concrete reservoir, and laying approximately 800 lineal feet of pipe in trenches, and relative works.
2. Supply of Air-Lift Pumping System.
3. Supply of Duplex Steam Pump.
4. Supply and erection of two H. R. T. Boilers and Stack.
5. Supply and erection of compound vertical steam engine.
6. Supply and erection of Generator, Exciter and Switchboard.
7. Supply of Poles, arms, hardware, copper wire, transformers and meters.
8. Supply of Series Tungsten street lighting apparatus.
9. Erection of Pole Line.

Tenders must be accompanied by an accepted cheque for five per cent. of the amount of the tender, or alternatively by the bond of an approved guarantee company.

Plans and specifications and other information may be obtained at the office of the Consulting Engineers at Winnipeg and Calgary. A deposit of $25.00 will be required on Contract No. 1, which will be returned to bona fide tenderers on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

F. J. STENT,
Secretary-Treasurer,
Carlyle, Sask.

The John Galt Engineering Co., Ltd.,
Consulting Engineers. 28-29
28-29

Tenders for Bridge

Tenders will be received up to noon, **July 24th, 1913,** for the erection of a steel bridge 90 ft. c. to c. I. W. on lot 20 x 21, Con. III. S. P. R. Bentinck. Also for two concrete abutments for same. Plans and specifications may be seen with Henry Metcalf, Hanover, or James Warren, Engineer, Walkerton. A certified cheque for $200 to accompany each tender.

Signed, ALEX. WILSON,
Elmwood, Ont.

Bentinck, July 7, 1913. 28-29

Tenders Wanted

Sealed tenders, addressed to the undersigned, marked "Tenders for Automatic Street Flushing Machine," will be received up till 4 o'clock in the afternoon of the **29th day of July, 1913,** for supplying an Automatic Street Flushing Machine of at least 600 gals. capacity.

Tenderers must supply their own specifications and designs.

A marked cheque for $200 must accompany each tender, made payable to the order of the City Treasurer, which cheque will be subject to forfeiture in case of failure on the part of the successful tenderer to enter into a written agreement and bond with the City of Windsor with approved sureties when called upon to do so.

The lowest or any tender not necessarily accepted.

M. E. BRIAN.
City Engineer.
28-29

Tenders Wanted

Sealed tenders, addressed to the undersigned, marked "Tenders for Incinerator," will be received up till 4 o'clock in the afternoon of the **29th day of July, 1913,** for supplying all labor, tools, and machinery for the construction of an Incinerator of a capacity to dispose of at least 25 tons per day of garbage and refuse. Incinerator must also be capable of destroying all kinds of refuse, including night soil and dead animals.

Contractors must supply their own specifications and designs, including brick or reinforced concrete building.

A marked cheque for 10 per cent. of amount of tender must accompany each tender, made payable to the order of the City Treasurer, which cheque will be subject to forfeiture in case of failure on the part of the successful tenderer to enter into a written agreement and bond with the City of Windsor with approved sureties when called upon to do so.

Incinerator must be guaranteed for at least one year from date of operation.

The lowest or any tender not necessarily accepted.

M. E. BRIAN,
City Engineer..

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Tenders for Dredging

Sealed tenders will be received at the Clerk's office, Chatham, Ont. (where plans and specifications can be seen) up to 12 o'clock noon, on **Thursday, July 31st, 1913**, for dredging about 9 miles of drainage work in the Township of Dover, County of Kent. The work to be let subject to the final passing of the By-law.

The lowest or any tender not necessarily accepted. Tenders must be marked "Tenders for Dredging," and each accompanied with a marked guarantee cheque for $2,000.

Dated, June 17th, 1913.

H. M. BEEHARD, Reeve.
JOHN WELSH, Clerk,
26-30 Chatham P. O.

TENDERS

Concrete Bridge at Saskatoon

Sealed tenders will be received up to 16.30 o'clock on **Tuesday, the 15th day of July, 1913,** for the under-mentioned work:—

Construction of a concrete bridge over the South Saskatchewan River at Saskatoon.

Tenders for this work must be accompanied by accepted cheque on a chartered bank, or other satisfactory deposit for the sum of $15,000. Deposits of unsuccessful tenderers will be returned when contracts are signed.

The right to reject any or all tenders, or to waive any defects or irregularities therein is to be at the discretion of the Chairman of the Highway Commission.

Plans, specifications, forms of tender and all information may be obtained on application to the undersigned.

A deposit of $50 must accompany each request for copy of plans and specifications; this amount will be refunded on the return of the plans.

The unauthorized insertion of this advertisement will not be paid for.

A. J. McPHERSON,
Chairman, Board of Highway Commissioners.
Regina, Saskatchewan.
June 20th, 1913. 26-28

BARGAINS!

1 Thew Steam Shovel, used less than 90 days, shop number 690; like new	$3,300
30 1½-yd. dump cars, 36-in. gauge; practically new. Each	30
1 American Well Air Compressor, 12 x 12 x 14, 340 ft. capacity, new	440
1 Rand Belted Air Compressor, 10 x 14; A.1.	240
1 Buckeye Trenching Machine, steam driven; cuts trench 27-in .wide to 8 ft. deep. Overhauled and A.1.	2,500
2 American, 6¼ x 10, D.C., D.D. Hoisting Engines with boilers and boom swingers, A.1. Each	725
1 Three-drum Stronsburg 7 x 10 Hoisting Engine with boiler; practically new.	725
1 Gates No. 5 Crusher, 2 arm Spider, rear drive (Rebuilt B.) Exceptionally low price.	

For anything else second-hand, write

WILLIS SHAW MACHINERY CO.

New York Life Building, Chicago, Ill.

Residences

(Continued from page 71)

L. Claffy, 70 Russell. Architect, J. P. McLaren, Sparks street. General contractor and mason, Thos. James, 140 Flora. Carpentry, McDermid & Tyndall, 243 Flora. 22 x 37 x 53, double brick construction.

Residence, cost $10,000, Clemow, for H. B. Borbridge, 539 Gilmour. Architect, W. Herbert George, Castle Bldg., Queen street. Mason, A. Tubbe, 72 Lees ave. Carpentry, Currie & Walsh. Heating and plumbing, J. T. Blythe, Bank street. Electrical, J. A. Ellacott, 226 Bank street.

Quebec, Que.

One pair residences, cost $12,000, for C. A. Vezina, Lockwell street. Architect and general contractor, Edm. Belanger, Lockwell street. Four storeys, 66 x 33, stone foundation, structural steel and brick construction. Excavating done.

Toronto, Ont.

Alterations to residence, cost $17,000, for J. B. O'Brien, 7 Thornwood avenue. Architect, H. F. Secord, King and Bay streets. Masonry and carpentry work being done by day labor by architect.

Residence, cost $5,000, St. Andrews Gardens. Builder and owner, T. U. Fairlie, 26 Adelaide street west. 2½ storeys, 24 x 36, brick construction.

One detached residence, cost $5,500. Builder and owner, H. F. Saunders, 35 Geoffrey street. Two storeys, 24 x 60, brick construction.

Three pair residences, cost $12,000, Langley. Builder and owner, Keyes & Seal, 12 Matilda street. 2½ storeys, 34 x 42, brick construction.

One detached residence, cost $5,000, Oakwood. Builders and owners, Shaw Bros., 501 Manning ave. 2½ storeys, 24 x 36, brick construction.

Windsor, Ont.

Residence, cost $7,500, Victoria, for James Pennington, 247 Sandwich street. Architects, Crane & Pennington, Boug Bldg. Mason, Robt. Parker. Carpentry, Wm. Hutchinson. Roofing, heating, plumbing and electrical work, Pennington & Brian. Two storeys, 31 x 32, brick construction and foundation.

Winnipeg, Man.

Two residences, cost $5,400, Glenwood Crescent, for A. Heilig, 129 Burrows ave. Architect and builder, owner. Two stys. 24 x 28, stone foundation, frame construction.

Three residences, cost $7,500, Martin, for Adelman & Safer, 592 Selkirk ave. Architect and builder, owner. Two stys., 24 x 26, stone foundation, frame construction.

Residence, cost $9,000, Waverley, for N. L. Leach, 607 McMillan ave. 2½ storeys, 30 x 43, cement foundation, frame construction.

Residences, cost $6,000 each, Spruce, for McCrae & McKenzie, 504 McIntyre Bldg. Architect and builder, owner. 2½ storeys and basement, stone foundation, pressed brick construction.

Residence, cost $4,500, Basswood Pl., for A. G. Davidson, 509 McIntyre Block, Main street. Architect and builder, owner. Two storeys, 23 x 30, stone foundation, frame construction.

Residence, cost $4,000, Strathcona, for J. Sangster, 60 Haldet street. Architect and builder, owner. Two storeys, 26 x 26, stone foundation, frame construction.

Residence, cost $3,500, Banantyne ave. for A. Matheson, East Kildonan Road. Architect and builder is owner. Two storeys, 22 x 26, stone foundation, frame construction.

Power Plants, Electricity and Telephones

Grand'Mere, Que.

Coffer dam and power house for Laurentide Co., Ltd., 71 Canada Life Bldg., Montreal. General contractor, H. F. Talbot, 907 McGill Bldg., Montreal. General contractor doing all work.

Grenfell, Sask.

Electric lighting plant, cost $15,000, planned by Town Council. Engineers, The British Canadian Engineering & Supply Co., Ltd., 122 Phoenix Bldg., Winnipeg, Man.

Montreal, Que.

Gas plant, cost $17,000, Cote St. Paul, for Montreal Light, Heat & Power Co., Craig street west or Harbour and Ontario. Builders, D. G. Loomis & Son, St. Patrick street. One storey, 105 x 68, concrete foundation, brick construction.

Morrisburg, Ont.

Hydro-electric Commission, Continental Life Bldg., Toronto, plan line 40 miles long to supply Morrisburg and district.

Russell, Man.

Electric lighting plant, cost $18,000. General contractor, S. D. Sparrow. 90 x 20, concrete foundation, brick construction.

Toronto, Ont.

Conduits for Toronto Hydro-electric System. Purchasing agent, C. W. Fatt, 226 Yonge street. General contractor, Claremont Sewer Pipe Co., 50 Church St., New York. Vitrified clay conduits.

Winnipeg, Man.

Extension of time. Tenders received by Board of Control, Secretary, M. Peterson, till August 1st, for one 1,000 kw. motor generator with accessories complete for King street sub-station. Specifications at office of Engineer, J. G. Glassco, 54 King street.

Business Notes

Montreal, Que.

Store and flats, Latour and St. Genevieve, owned by E. J. Savage, 121 Metcalfe street, Montreal, destroyed by fire. Loss $25,000.

Nairn Centre, Ont. (Algoma Dist.)

Store and hall of H. Lesser destroyed by fire. Loss $9,000; insurance $6,500.

St. Vincent de Paul, Que.

Residence of Arthur Desnoyers destroyed by fire. Loss $10,000.

Quebec, Que.

Factory of Canadian Packing Company, 4th street, Limoilou, burned. Manager, Theo Dion. Will rebuild at once, machinery required.

Miscellaneous

Amherst, N.S.

Tug, etc., for Dominion Government, Dept. of Marine & Fisheries. Minister, Alex. Johnston, Ottawa. A tug, dredge and two scows to be purchased. To remain at Amherst permanently.

Humberstone, Ont.
The Village Council contemplate purchasing new fire equipment. Clerk, J. J. Wichman.

Unclassified Items

Amherstburg, Ont.
Residence, cost $5,500, for E. P. Scratc. Architects, G. Jacques & Co., Windsor. General contractor, Jos. B. Wilson. Two storey, red pressed brick construction.

Berlin, Ont.
Factory, for Beck Duplicator Co., New York City. Sec.-Treas., H. M. Isaacs. Option secured on site.

Chaudiere Curve, Que.
Chaudiere Pulp & Lumber Co.'s plant destroyed by fire. Loss over $50,000. Will probably rebuild.

Cochrane, Ont.
Railway buildings for Commissioners of Transcontinental Railway. Sec., P. E. Ryan, Ottawa. Tenders received until noon July 22nd for ice house, storehouse, freight shed and 2 tool houses. Plans at office of Gordon Grant, chief engineer, Ottawa, and T. S. Armstrong, Dist. Engineer, Cochrane.

Espanola, Ont.
25 workmen's houses, for Spanish River Pulp & Paper Co., Espanola and Sturgeon Falls. Company will build above for their employees and an addition to their 3-storey hotel is also contemplated.

Hamilton, Ont.
Alterations to hotel, cost $8,000, for Geo. Goldbery, Pioneer Hotel, King and Caroline. General contractors, Mitchell & Riddell, 89 Sherman ave north.

Apartment house, cost $18,000, Sherman Ave. S., for P. G. Colvin. General contractors, Sparks & McKay, 133 Cannon street east.

London, Ont.
Residence, cost $6,000, Wellington. Builder and owner, L. E. Carrothers, 435½ Richmond St., c/o J. M. Moore. Two storeys, red pressed brick construction.

La Salette, Ont.
Church, cost $40,000, for the R. C. congregation of La Salette, Ont. General contractor, Ben Blonde, La Salette, Ont.

Montreal, Que.
Alterations to Windsor station entrance, Windsor street, for C. P. R. Architect, C. P. R. Engineering Office. General contractors, Geo. A. Fuller Co., Ltd., 210 Read Bldg. Stone construction.

Four flats, cost $7,000, Marlowe. Builder and owner, Fred Demers, 288 Marlowe Ave. Two storeys, 50 x 38, cement foundation, brick construction.

Double tracking for Intercolonial Railway. Manager, F. P. Gutelius, Montreal. Company intend to double track road from Halifax to Montreal. A six-tenth grade is contemplated which may necessitate a change of route in several localities.

Flats, cost $10,000, Maisonneuve (Orleans), for Mrs. M. Limonges, 77 Orleans. Builder, Roch Limoges, 66 Orlean. Three storeys, 30 x 53, brick construction.

Six flats, cost $16,000, Outremont (Hutchison), for H. Fortier, 2473 Hutchison St. Builder and architect, Owner. Brick, Come Frenette, 1354 St. Denis. Stone, Ros Frenette, c/o Owner. Other contracts will be awarded about July 11th. Three storeys, 50 x 74.

Eight flats, cost $7,000, Poupart. Builder and owner, J. P. A. Belanger, 2109 Poupart. Brick, Mr. Iron, c/o Owner. Heating and plumbing, J. E. Belleau, 226a Bourbonniere. Three storeys, 50 x 38, brick construction.

Ottawa, Ont.
Pavements, cost $40,000, for city council. Mayor, J. A. Ellis. City engineer, Archibald Currie. Tenders will be called in about 2 weeks. Asphalt pavements on Spadina, Dalhousie and Clarence.

Factory, cost $35,000, for the Crown Lithographing Company, Limited, Nelson street. Two storeys, 175 ft. x 60 ft. Architects, Dore & Coyles; bulk contractors, Toms & Copeland; plumbing and heating, M. M. O'Connell.

Province of Ontario
G. T. Rly Co. has been authorized to reconstruct bridge No. 99 over public road between Lots 16 and 17 in Con 3, Twp. Ray at Mile Post 161.10, 9th Dist. 2.90 miles east of Midland.

Province of Quebec
Bridge cost $3,000, over River des Chutes, for Municipal Council for St. Narcisse. Mayor, Treffle Barril. Plans, etc., at office of Sec.-Treas., Alfred Trudel. One span, 30 x 16, concrete, steel, 5 18 in. I beams, 55 lbs., 34 ft. long and 4 in. red pine.

Port Colborne, Ont.
Robinson Cork Co.'s factory destroyed by fire. Main building destroyed, will likely rebuild this summer.

St. Marys, Ont.
Two residences, cost $6,000. Builder and owner, Jas. McCardle, Peel Street. White brick and cut stone construction.

Thorold, Ont.
Factory, cost $400,000, for Coniagas Reduction Co., Ltd. Manager, J. J Mackan, Bank of Nova Scotia Bldg., St. Catharines. Motors and generators, tanks, stacks, cranes required.

Euthilda, Sask.
Station for G. T. P. Branch Line Co. Company's revised location of sation at Euthilda in Sec. 3-34-18, W 3 M has been approved.

Westboro, Ont.
Bank, cost $10,000, for Bank of Ottawa, Wellington street, Ottawa. Solid brick construction. Plans ready.

Windsor, Ont.
Store and flats, cost $10,000, Pitt & McDougal, for Herman Benstein. Architect, G. Jacques & Co. Two storeys, 45 x 88, brick construction. Plans ready.

Alterations to store, Sandwich street, for Lyons Tailoring Co. Architects, G. Jacques & Co. Plans in progress.

Factory, cost $10,000, Factory Dist., for Swedish Crucible Steel Co. President Nelson L. Olson, Detroit, Mich. One and two storeys, 100 x 45, 100 x 125, structural steel and reinforced concrete construction. No contracts let.

Weyburn, Sask.
Pipe laying, etc., for C. P. R. Tenders received by District Engineer, J. G. Martin, Moose Jaw, until July 12th for trenching, pipe laying and back filling, 10-in. wooden pipe line 3.3/10 miles long. Plans at office of J. G. Sullivan, Chief Engineer, Winnipeg, W. T. Daniels, Res. Engineer, Regina, and J. V. McNab, Res. Engineer, Saskatoon.

New Companies

Germanite Limited, incorporated with a capital of $100,000, to carry on business as manufacturers of bricks, tiles, terra cotta, etc., with head office at Toronto. The provisional directors are E. G. Law, Howard Scott, contractors, and Edward Gillis, solicitor, all of Toronto.

The Sault Ste. Marie Land Company, Limited, has been incorporated with a capital of $50,000, to carry on business as a general land and building company, with head office at Sault Ste. Marie. The provisional directors are J. A. McPhail, barrister, T. T. Barnes, druggist, and Dr. G. W. Bald, all of Sault Ste. Marie.

The Toronto-Berlin Land Company, Limited, has been incorporated with a capital of $40,000, to carry on business as a land and building company, with head office at Toronto. The provisional directors are R. B. Haley, broker, R. T. Irvine, and G. W. Eversfield, salesman, of Toronto.

Gloucester Realty Company, Limited, has been incorporated with a capital of $50,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are J. H. T. Nesbett, J. J. Flint, bookkeepers, and G. D. Waters, cashier, all of Toronto.

Volt Electric Company, Limited, has been incorporated with a capital of $40,000, to manufacture and deal in electrical appliances and devices, etc., with head office at Toronto. The provisional directors are D. F. Pierce, manager, J. J. Kenney, sales manager, and J. E Anderson, law student, all of Toronto.

The Kildonan Land and Development Company, Limited, has been incorporated with a capital of $150,000, to carry on business as a land and building company, with head office at Winnipeg. The incorporators include J. R. Frizzell, barrister, A. H. Farries, real estate agent, and D. M. Telford, custom house appraiser, all of Winnipeg.

Williamson Construction Company, Limited, has been incorporated with a capital of $100,000, to carry on business as general contractors and dealers in builders supplies, with head office at Walkerville. The provisional directors are Victor Williamson, contractor, C. V. Williamson, architect, and C. K. Hall, millman, all of Walkerville.

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

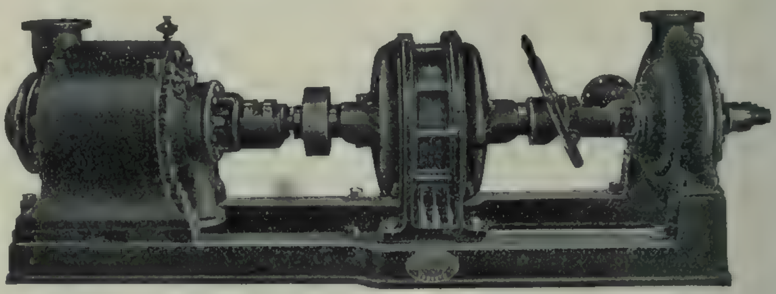
220 King Street West - TORONTO

MATHER & PLATT

TURBINE PUMPS

FOR WATERWORKS PURPOSES

Nearly all waterworks for municipalities require two pressures, Domestic and Fire. The arrangement illustrated is one method of conveniently attaining this end and maintaining the highest efficiency for domestic purposes. The left hand pump is the domestic pump and delivers 1000 imp. gallons per min. against 100 lbs. In case of fire the clutch is thrown in and 125 lbs. is immediately obtained. When making out your specifications insist on maximum efficiency against domestic pressure.



Two Pressure Unit. City of Belleville.

CANADIAN ALLIS-CHALMERS

LIMITED

HEAD OFFICE, - TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Fort William Winnipeg Regina
Saskatoon Calgary Edmonton Vancouver Victoria Nelson Prince Rupert

FILE YOUR PLANS

Free of charge at any of the four offices of the

"CONTRACT RECORD"

AND ENGINEERING REVIEW

Contractors and manufacturers of building, municipal, railway, and power plant equipment not only expect to see your tenders advertised in the "Tenders' Department" of the "Contract Record," but they will also find it a great convenience if you place your plans and specifications on file at any or all of our four offices, viz. Toronto, Montreal, Winnipeg and Vancouver.

Send along your next Tender Advt. together with Plans and Specifications

CONTRACT RECORD

AND ENGINEERING REVIEW

220 King St. West, TORONTO

MONTREAL
Board of Trade Building

WINNIPEG
Travellers Building

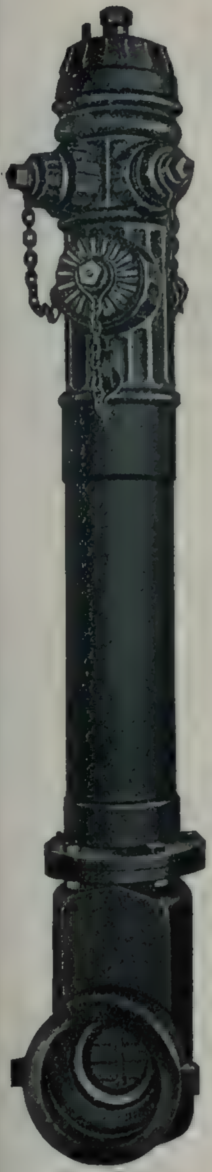
VANCOUVER
Hutchison Block

We Manufacture

The Reliable Line of

VALVES

- Brass Globe and Gate.
- Steam and Hot Water.
- Packless Radiator.
- Iron Body "Keystone" Gate, (non-rising stem or outside screw and yoke, with screwed, flanged or hub end)
- Iron Body Swing Check.



Kerr Gate Hydrant.

Gate and Compression FIRE HYDRANTS

INDICATOR POSTS

CRANES FOR FILLING WATER CARTS

VALVE BOXES
Screw Adjustable or Slide Adjustable

Forty Years of Experience has much to do with the satisfaction these goods give our customers.

6" Hub End Gate

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

Fresh Air for 9,000 People Delivered by ONE

"Sirocco"
TRADE MARK.

Ventilating Fan

The illustration shows a double inlet "Sirocco" Fan with a capacity of 270,000 cubic feet of air every 60 seconds at 5" water gauge.

A "Sirocco" Fan will deliver twice as much air as the ordinary steel plate fan of the same wheel diameter. Save one-half the space and one-third the power.

"Sirocco" Fans and Blowers are made in sizes to deliver from 75 cubic feet per minute to 1,000,000 cubic feet per minute.

Our Engineering Department will gladly co-operate with you in the selection of the proper equipment for YOUR needs.

Let us tender on your next requirements. Bulletin No. 3401 is descriptive of the construction and operation of "Sirocco" Fans. You should have a copy.

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR. ONTARIO.

Engineering Salesmen
CLARK T. MORSE, 301 McGill Bldg., Montreal
E. C. POWERS, Room 5, 43 Victoria St., Toronto
W. P. EDDY, 214 Donald St., Winnipeg

Current Prices of Building Material.

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	26 00	30 00
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	24 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 10 per cent.; lead waste, $9.00, less 10 per cent.; caulking lead, 6¾ cents per lb.; traps and bends, 35 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. .. .. 25c ft.		15-in.	1.35 ft.
6-in. .. .. 40c ft.		18-in.	1.90 ft.
9-in. .. .. 65c ft.		20-in.	2.25 ft.
12-in. .. ..1.00 ft.		24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, $9.00 in car lots.

Lime, per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil, in bbls., 63c. per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 60c. per gal. of 9 lbs.

Turpentine, in barrels, 60c. per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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Alphabetical Index of Advertisers
Page 16

Vol. 27 July 16, 1913 No. 29

The Building Situation

THE building permits issued in the city of Toronto and several other large cities for the month of June show a decrease in value as compared with those issued during the same month of last year. As pointed out elsewhere in this issue these decreases arise because 1912 was an extraordinary year and the first six months of 1913 is compared with an exceedingly high rate. If the amount of building indicated by the returns is looked at apart from all comparison they will be seen to represent a very substantial amount of work. It may be noted that among contractors there is manifested no alarm. Some hail the conditions as a necessary economic movement. All expect the period of retrenchment to be of short duration and look forward hopefully to a freer money circulation in the near future.

As bearing upon this feature of the situation we may quote from the speech of Sir Edmund Walker at a gathering of the Royal Colonial Institute, London, Eng. "What the people of England ought to remember is, that the series of securities sold by Canada in London during the past few years have been, taken as a whole, the best securities that have been offered by any foreign country or overseas dominion." "The point to be remembered is that the borrowing of Canada is finally determined by emigration." "Now we are forced to build whether we like it or not because of the increase in population and because of the new areas in Canada being open to settlement." "Apart from the scarcity of money—and I should say that money is not tight in Canada at any time that it is not tight in London—I know of no difference in Canada from past years except the decline in real estate speculation—a thing not to be regretted." "I am certain that the land banking of the country is perfectly secure and that such loans have been made at prices which are easily realisable from the inherent value of the property even if there were a great decline."

For those who contemplate building and who have money in hand or can command the capital, the outlook is favorable. Building material has felt already to some slight extent the effects of the restriction. The larger brick concerns contracted for their whole output early in the season and will probably go through the year without any change in price. But the newer and smaller companies have reduced their prices and are doing what has not been done in Toronto for some years. They are actually seeking to sell their product to the city contractors. Lime, crushed stone and cement are firm and likely to suffer very little change in price. Building steel shows a downward tendency. The American market for steel is dull. There is very little demand and considerable production and pig iron has declined a dollar a ton. Lumber is fairly firm. Two conditions have a tendency to keep it so. The cut last winter was light and the demand is fairly well up to the supply. If the present tariff provisions at Washington pass there will be opened a market of some importance for the Canadian output. However in response to the decline in the building trade there will probably be a slight falling off in the price.

A marked feature of the building material situation is that there is more in sight than for some time past It is more easily obtained, and while a slight decline in price might be anticipated from this condition, it does mean assuredly an economy in handling and fewer irksome and expensive delays.

The labor market is easier than it has been for some years. This again means an economy for those building under present conditions. In spite of agreements as to wages, the law of supply and demand will govern. While there may be those who will lay down their tools rather than accept a wage lower than the fixed standard, there will always be those to whom work is a necessity, and who will offer their services at a lower wage rather than go idle. Moreover, free competition in the labor market means both an increase in the quantity and improvement in the quality of the work done by the individual workman—an item to be considered in building estimates.

Furthermore, while many contractors are busy with work now under way, there are many to whom a large contract would be quite acceptable, if for nothing more than "to keep things moving." This again means an economy from the owner's standpoint.

We do not for one moment believe that there is to be a general permanent depression in the building trades of Canada. In Toronto alone, the supply of house accommodation has not overtaken the demand. With dear material, high-priced labor, abnormal land values and lack of suburban railway connection, it is impossible that the supply should keep pace with the demand. We do believe that there is a momentary check which will have a wholesome effect in producing a sounder, and more economical development.

WE regret that in the issue of July 2nd the name of Mr. H. K. G. Bamber, Inst. C.E., F.C.S., was omitted in connection with the article, "Modern Methods in the Manufacture of Portland Cement." The paper was originally read by Mr. Bamber before the Vancouver Branch of the Canadian Society of Civil Engineers.

An Important International Question

A QUESTION which may necessitate international arbitration between Canada and the Republic to the south looms up on the horizon. In 1900 the American engineers completed, at an expense of $45,000,000, the Chicago Drainage Canal, whereby the waters of Lake Michigan were admitted to the Chicago River and the sewage of the city carried by this means through the Des Plaines and Illinois rivers to the Mississippi. It was feared at the time that the levels of the Great Lakes would be affected. A constantly increasing supply of water has been taken with the result that the lake levels have been lowered.

American shipping interests extend from Lake Erie to Lake Michigan and Lake Superior while those of Canada extend from Lake Superior to the Atlantic. An International Waterways Commission was appointed to investigate. The Commission has reported to both governments that the engineering feat of building a weir across the Niagara is possible; that the weir would raise the levels of Lake Erie; that the building of the weir would not affect Lake Ontario or the St. Lawrence.

The proposal is to build a five foot compensating ridge where the Chippewa River joins the Niagara. Such a work would raise the waters of Lake Erie and the remaining western lakes and satisfy American and Canadian shippers from Lake Erie westward. But how are the levels of Lake Ontario and the St. Lawrence to be raised and maintained? What assurance is there that the harbors at Montreal and Toronto will be uninjured?

The Canadian Government is spending $50,000,000 to open through the Great Lakes system a channel for twenty-two foot ships. In view of this expenditure and in view of the importance of the Canadian interests in this great internal highway it is important to watch carefully every step taken and not to permit the improvement of one part of the system at the expense of the other.

Editorial Comment

THE charge against Rutherford Cumming, Frederick L. Richardson and Solomon Thompson, of conspiring to defraud the city by making excessive charges for repairs to the water works' intake pipe was dismised by Judge Morgan recently. His Honor stated that the repairing of the intake was an emergency and rush job that the contractors had to be ready at any time to take advantage of favorable weather conditions. They were to receive 20 per cent. of the cost of the work, "whatever that phrase meant to the party drawing the contract." The contractors had interpreted the contract as referring not only to money expended on material and labor for work actually done on the intake pipe, but also to losses sustained through keeping gangs always ready for work.

* * *

A PERMANENT auxiliary plant to serve the waterworks, pumping, filtration, and sewage disposal plants in the case of interruption in the service for the transmission lines from Niagara is to be established at Toronto. The joint report of Chief Enginter Gaby, of the Provincial Commission, and General Manager Cousins, of the Toronto system, stated that 14,000 h.p. was required for the civic plants. The report favored the installation of a generating plant within the city operated by steam, gas or oil engines rather than depending upon the system of the allied electric companies.

* * *

THE American and British Claims Tribunal which recently completed its initial sessions at Washington and Ottawa has issued judgment on four cases. This Tribunal was organized for the purpose of settling pending claims against the British and American Governments. Some of the claims date back many years. Three of the decisions given were in favor of United States Government. The claim of William Hardman, British subject, who lost property in Cuba during the Spanish-American war, was dismissed, as were also the claim for $4 a thousand on timber purchased by the War Department from a contractor for building a fort in Alaska and the claim for compensation for the use of the steamer Robert King for transporting coal for the Navy Department. The British claimant was awarded demurrage amounting to $150 on account of a collision between a British steamer and a United States army transport.

* * *

THE vigilant Medical Health Officer of Toronto, Dr. Hastings, is issuing a series of regulations providing for proper sanitary precautions on the part of the street railway authorities. To provide against overloading, the regulations state that the cars shall carry not more than their seating capacity plus two-fifths of the seating capacity and five more for the rear platform. In a normal car this makes the total of sixty-one. In the open summer cars no passengers are to be carried between the seats. All straps are to be celluloid or composition. The cushions are to be of such material as may be readily cleaned and all cars in use are to be daily washed and the cushions cleaned with a vacuum cleaner. The heating and ventilation is to be under the supervision of the Medical Health Officer. The company itself in the past has tried to enforce somewhat similar regulations in regard to overloading but has failed. It remains to be seen whether the Medical Health Department will be able to make its regulations effective. The hearty co-operation of the people would greatly simplify matters.

Under Lord Kitchener's economic administration,
ity. This discharge is to be led through a power
the great Assouan dam in Egypt is to be utilized for
reservoir passes through the sluices at a high veloc-
power. During five months of the year water from the
house for the purpose of developing an electric current. It is estimated that a total of 150,000 h.p. can be obtained. The power is to be used in the manufacture of chemical fertilizers by the fixation of nitrogen from the atmosphere. Over three million dollars was spent in Egypt last year for manufactured fertilizers.

Recent tests for electrolysis in water mains at Seattle, Wash., showed, it is said, the existence of an electrical current from trolley wires sufficient to furnish power to six 32-candle lamps. The city has filed a claim for $8,000 damages by electrolysis against the street railway company, which, it is said, has been denied. Double trolley wires have been suggested by Superintendent L. B. Youngs of the Water Department to prevent further damage.

Third International Road Congress*

Text of Resolutions Adopted, with Comments Thereon—Road Construction—Lighting—Traffic Control—Functions of Authorities—Finance Problems

(Staff article direct from the Editor)

At the closing meeting of the Congress, held on June 27, the resolutions proposed by the various sections were read in their order in the three official languages of the Congress and voted upon with due regard to the amendments proposed. As we have said, these resolutions had reference to the "questions" only and not to the "communications." We give now the final text of the resolutions as adopted by the Congress.

1st Question—Planning of New Streets and Roads

1. As a general principle, it is better that new main roads be constructed to pass outside than through town, and, where an existing main road passing through a town is unsatisfactory for through traffic, it is often better that, in preference to widening an existing narrow main road through the centre of a town, new roads should be planned according to the principles of the science of town planning.

2. Gradients on new roads should be as easy as possible having regard to the physical character of the country through which they pass and they should be easier where there are curves, trams, or a preponderance of heavy traffic.

3. The radii of curves in roads used by fast traffic should, where practicable, provide the best possible (and an unobstructed) view, and where this is not possible, the curve being too short a radius, means should be provided whereby the approach thereto is in some way clearly indicated.

4. Except where it is possible to provide special reserved spaces, tram tracks are best placed in the centre of the roads, and where so placed it is desirable to provide space on either side for two tracks for vehicles.

5. The main traffic roads should be so designed that spaces are provided for tram tracks, fast and slow traffic, and standing vehicles; and in such a way that they can proceed without unduly intermixing. In fixing building lines along what may ultimately become main roads, regard should be paid to ultimate requirements. Adequate space should be provided between the buildings, and powers for enforcing this should be held by all authorities who decide the widths of roads.

6. The planning of main road communication outside towns should be at once undertaken; it is a matter of national importance in regard to which some initiative should rest with a Central State Authority, and the action of Local Authorities should to some extent be regulated or supervised by Central State Authorities.

There is nothing to cavil at in these really harmless resolutions. We all know that "gradient should be as easy as possible having regard to the physical character of the country," and the advantage of wide roads, sufficient for the traffic, is apparent. It has to be remembered that the London Congress was run largely by the motor interest; hence perhaps the recommendation that main roads be carried outside rather than through towns. A main road, by leaving the track of civilization, would surely cease to be a main road, and would form rather a by-pass road, on which of course motor traffic could make its own pace. Opinions as to central or side tram tracks will differ, and no resolution of the Congress can, we fear, do much towards a settlement of the question. Certainly the side track appears more suitable to a concave than a convex road, for then the slow traffic would naturally gravitate to the centre.

2nd Question—Types of Surfacing to be adopted on Bridges, Viaducts, etc.

1. The choice of road surfacing for bridges depends on the nature and intensity of the traffic, the local conditions, such as permissible first cost, kinds of material readily available, and climate. For light bridges the choice is largely influenced by the weight of the surfacing. Public safety and convenience should be first regarded rather than questions of comparative cost.

2. On short bridges in town or country, it is desirable that the surfacing should be the same as that on the adjoining streets or roads.

3. In forming the roadway on bridges, special care should be taken to secure proper drainage, and to prevent the harmful percolation of water. With longitudinal gradients of at least 1 in 50, the cross section of the surface may be made nearly flat and the dead load thus reduced.

4. As a general rule, the surfacing a bridge should be waterproof, capable of resistance to wear, durable, and of a weight appropriate to the structure of the bridge; it should also be as smooth as possible without being slippery.

5. Plank surfacing on bridges is light, and its first cost is low. Its cost of maintenance is, however, excessive, except where the traffic is light. Its extreme liability to damage by fire is a serious disadvantage. It should not be adopted, except in remote districts in which there is an abundance of cheap timber, and where a more desirable form of surfacing is not easily obtainable. Single plank floors are only suitable for very light traffic. For moderate or heavy traffic, two layers of planking, the lower of which is creosoted or otherwise protected from rapid decay, should be used.

6. Macadam, or ordinary broken stone surfacing, on timber planking, is not always satisfactory on account of its great weight and its permeability. Macadam is, however, quite satisfactory for massive bridges in rural districts, if the substructure has a proper damp course.

7. Macadam, bound with tar, or other waterproof and elastic material, is useful and economical for the surfacing of rural bridges with moderate traffic, when the spans are short or the structure is massive.

8. Wood block paving, 3 to 5 inches thick, is an ideal surfacing for bridges in most cases. It is light and durable and can be laid on concrete, or, when weight must be minimised, on a timber sub-floor, which should be creosoted. Special care should be taken in the selection, treatment and laying of wood blocks for bridge paving, to avoid troubles due to expansion and contraction of the blocks or of the metal structure.

9. Asphalt, in various forms, is an excellent surfacing material for bridges with easy gradients, on which the traffic is not confined to definite lines or very heavy.

10. Stone paving, carried out either with ordinary hand-dressed setts or with small setts (Durax; Kleinpflaster), laid on concrete and bound with cement or pitch, makes an excellent and economical surfacing for bridges with heavy traffic, However, it is only suitable in cases where questions of the

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*Concluding portion of report published in our last issue.

weight of the surfacing or of noise are of no importance. The thickness of the layer of sand interposed between the sets and the foundation will be decided in the same way as with an ordinary carriage-way, in town or country, as the case may be.

11. For movable bridges, and for non-rigid suspension bridges, the surfacing should be light and easy to attach to the bridge platform. The trials made in France and Belgium with old mine cables, or other fibrous substances of even less cost, and with such materials impregnated with tarry, bituminous or asphaltic materials should be encouraged.

These resolutions are of quite a different type to those under the previous question, and although there is much of the obvious in them they are not without their value. M. Verriere, Engineer of the Ponts et Chaussees, Paris, said in his paper: "The various types of surfacing to be employed on bridges do not differ, in the main, from those which are usually employed for other positions of the roadway," and this is so to a great extent; but, as he also pointed out, the question of lightness, waterproofing quality, depth and elasticity must also be taken into consideration in selecting a material for bridge surfacing.

3rd Question—Construction of Macadamised Roads bound with Tarry, Bituminous, or Asphaltic Materials

GENERAL CONCLUSIONS

By the use of bituminous, including tarry or asphaltic binders, we may obtain a number of different forms of road crust, which may be employed with advantage, according to the various conditions of the road as regards traffic, locality, and climate.

The exact value and duration of life of these various road crusts, taking into account traffic, climatic conditions, and the methods of construction, remain to be determined.

For this purpose it is advisable to draw up a uniform system of tests, measurements and records, under the following headings:—

1. Physical and local conditions. (Plans, cross-section, slopes, camber, foundations, subsoil.)
2. Materials employed, petrological analysis, dimensions, composition of the binding agent.

2a. Method of construction, date of construction.

3. Census of traffic on the section under review.
4. Climatic conditions affecting the road.
5. Periodical measurement of wear.
6. Periodical examination of the state of the road crust.
7. Actual cost of the road crust—(a) as regards cost of construction. (b) as regards maintenance cost.

The standard form in which the information is to be furnished will be drawn up by the Permanent Commission.

PARTICULAR CONCLUSIONS

I. Foundation and drainage.

Confirming the conclusions adopted in 1910 by the 2nd Congress (Brussels, 2 Question), which called attention to the advantages of a dry foundation and a sound subsoil, the Congress especially insists upon the great importance of efficient foundations in the case of road crusts bound with bituminous (including tarry or asphaltic binders) for the following reasons:—

(1) The road crust being expensive, it is important to give it a base which will increase its life.

(2) As the weight, speed and intensity of the traffic continually tend to increase on roads considered worthy of such a crust, it is best to provide a foundation which has been so constructed as to secure for the crust the best possible conditions of resistance to wear.

II. Dimensions and shape of metalling.

(1) When an ordinary macadamised road crust is constructed with a view to being tar-sprayed, it should be constructed of hard metal, with sharp edges, and broken as nearly as possible to a cube of the dimensions of from 4 to 6 c/m.

(2) In the case of bituminous including tarry or asphaltic macadam, carried out by the mixing process, the dimensions of the metal may be so selected and graded as to form a compact road crust with the fewest possible voids. The dimensions of the largest metal may vary according to the nature of the stone and of the traffic. When the process of construction employed requires more than one layer of material, the upper layer or wearing crust may be formed of smaller metal.

(3) In respect of bituminous (including tarry or asphaltic) road crusts constructed by the penetration process, the trials and tests now being carried out in various countries should be continued, taking care only to employ metal of as cubical a shape as possible, and with sharp edges, at any rate for the portion of the road crust nearest the surface.

(4) It is understood that further experiments will also be carried out in the use of other methods, and especially those referred to in paragraphs (1) and (2).

III. Employment of partially used metal.

By carefully eliminating all particles of mud and organic matter, it is possible to successfully make use of partially worn materials, on condition that they are not employed for the surface of the road crust.

IV. Relative importance of patching.

It is agreed that it is absolutely necessary to carry out repairs, in the case of all bituminous (including tarry and asphaltic) road crusts, immediately the necessity for them arises.

V. Permissible wear.

The complete renewal rendered necessary by wear must be carried out immediately the depth of the road crust is below a given limit of safety, or when its waterproofing qualities have become so poor that the road will unduly suffer from climatic conditions.

VI. Various means of employing tarry, bituminous and asphaltic materials.

In using these materials, both in the penetration method and the mixing method:—

(a) It is preferable to use dry stone in order that it may adhere well to the binder. In the mixing method the stone must always be dry, and if necessary it must be heated.

(b) One must never lay a top crust upon a soft or damp foundation. One should preferably carry out the work in fine weather.

(c) One must never employ too much binder, but only a sufficient quantity to bind the portion of the road which is being rolled.

(d) One must never employ road rollers which are too heavy.

VII. Tests and chemical analysis.

The advantages of analyses and methodical laboratory tests, and their necessity in the case of bituminous binders, are unanimously recognized.

It would be of advantage to obtain uniformity—

(1) As regards the specification of the principal characteristics of these binders.

(2) As regards the methods of testing for drawing up these specifications. The Permanent International Commission will be entrusted with the work of enquiring into the best way of standardizing the above.

VIII. Climatic effects.

It appears to be generally agreed that certain tarry bituminous or asphaltic road crusts (as is also usually the case with all smooth and waterproof road surfaces) may become slippery under certain conditions of weather.

This may be remedied by strewing the surface with coarse sharp sand; and in most cases a good cleansing of the surface will usually prevent the carriage-way becoming slippery.

IX. Effects on public health, etc.

Sufficient information is now available to enable engineers to select and specify bituminous binders which will have no prejudicial effect upon public health, fish life, or vegetation; but which, on the contrary, will conduce to conditions of considerable hygienic advantage.

X. Cleansing and watering.

It is recognized that carriageways properly treated with bituminous (including tarry or asphaltic) materials require less sweeping and watering than ordinary water-bound macadamized roads, and that they allow of considerable economy being effected under this head.

The meeting puts forward the following additional proposal: That an International Technical Committee should be appointed by the Permanent International Commission in order to study a standard method of obtaining information and data upon materials, physical conditions, local conditions, methods of construction, terminology and other points concerning macadam bound with tarry, bituminous or asphaltic binders.

The report of the Committee should, after examination by the Permanent Commission, be presented to a next Congress.

There is nothing to which we could take exception in the foregoing. Precise information on the subject is badly needed and the preparation of standard forms for international use would be a useful work. The advantages too of analyses and methodical laboratory tests are apparent, and it is to be hoped that the Permanent International Commission will bring about the sadly-needed uniformity in these matters. Possibly the Munich Congress will be enabled to discuss the report of the proposed International Technical Committee. It is well to realise that roads and road surfacings of the nature of those under discussion are as yet but in their infancy.

4th Question—Wood Paving

1. Where gradients permit, wood block pavement is very suitable for streets where the traffic is great, but is not of the exceptionally heavy character usually existing on streets near docks or similar centres of industrial traffic. It should be used where a noiseless pavement is desirable.

It is of great importance that a concrete foundation should be laid of sufficient strength to carry the traffic passing over the pavement.

2. Great care is necessary in the selection of the proper timber for the purpose, and all soft wood blocks should be thoroughly impregnated with a well proved preservative before being laid.

3. In view of the varying results given by wood pavements, according to local circumstances, it is desirable that further investigations and laboratory experiments should be carried out in connection with the selection of the timber and of the impregnating preservative.

4. Every precaution should be taken in laying the blocks to prevent, so far as possible, the entry of water through the joints.

4a. Hard woods give varying results according to local circumstances, and it does not appear desirable to recommend them for roads with intense traffic in large cities, unless some means are devised to effectively prevent the rapid destruction of the joints and the resulting destructive effect on the concrete below. If these woods are employed it is desirable not only to prevent the percolation of water through the joints to the foundation, but also to consolidate the blocks as far as possible, so that they may not become rounded at the edges.

Soft woods obtained from suitable kinds of trees, and especially from resinous species, are equally suitable for roads with a comparatively heavy and intense traffic as well as for roads with a light and infrequent traffic. In the latter, however, the blocks are liable to rot if they have not been suitably pickled. It is also desirable to make the joints as small and watertight as possible. On the other hand, their comparatively rapid wear on roads with great traffic should encourage one to make exhaustive investigations into the best means of treating them, so as to increase their strength without prejudice to their elasticity.

5. Subject to certain precautions, such as impregnating of the wood, waterproofing of the joints and surface, frequent cleaning of the roadway, etc., there is no objection to wood pavement from the sanitary point of view.

6. The spreading of gritting is necessary under certain conditions and in certain weather (especially on hard wood paving) to prevent the surface becoming slippery, but the gritting should be done with suitable small gravel chippings or sharp sand, so as to avoid, as far as possible, any injury to rubber tires.

Here again, we are reminded of the necessity for further investigations and laboratory experiments, and we recognize to the full the importance of these as regards impregnating preservatives. As to the selection of the timber, that is largely a local matter. Hardwood pavements are largely used in Australia, with the very best of results; but then Australia (or at least Australasia) may be called the home of the hard woods. Other countries rich in hard woods have obtained similar results, while soft wood countries lean towards soft wood pavings. When importation becomes necessary, the fight between hard and soft wood becomes most keen, and no finality can be obtained without much further investigation and laboratory experimentation.

5th Question—Methods of Lighting

I. For the purposes of a general determination of methods of lighting, highways may conveniently be divided into three classes as follows:—

(1) Important streets in cities, towns or other urban areas in which the traffic after dark is considerable in volume;

(2) Important suburban roads in the vicinity of large towns;

(3) Rural roads in open country; and having regard to modern conditions of traffic it is essential that adequate lighting by means of fixed lights should be provided in classes 1 and 2.

II. As a general principle in the lighting of all highways which require to be lighted by means of fixed lights, the method of lighting to be adopted should be such as will provide an illumination as uniform and free from glare as possible. The amount of illumination and the position of lamps must be determined with reference to local circumstances.

III. It would be impracticable to light rural roads in open country generally by similar methods to those adopted in urban streets or suburban roads, and the lighting of vehicles running or standing on rural roads at night is therefore of the highest importance.

IV. Every vehicle whether standing or moving should carry or show a light of sufficient power at night which can, except when specially unauthorized, be seen from the rear as well as from the front of the vehicle.

(2) Every motor car must carry after nightfall, two

lighted lamps in front, and one at the back; if it is able to move at a high speed it must be fitted in front with a headlight of sufficient illuminating power to light up the road or path for at least 50 yards to the front. In inhabited places where the ordinary lighting is sufficient to allow motorists to see their way and to be easily seen, the light of the headlights must be limited to that of the ordinary lamp.

V. It is desirable that all obstacles across a road such as gates, and particularly gates at railway level crossings, should be painted white and in other colours in alternate parts, and illuminated by fixed lights which are lighted at dusk.

(2) It is desirable to paint with white paint or indicate by some other method all danger signal posts, direction posts and other posts, milestones, wheel kerbs, bridge abutments, etc., or other special features, the indication of which would aid travellers, or conduce to the safety and convenience of the traffic.

VI. One and the same colour should be universally adopted as the colour for danger signals.

VII. It is desirable that each government should do away as soon as possible with coloured lights on automobiles.

VIII. The Congress expresses the wish that regulations should be made to compel drivers of herds of cattle to make their presence known at night.

Three clauses call for a word of comment here. In IV. (2) mention is made of motor cars that are able to move at a high speed and it is recommended that these be fitted with a correspondingly far-reaching light. It would surely be better to put some check on these high speed machines than to encourage their speed by allowing them to use lamps which dazzle and confuse other road users. Resolution VII. advocates that coloured lights on automobiles should be done away with. Surely this cannot mean that both head and rear light are to be white! Resolution VIII. is so vague that comment would serve no purpose. Local conditions must govern it entirely. We note that there were two dissentients to its adoption.

6th Question—Observations noted since 1908 as to the various causes of Wear and of Deterioration of Roadways.

1. Weather conditions are amongst the most powerful influences which cause deterioration of roads, and the destructive effect of weather can be minimized by effective waterproofing of the road surface, with suitable drainage for the foundation.

2. Any considerable volume of traffic consisting of either heavy motor vehicles or high speed light motor cars has a seriously damaging effect on waterbound macadam roads. The damage caused is effected by the balancing of the motor; the ratio between propelling power and adhesive weight; the weight of unsprung portions of the motor; the progressivity of action of the brakes; the system of springing; the type of tires employed, the diameter of the wheels, the width of the rims, variation of speed and adherence, and other factors.

3. The damaging effect of heavy motor vehicles can be minimized by the use of wheels of large diameter; tires of a width properly adapted to the weight of the axle load; rubber or elastic tires and suitable springs; and all reasonable means of reducing the damage to roads caused by such vehicles should be enforced.

4. Light motor car traffic does not cause serious or exceptional wear or damage in the case of properly made macadam roads which have been properly treated or bound with tarry, bituminous or asphaltic materials, except in sharp curves.

As regards horse drawn vehicles it is desirable also to study the relations between load, width of rims and diameter of wheels and more especially the system of shoeing horses. It is also necessary that power should be given to local authorities to prevent the deposit of refuse from the fields and earth upon the roadway by the wheels of agricultural carts.

5. There is still a great lack of precise information in regard to the various causes of wear and deterioration of roadways, and it is desirable to collect more information compiled on carefully devised scientific methods standardized as far as possible for the purposes of comparison, and to make further systematic study of these causes.

The International Permanent Commission is charged with the preparation of a programme of observations, studies and experiments.

7th Question—Regulations for Fast and Slow Traffic on Roads.

1. That all regulations for the control of road traffic should be based on the principle of allowing the speed practicable for each different kind of vehicle consistent with public safety, general convenience, and the normal wear of the road.

2. That regulations for the conduct of fast and slow traffic should be as few and simple as possible and should be such as can and ought to be universally adhered to and enforced.

3. That in all large cities there should be a Traffic Authority on whom should be charged the duty of studying and dealing with street traffic problems, the powers of such authority and the co-ordination of such powers with those of other public authorities being matters of detail which must be settled by public authorities on consideration of the circumstances and conditions of each large city.

4. That there should be ample provision of traffic controllers (such as the police in London) with adequate powers to regulate the traffic, not only at congested points, but throughout the course of crowded streets.

5. That having regard to the increased danger which is necessarily created by the conditions of modern traffic it is important that drivers should be carefully and systematically trained, and that children should be specially taught how to provide against the dangers of the road.

6. That except where local circumstances render it absolutely necessary, no obstructions, such as lamp-posts, tramway standards, etc., should be placed in the centre of a road, except necessary refuges for pedestrians crossing.

7. No obstruction of the public highway should be permitted either by vehicles standing unreasonably, or travelling at an obstructing speed, or by things placed on the highway. Exception must, however, be made for depots required for the work of maintenance or repair of the road, or for work being carried out by duly authorized and competent authorities, but in every case, all necessary steps must be taken to ensure the safety of traffic.

8. Regulations for roads and traffic must aim at defining the rights, duties, and responsibilities for each kind of traffic, in order to avoid the causes of accidents and damage and to ensure the maximum of order and liberty.

We cordially agree with the establishment of a traffic authority in all large cities, so long as such authority takes seriously to heart recommendation 2. Regulations to be of any use must be simple and few, and none should be made that cannot be rigidly enforced. Citizens have rights as well as duties, and local authorities are apt to forget this. The last words in recommendation 8 are among the most valuable: "to ensure the maximum of order and liberty." The London police certainly deserve the reference made to them as "traffic controllers." We cannot quite agree with recommendation 6. Central lamp standards serve a useful purpose in keeping the two streams of traffic apart. That an isolated unlighted obstruction is a danger goes without saying, and these should certainly not be allowed.

8th Question—Authorities in charge of the Construction and Maintenance of Roads. Functions of Central Authorities and Local Authorities.

1. The system of road administration in any country must be in harmony with the general system of government prevailing in that country, and the political genius of its people. It is impossible, therefore, to lay down any general rule of universal application as to the extent to which the road organization of any country should be centralized or decentralized.

2. A principle that can be laid down as to universal application is, that the unit of highway administration shall be sufficiently large and command sufficient resources to employ and adequately remunerate a competent staff.

9th Question—Finance of the Construction and Upkeep of Roads, Provision of Revenues.

1. The expenditure on the maintenance and improvement of—

(a) the roads which serve as main routes of communication between important places in any country, or

(b) roads which are used mainly by long distance traffic; unless such expenditure is borne wholly out of the National Revenues under a system of State Administration of roads (which system is practicable and suitable in the case of some roads in some countries) should be mainly paid for out of National Revenues, whether or not such roads are locally administered and maintained, subject, where local administration prevails, to the supervision of a central government authority both as to efficiency and expenditure.

2. It is desirable to abolish, so far as possible, all tolls on public roads, but it is equitable that vehicles which, on account of their weight or weight combined with speed or any other exceptional circumstances connected with either the vehicle or use of the road, cause special damage to roads beyond the wear and tear of the ordinary traffic of any district, should be subject to special taxation the proceeds of which should be earmarked for expenditure on roads.

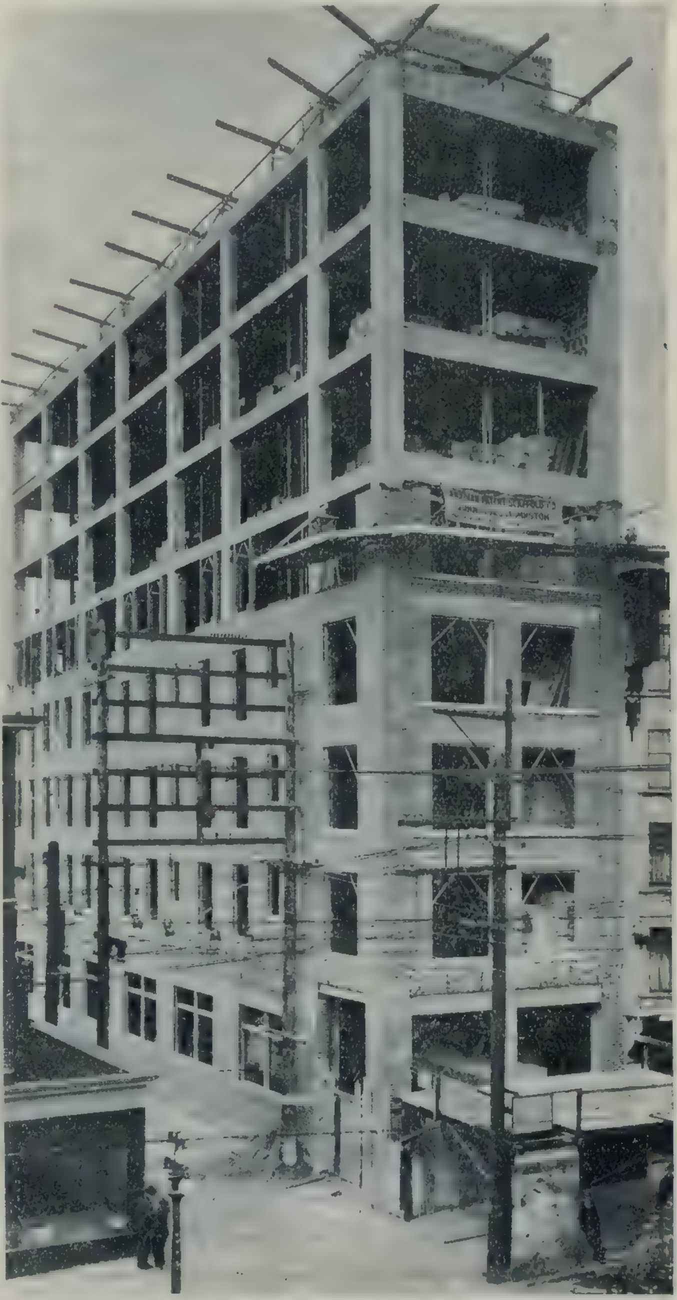
3. Borrowing money for new road construction and for the periodic renewal of the surface coating of a road is consistent with sound financial principles provided that the loan period in the case of loans for renewals, is kept well within the life of the surface coating.

We are exercised in our minds as to the wisdom of a "central government authority" for roads of any class, but the matter is too big a one to be dealt with here and we say no more for the present. With recommendations 2 and 3 we are quite in agreement.

New Vancouver Hotel

The accompanying view shows construction work at an advanced stage on the new Empress Hotel building which is located in the 200 block, Hastings street east, Vancouver. The dimensions of this structure are 25 x 132 feet, and the height is eight storeys with full basement. Reinforced concrete on a skeleton frame and long slab span construction are being used, the spans of the slabs varying from 16 to 22 feet in length, constructed in accordance with the latest product of the Kahn system. All floors are of steel, tile and concrete construction, the beams supporting the floors being the full width of the building, the loads are taken care of without the use of any intermediate supporting columns. Hy-rib lath is used for the ceiling.

The partitions throughout are of Pyrobar blocks. The exterior facing is red pressed brick on the front and lane elevations, with Dennison tile and plaster for the remaining sides. The main entrance will be treated in marble and tile, and the interior finish throughout will be hardwood trim.



Empress Hotel nearing completion.

The cost complete has been estimated at approximately $105,000. Mr. F. N. Bender prepared the plans and the Trussed Concrete Steel Company of Canada is carrying out the general contract.

A bucket dredge claimed to be the largest in the world was recently launched at Renfrew, Scotland. It is 309 ft. long, 47 ft. wide and 20 1-6 ft. deep. It is to work at the entrance of the Suez canal.

A Reinforced Circular Reservoir

Necessity for a Storage Reservoir—Considerations Determining the Design —Departures from the Plan—Architectural Treatment—Table of Costs

By Alexander Potter, Consulting Engineer, New York City

ONE of the features of the convention of the American Water Works Association held at Minneapolis in June was a paper by Mr. Alexander Potter. The paper gave the description and design of a circular reinforced concrete reservoir, two hundred feet in diameter and twenty-six feet deep, with the side wall wholly above the ground. As the subject is one of exceptional interest we publish the discussion in full.

In the fall of 1910, the writer was retained by the City of Muskogee, Oklahoma, to investigate the existing water and sewerage systems, and to devise methods and means to adapt the existing systems, then overtaxed, to the present and probable future needs of the City.

Upon his recommendation, the people of Muskogee voted a bond issue of $650,000 to carry out the improvements. Of this amount, $325,000 was set aside for improvements to the water system, $300,000 for sewerage improvements, and $35,000 for garbage disposal.

Outline of the Water Works Improvements

Muskogee takes its water supply from the Grand river. The present intake is located in the channel of the river, about 1,800 feet above its confluence with the Arkansas river. Two 16-inch cast-iron pipes, each 2,600 feet long, laid in the bed of the Grand and across the Arkansas river, convey the water to the pumping station. Low-lift pumps raise the water to a three million gallon settling basin. The water is then pumped through a 24-inch main, 20,800 feet long, to the city. A standpipe located in the northern part of the city, equalizes the pressure in the town.

The improvements to the water system designed by the writer consist in the replacing of the two 16-inch suction lines by a 4 ft. 6 in. intake constructed in rock tunnel, with an intake tower at the upper end; the installation of additional high and low-lift pumping units; the construction of a water purification plant, including a six million gallon settling basin, the design and construction of which basin was described in detail by the writer in a paper presented at the Thirty-second Annual Convention of the American Water Works Association at Louisville; the building of the six million gallon reservoir with which this article deals; together with the laying of a 24-inch supply main, 12,600 feet long, connecting the reservoir located on the other side of the city from the pumping station with the existing distribution system.

The Need of a Large Storage Reservoir

The object in constructing the reservoir was twofold; namely, to increase the pressure throughout the town, and to have at all times a large quantity of water available at a sufficiently high elevation to maintain the pressure in the town at times of heavy draft or in case of a serious breakdown of the pumping station or force line.

The pressure in the central portion of the city ranges from sixty to seventy pounds. At times of heavy draft, this cannot be maintained. A standpipe, 25 feet in diameter and 120 feet high, was erected in 1903 to help maintain the pressure in the city. The effect of the standpipe in this direction, however, is very slight, because of the small quantity of water in the pipe at the height at which it is required.

Conditions Which Influenced Design of Reservoir

A storage and distribution reservoir, to be effective, should always be located as close to the city as possible, otherwise, too great a fluctuation in pressure will exist in the distribution system. A site suitable for a reservoir exists within the city limits. In the northern part, there is a knoll which reaches an elevation of 653 feet above mean sea level. The standpipe was erected on this knoll when the plant was built. In the extreme western end is another knoll, known as Agency Hill, which reaches an elevation of 760 feet, thirteen feet lower than the highest water level in the standpipe. The top of this knoll has a hog-back shape, and averages about 200 feet in width. This is the only hill available for the construction of a distribution reservoir of the size required.

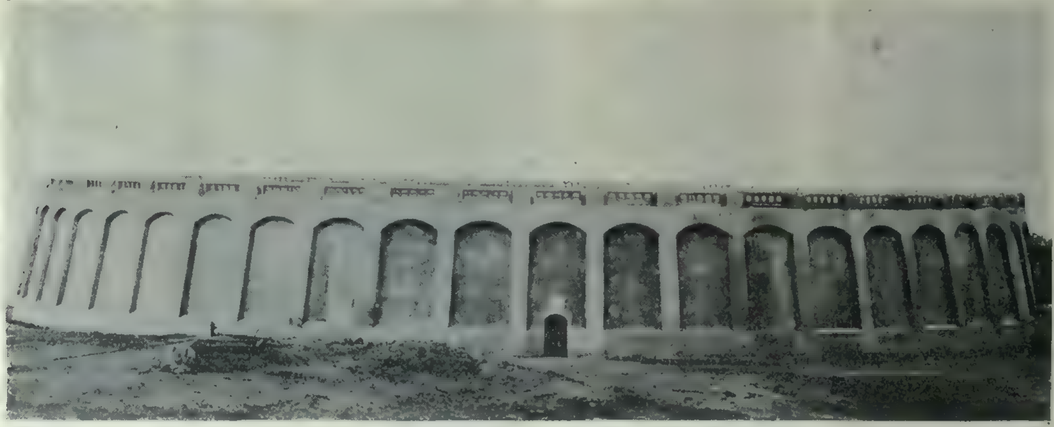


Fig. 1—View of the completed exterior wall.

Good water works practice would require a city of the size of Muskogee to maintain a fire presure of at least seventy-five pounds. A reservoir with its average water level at the elevation of the surface of the ground on the hill; viz., 760 ft., would give a static pressure of only 69.4 pounds over the central portion of the city. It was decided to adopt some type of construction that would insure a normal water level in the reservoir at least 20 feet above the surface.

The shape of the top of the hill, the size of the reservoir, the necessity of having most of the water stored above the ground—all tend to make the structure one of more than usual interest. The top of the hill consists of three or four feet of clay and scattered boulder, underlaid with layers of clay and shale. Reinforced concrete is practically the only material that could be used to construct a reservoir of the proportion and shape required by the conditions assumed above.

Possible Types of Construction

A circular shape was decided upon. This shape is usually the most economical, but under the existing conditions, unquestionably so.

To obtain the required capacity of 6,000,000 gallons, a circular tank with its diameter limited to 200 feet requires a depth of 26 feet. To construct a circular tank of these dimensions in which the internal pressure is resisted by the tension in the shell, was considered inadvisable; first, because of the high cost of construction, and second, because of the probability of structural defects developing at the junction of the shell and the bottom. Such defects might permanently impair the value of such a structure as a reservoir.

A circular reservoir 200 feet in diameter will, when filled with water, expand 0.96 inches, on the assumption that the steel in the shell is stressed to 12,000 pounds per square inch. This enlarging of the cylindrical shell, as it affects its connection to the bottom of the tank, can be taken care of in one of several ways, all of which are more or less unsatisfactory:

(1) By rigidly connecting the bottom to the side and making the bottom a thin section not more than 6 inches thick and sufficiently reinforced with steel so that it can stretch this amount without producing cracks large enough to allow the water to escape.

(2) By the use of a water-tight expansion joint at the point where the bottom joins the shell.

(3) By preventing the expansion at the bottom of the shell.

The third method calls for heavy, massive construction, is correspondingly costly, and is not successful unless the lower portion of the tank is designed with the greatest of care. When this is done, the economy of this type of construction no longer obtains, as the stress in all circular reinforcement depends on the expansion of the shell, which, if prevented by a rigid connection at the bottom, will reduce the working tension in the circumferential bars directly proportional to the amount by which the expansion of the shell is prevented.

As all of the methods mentioned for overcoming the weakness at the connection of the bottom to the cylindrical shell, are more or less experimental in a large reservoir, the writer was opposed to this type of construction. The amount of circumferential steel reinforcement required in the circular type, also increases with the square of the diameter. Therefore, the economy in the cost of construction found in the smaller tanks, no longer obtains in the larger sizes.

Another type of construction for the side walls of large reinforced concrete tanks is the cantilever section. This type of construction is not, in the writer's opinion, adapted to tanks deeper than 15 feet. In a tank of this type there is always the possibility of hydrostatic pressure developing under the broad base, thereby endangering the stability of the structure.

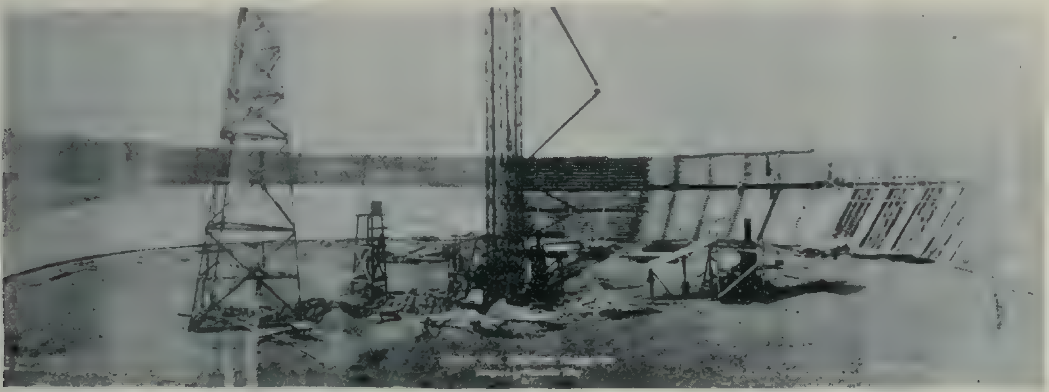


Fig. 2—View of interior wall under construction.

A third method, and one which has been in general use, is that in which the side walls are supported by buttresses or counterforts. This method of supporting the wall sections is a very economic one for tanks of considerable size in which the depth exceeds 8 to 10 feet. A modified type of this construction, in which the deck is inclined and supported by buttresses, is a very economic one for tanks of greater depth and is the one adopted for the Agency hill reservoir described in this paper. The latter type of construction is not adapted to rectangular tanks of considerable depths. In rectangular construction, the corners are very apt to give trouble. Here, the pressures are at right angles to each other, and with the resultant deflections which are appreciable at the top of the tank, also as right angles, it is almost impossible to prevent large cracks from forming at the corners. These cracks are apt to be of such magnitude as to render the structure of little value as a reservoir. This criticism does not hold good when circular or elliptical construction is resorted to. For the above reasons, the type of construction illustrated in Figs. 1 and 2 was adopted.

Description of the Reservoir

The reservoir as built is circular in form, 200 feet in diameter on the inside, and 31 feet deep in the centre. The walls of the tank are supported by fifty buttresses, radially spaced. The deck is carried straight between the buttresses, thus the reservoir is not truly circular but a fifty-sided polygon. For a distance of 10 feet below the water level, the sides are carried down straight; below this point, the sides are inclined at an angle of 45 degrees. The bottom of the reservoir is a segment of a sphere, with a maximum ordinate of 5 feet at the centre.

The shape adopted is one in which practically all of the available water is stored above the surface of the ground. Of the total storage, amounting to 6,000,000 gallons, only 580,000 gallons, or 9.7 per cent. of the total storage, is below the finished grade, and approximately 40 per cent. is stored in the upper 10 feet, thus making it a very effective pressure-equalizing reservoir.

Fig. 3 shows the stresses acting on a portion of the dam subtending an angle of 7 degrees 12 ft. at the centre, all of which is supported by one buttress. In this figure are shown all of the forces acting on the section.

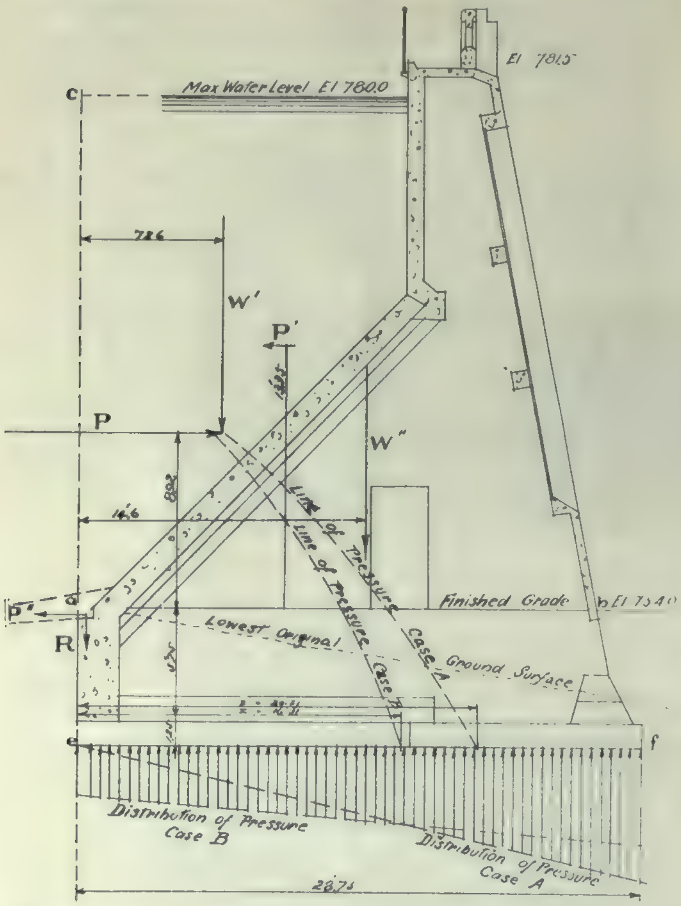


Fig. 3—Stresses on a portion subtending an angle of 7° 12′ at the centre.

The horizontal component "P" of the water pressure acts radially outward and amounts to 244,880 lbs. Its line of action is 8.92 feet above the line a-b. The total weight of the water—W′—resting on the inclined deck is 218,560 lbs. with its line of action 7.26 feet to the right of the line a-c. The prismoidal form of the body of water resting on the inclined deck makes the computations, both for the amount of these pressures and their locations, somewhat involved, and for this reason they are not reproduced in this paper.

The weight of the concrete section—W″—based on 145 lbs. per cubic foot of concrete, amounts to 191,000 lbs. Its centre of gravity is 14.6 feet from the line a-c.

As several indeterminate factors enter into the computations necessary to determine the line of pressure in the buttress and the distribution of the foundation pressure over the footing course of each, it was deemed best to compute the limiting values of these pressures under the following assumptions:

Case A—Based on the assumption that each section must stand independent of its neighbor;

Case B—Based on the assumption that the various sections are united into a monolithic structure and that all the forces resulting therefrom are taken into account to the full extent that they may be counted upon to develop in the structure.

Case A—The point where the resultant pierces the base, e-f (Fig 3), under this assumption can be obtained by taking moments about the point "e," as follows:

$$\begin{aligned} P\ (&= 244{,}880 \times (8.92 + 5.75 + 1.25) &&= 3{,}898{,}490 \\ W'\ (&= 218{,}560) \times 7.26 &&= 1{,}586{,}700 \\ W''\ (&= 191{,}000) \times 14.60 &&= 2{,}788{,}600 \\ & && \Sigma M = 8{,}273{,}790 \end{aligned}$$

$$z = \frac{\Sigma M}{W'' + W'} = \frac{8{,}273{,}790}{409{,}560} = 20.21$$

"z" is the distance from the line e-a to the point where the resultant pressure on the foundation pierces the base.

The total width of the base is 28.75 ft. Therefore, the line of pressure falls 1.13 ft. outside of the middle third, thus making it appear that there will be considerable uplift at the heel of the buttress. This, however, is not the case. The total supporting area amounts to 117.65 sq. ft. Under the assumptions of Case A, the maximum pressure at the toe would amount to 6,727 lbs. per square foot, and the minimum to 29 lbs. per square foot. There is no uplift whatever at the heel. If, instead of a spread footing, a rectangular-shaped footing of the same area were used, the maximum pressure in the footing would be 7,755 lbs. per square foot, and the minimum, a tension of 795 lbs. per square foot.

Case B—The line of pressure determined under Case A will not be the true line of pressure in the complete structure. In the complete structure a number of forces are developed, all of which add to the stability. The effect of these on the stability of the structure will be taken up in detail.

Effect of Bottom Connection

Prior to placing the concrete in the bottom of the reservoir, further study of the problem indicated a probable weakness in the design of allowing the 6 in. bottom slab to span the refilled excavation made necessary in building the cut-off wall between buttresses. The plans of the bottom, therefore, were revised as follows:

To strengthen the structure, the reinforced concrete bottom rests upon and is tied into the face slab by steel reinforcement. The concrete bottom is 6 inches thick and is reinforced with ⅜-in. bars spaced 12-inch centres. Seven feet from the wall, the thickness of the concrete bottom was gradually increased from 6 ins. to a depth of 15 ins. directly over the supporting wall. The reinforcement in the bottom immediately adjacent to the wall consists of ⅜-in. square bars spaced 6 ins. at the perimeter. The bottom is tied into the deck by half-inch bars, 5 feet long, spaced 12-inch centres.

Fig. 4 shows the connection of the bottom to the sides. In this figure are shown all of the forces that act on the section A, viz., the weight of the water resting on the bottom with an intensity of "p" pounds per square foot, the supporting pressure of the foundation increasing from zero at the support to a maximum of "p" pounds per square foot, "x" feet distant from the support; R, the re-action per lineal foot of the supporting wall, and P′, the pull per lineal foot exerted by the side walls. This construction would add appreciably to the stability of the buttresses in transferring the line of pressure nearer to the centre of the wall.

In Fig. 4, the distance "x" is limited by the strength of the bottom slab. Assuming a fibre stress of 20,000 pounds per square inch as the limiting stress that can be developed in the steel without permanently impairing the strength of the structure, we obtain a value of 6.28 ft. for x and a value of 3,400 pounds for R. The force T is developed in the ½-in. bars spaced 12-inch centres along the perimeter of the bottom and can reach 5,000 pounds per lineal foot without injury to the structure.

A new city engineer was appointed about this time, who was placed in actual charge of the construction. He was wholly out of sympathy with all the writer's plans.

The need of some additional reinforcement of the bottom at this weak point of connection was apparent when pointed out. As a substitute therefore, all the excavated material disturbed by the construction of the toe of the deck slab was removed and the space filled with plain concrete and the original thickness of the bottom maintained. This not only required more concrete, but it effectually destroyed the function of the drain laid at the foot of the wall to prevent hydrostatic pressure from developing under the structure. The opinion of the writer was not asked upon the wisdom of this change.

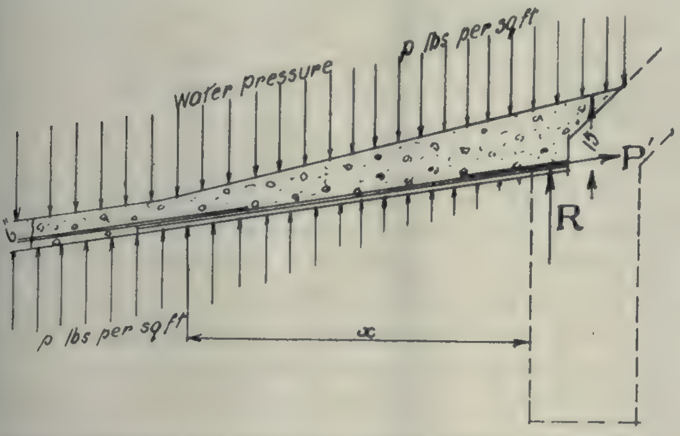


Fig. 4—Showing the connection of the bottom to the sides.

Effect of Continuity of Circumferential Reinforcement on the Stability

The circumferential reinforcement of the structure consists of sixty-five ¾-in. bars, eleven ½-in. bars, and six ⅜-in. bars, giving a total cross-section of 39.97 square inches. All of this reinforcement is lapped sufficiently at all connections so that the steel reinforcement of the shell can be considered to be practically continuous. As the shell expands under the internal pressure, this steel reinforcement is subjected to tension, thereby resisting directly a certain amount of internal pressure. The writer has every reason to believe that the diameter of the tank when filled with water will increase by ½ to 1-inch at the top. This expansion of the tank under pressure produces a stress of from 6,250 to 12,500 pounds per square inch in the circumferential steel reinforcement.

Assuming the average stress in the ring tension due to the circumferential reinforcement to be 6,000 pounds and to increase from 3,000 pounds at the bottom to 9,000 pounds at the top, the total outward pressure per lineal foot of tank thus resisted by the steel, amounts to 2,585 pounds. This is obtained from the formula,

$$T = pr$$

where T = ring tension = 6,000 × 39.97 = 239,820 lbs.
p = total hydrostatic pressure per lin. ft. of perimeter resisted by ring tension.
r = radius of tank, 92.75 ft. measured at the same height as the resultant line of action of the horizontal water pressure.

The height at which the force "p" acts can only be approximately determined. The centre of gravity of the steel reinforcement is 11.5 ft. above the line a-b and with the assumption as to the distribution of the pressure, the line of action of "p" is about 13.35 ft. above the line a-b.

In Fig 3 are shown all of the forces acting on a portion of the dam, supported by one buttress, when this section is considered to form a part of the complete structure. The additional forces acting on the section, due to the rigid connection, are P′, R and P″.

P″ represents the radial tension that may be developed by the steel reinforcement connecting the bottom with the inclined deck. The value of P″ may reach 5,000 lbs. per lineal foot, or 52,900 lbs. per buttress, without injury to the structure.

R represents the reaction of the bottom on the supporting wall. This may also attain 3,400 lbs. per lineal foot or 35,900 lbs. per buttress.

The pressure—P′—under the assumptions made, amounts to a maximum of 2,585 lbs. per lineal foot of circumference, or 31,500 lbs. per buttress.

Taking moments about the point "e" of all the forces acting on the section, under Case B we have:—

$$\begin{array}{lrr}
P \;\;= 244{,}880 \times 15.92 & +3{,}898{,}490 & \\
W' = 218{,}560 \times 7.26 & +1{,}586{,}700 & \\
W'' = 191{,}000 \times 14.60 & +2{,}788{,}600 & \\
P'' = 52{,}900 \times 7.00 & & -370{,}300 \\
P' = 31{,}600 \times 20.35 & & -643{,}060 \\
\hline
 & +8{,}273{,}790 & -1{,}013{,}360 \\
 & -1{,}013{,}360 & \\
\hline
\end{array}$$

$$\sphericalangle M' = 7{,}260{,}430 \text{ ft. lbs.}$$

$$\sphericalangle V' = W' + W'' + R = 445{,}460$$

$$z = \frac{\sphericalangle M}{\sphericalangle V} = 16.31$$

Under Case B, the pressure line cuts the base 16.31 feet from the heel, well within the middle third. This gives a foundation pressure ranging from 4,962 to 2,544 pounds per square foot.

The foregoing computations show that the pressure at the toe of the buttress footing may range from 4,962 to 6,727 pounds, and the minimum pressure at the heel from 29 to 2,544 pounds. These pressures are conservative for the character of the foundation upon which the footings are placed.

The buttresses, which are radially spaced, are 15 inches in thickness. At the point where the inclined deck starts, there is considerable tension on the side of the buttress nearest the water. This tension is taken up by three ⅞-inch square bars at a unit stress in the steel of 9,000 lbs. per square inch, making full allowance for the weight of the section; ignoring this, the stress in the steel will be 15,000 lbs. per square inch. Two ⅞-inch square bars are carried up along the face of the incline of the buttress to take care of any possible tensile stresses, especially at the upper end of the incline where these stresses may be considerable.

The face of the buttress upon which the deck rests, is corbelled out to 30 inches. The corbel is reinforced by two ⅝-inch square bars tied together by ⅜ square ties spaced 12 inches centres. These ties serve both the purpose of reinforcing the corbel against cantilever action developed by the deck resting on the outer ends of the corbel and preventing the splitting of the buttresses.

When the structure was about half completed, the writer discovered an error that had crept into the plans which called for ⅜-inch square bars in the spread footings of the buttresses in place of ¾-inch square bars as required by the computations. The footings as constructed, in the opinion of the writer, do not give a sufficient factor of safety in adequately distributing the pressure over the area assumed in the design, and it was therefore deemed highly advisable to reinforce the spread footings.

This method required the cutting out of each buttress already constructed, a section, marked A-B-C in this plate, and placing upon the footing a reinforced concrete beam 3 feet wide on the base and about 27 inches deep under the buttress and 12 inches deep at its outer end. This beam was to be reinforced with six ¾-inch square bars.

To obtain a good bond between the old buttress and the new work, it was proposed to maintain a head on the semi-liquid concrete so as to force it into the buttress and to maintain this head until the new concrete had obtained its final set.

It is to be regretted that the city officials failed to appreciate the importance of strengthening of footings, which could have been done at a nominal cost and would not have added more than one per cent. to the total cost of the structure. In thus refusing to comply with the plans, they have assumed all responsibility for the structure. The structure is strong enough as built to withstand all the pressures that may come upon it, but there is always a possibility that one of the buttresses may settle sufficiently to impair the usefulness of the structure as a reservoir. The cost of repairing this defect may exceed many times the cost of reinforcing the footings in accordance with plans. Had the suggestion been carried out, it would have effectively reinforced the spread footing so as to enable it to properly distribute the pressure over the foundation.

Construction of Deck

The deck, with the exception of the top, is not tied into the face of the buttress by steel reinforcement. The vertical portion of the deck is 10 inches thick. The thickness of the inclined portion varies from 12 inches at the top to 15 inches at the bottom. The steel reinforcement is stressed to an average of 5,200 pounds per square inch in the vertical portion of the deck, and to 10,000 pounds in the lower or inclined portion. The deck of the reservoir is constructed as a monolith; no expansion joints are used. This type of construction throws additional tension upon slab reinforcement, especially in its upper portion. Provision has been made, in the design, for this additional stress by using a somewhat lower working tension in the slab reinforcement than is otherwise necessary. A widening of the diameter of the tank at the top, of as much as an inch, will increase the stress in the circumferential reinforcement to 17,200 lbs. per square inch.

Attention is called to the connection of the inclined to the straight portion of the deck. This joint, which is naturally a weak one, has also been made a construction joint. It has been strengthened by a 12 x 16-inch concrete beam reinforced with four ¾-inch square bars.

Hydrostatic Uplift

In this article, no mention whatever has thus far been made of the possibility of hydrostatic pressure developing either under the concrete bottom or against the curtain wall, and thereby affecting the stability of the structure. This is guarded against by under-draining the spherical bottom with four and six-inch tile drains. Five 4-inch lines of drains are laid radially and drain to a sump at the centre of the reservoir. From this point a 6-inch drain is carried radially outward to a free outlet on the hillside. A circular line of 4-inch tile drain is laid entirely around the outer edge of the spherical bottom just above the footing of the 24-inch circular cut-off wall.

With these provisions, it is almost impossible to conceive of hydrostatic pressure developing to an extent to make it necessary to take it into consideration in the stress analyses. Under the worst possible conditions, with all the underdrains clogged, the hydrostatic uplift is limited to the bottom of the reservoir and the footing of the 24-inch wall, and even then the effect of it on the stability of the structure is negligible.

Architectural Treatment

At the writer's recommendation, the city bought the property immediately adjacent to the reservoir to convert it into a park. To improve the appearance of the structure, the buttresses are widened out to three feet at the back, and between them a concrete curtain wall, four inches thick, is carried up for a distance of four feet above the finished grade. Between the tops of the buttresses, concrete arches are sprung. Each arch has a rise of three feet and a clear span of three feet less than the distance between the buttresses. The recess thus formed is filled at a depth of 12 inches with a thin curtain wall of stucco placed on hy-rib. At intervals of 5 ft. 7 ins., the hy-rib is supported by reinforced concrete beams. A concrete walk, 2 ft. 8 in. wide, extends entirely around the reservoir. On the outside of the walk, a concrete railing in conformity with the architectural treatment of the reservoir is built. The false construction just described gives the reservoir a pleasing appearance of massiveness. A driveway, 33 ft. 6 in. over all, extends entirely around the reservoir.

Piping and Drains

The water enters the reservoir through a 24-inch line. The outlet is located at the centre of the reservoir and is of the same size. Circulation is maintained by two check valves, one in the inlet and the other in the outlet, so arranged that the direction of the flow in these pipes cannot be reversed.

The overflow is located 18 inches below the top of the tank. The overflow pipe is 10 inches in diameter. A 10-inch cast iron pipe with its inlet in the lowest part of the spherical bottom and its outlet on the hillside, drains the reservoir.

Monolithic Construction

Some question may be raised as to the economy of constructing a reservoir of the size described without expansion joints. The principal advantage that can be gained by monolithic construction is a general increase in strength. In a large structure, this increase in strength is by no means as great as a casual inspection leads one to believe. It is obtained only at a sacrifice. The stresses in the deck, when built continuous, are no longer static determinate quantities, and their amounts cannot be determined with any degree of accuracy. The stresses developed in the deck acting as a beam are also increased a more or less indeterminate amount by the expansion of the shell under pressure. For these reasons, comparatively low unit stresses must be used in designing the deck. The gain in strength due to continuity of deck construction, practically decreases as the square of the diameter in a structure of the type described. The increase in strength due to continuity of deck construction in large tanks is therefore very small.

Water-tightness of the Structure

Under ordinary conditions, the writer is opposed to the use of water-proofing ingredients or water-proofing applications, as both add considerably to the cost of concrete work. It is far better to put the value of the water-proofing materials into the concrete work itself by adding more cement. In general, the use of water-proofing ingredients or application tends to poor construction work, the contractor counting upon the water-proofing to materially help out careless construction.

The only water-proofing called for in the specifications under which the reservoir was constructed, was two coats of neat cement wash to be applied with a whitewash brush on the inside of the basin. The second coat must be applied before the first one has had time to get very hard.

Before the final acceptance of the work, the contractor was called upon to render the structure water-tight if leakage develops in the basin in excess of five gallons per minute. The reservoir has been filled for a number of months to within ten feet of the top, and the leakage, as measured at the outlet of the under-drains, at no time has exceeded half a gallon per minute. No leakage whatever is visible on the outside of the shell.

Horizontal construction joints are used freely. The unfinished surface of these was always left in as rough a condition as possible, but was never roughened up after the concrete had partially set. The writer's experience is that this roughening often loosens the stones in the partially set concrete, but not sufficiently so that the loose stones can be removed by brushes, a condition which is apt to impair the water-tightness of the structure.

To start a day's work, the old concrete surface was thoroughly cleaned with wire brushes and water, and a semi-liquid mortar mixed in the same proportions as the mortar in the concrete was poured over the old work to a depth of half an inch. This method has given good, water-tight horizontal construction joints.

Vertical construction joints were permitted only over the buttresses as such joints are very difficult to make water-tight.

Cost of the Structure

The following is an approximate estimate of the materials required for the structure, together with the contract unit prices:—

7,271	cu. yds. excavation, including grading,	at $ 0.55	$ 3,999.05
100	cu. yds. rock excavation	at 1.70	1,700.00
965	cu. yds. 1:2:4 concrete masonry	at 9.00	8,685.00
1,739	cu. yds. 1:3:6 concrete masonry	at 7.00	12,173.00
3,400	bbls. cement	at 1.50	5,100.00
189,900	lbs. steel reinforcement	at 0.0425	8,070.75
650	lin. ft. parapet wall	at 1.40	910.00
196	lin. ft. 24-in. cast iron pipe	at 5.40	1,058.40
215	lin. ft. 10-in. cast iron pipe	at 2.00	430.00
110	lin. ft. 3-in. cast iron pipe drain ...	at 0.50	55.00
12,300	lbs. cast iron specials	at 0.05	615.00
2—	24-in. check valves	at 200.00	400.00
1—	24-in. gate valve	at 240.00	240.00
1—	10-in. gate valve	at 25.00	25.00
880	lin. ft. 4-in. tile drain	at 0.12	105.00
160	lin. ft. 6-in. tile drain	at 0.20	32.00
90	lin. ft. 12-in. vitrified pipe	at 0.70	63.00
1	strainer 24-in. outlet pipe	at 7.50	7.50
630	lin. ft. 1-in. pipe railing	at 0.40	252.00
500	lbs. wrought iron	at 0.05	25.00
20,300	sq. ft. of stucco on hy-rib	at 0.15	3,045.00
	Total contract price		$46,991.30

The reservoir was built on the summit of a hill about a mile from the nearest railroad station. All water used for concreting had to be carted up the hill, a distance of about a mile.

The final estimate exceeded the bid price by a very small percentage. The contractor's profit on the work approximated twenty per cent., indicating a reasonably economic reservoir, yet one which presents a very attractive appearance.

The opening of the first section of the percolating filters for the biological treatment of the sewage effluent at Dalmarnock Sewage Works, Glasgow, took place on June 23rd. The necessity for submitting the Dalmarnock chemically precipitated effluent to further treatment has long been recognized by the Corporation, and it was decided to construct filters 1.28 acres in extent on the west side of Swanston street. It is expected that the new filter will be able to treat 4,000,000 gallons of precipitated effluent per twenty-four hours, and when the full installation is completed the filters will be capable of dealing with 24,000,000 gallons per twenty-four hours.

Steel king-post trusses were employed in a large reinforced-concrete hotel of mushroom flatslab construction in Sioux Falls, S.D., to support one of the walls of a light area extending 90 ft. into the building. One wall of this area is supported on the regular line of columns, while the other is placed in the centre of the panel, and to support it from the second storey up steel king-post trusses were placed in the second storey and were supported on the concrete columns of the first storey. The span of these trusses is 24 ft., and they carry a four-storey wall. Each of the five trusses supports a concrete column, which in turn carries the lineal beams and the brick wall. Where exposed these trusses are covered with concrete in order to protect them, as far as possible, from injury in case a fire should start in the hotel.

The extent to which cement tiles are appreciated in Germany is indicated by the fact that the production has now reached the large total of 200,000,000 tiles yearly. The machines generally employed involve two separate operations—the mixing of the mortar and the pressing of the tile. An improved type of tile machine has recently been devised wherein the measuring, mixing, and colouring of the materials and the work of moulding are performed by the aid of two men. The machine is said to be capable of turning out 6,000 tiles, 9 in. by 12 in., in a day of ten hours at a cost of about 36s per thousand.

Canada's Half-Yearly Building Returns

THE building operations throughout the Dominion for the first six months of the year 1913 show, when compared with the same period of 1912, a slight decline. The total of the permits issued in the thirty-two cities tabulated below amounts to $79,787,919 for the first six months of the present year. The total for the same period of last year was $87,353,151, indicating the very slight decline of eight per cent. However, it must be remembered that the year 1912 was an extraordinary year. When the totals for the first half of 1913 are considered apart from any comparison they show a building expansion that would be highly gratifying under ordinary circumstances but our proneness to make comparisons gives rise to a feeling of disappointment because we have not surpassed last year when as a matter of fact the showing has been very creditable indeed.

Out of thirty-two cities reported twenty show a substantial increase, while the remainder show a decrease when compared with 1912. In the amount of permits issued Toronto still leads, with an increase of four per cent. The increase for the first five months of the year was considerable but June showed a decline of over a million dollars. Montreal is second in the value of the permits issued and shows an increase of twenty-three per cent. The highest percentage of increase falls to London and Port Arthur, both rejoicing in a growth of about one hundred and ten per cent. over last year. The increased percentage represents in London about one-half million dollars and in Port Arthur about three-quarters of a million.

The decline, of course, is due to the money stringency, and it is hoped that the spring will see a marked recovery in tone and confidence.

Reports

Fort William reports an increase for the six months. During June 58 permits for houses were issued at an estimated cost of $431,735.

Vancouver—While this city shows a decrease, permits were issued in June for 131 houses, 6 apartment houses, 18 factories and 13 offices and stores. One thousand one hundred and ninety-seven permits were issued for the six months.

Victoria—From the British Columbia capital, Mr. Northcott, Building Inspector, reports a large decrease compared with 1912 but an increase of nearly one hundred per cent. over 1911.

Moose Jaw—The building permits here fell by twenty-four per cent. But the next six months promise to be very active. A terminal elevator, school, and building blocks are in sight for July, totalling nearly two millions.

City	June 1913	June 1912	First 6 mos. 1913	First 6 mos. 1912	Increase per cent. for 6 months
Toronto	$2,036,928	$3,292,766	$13,734,410	$13,195,271	4
Montreal	2,278,424	1,718,505	9,942,285	8,065,993	23
Winnipeg	1,843,350	3,210,370	9,531,400	11,487,150	17*
Vancouver	908,881	1,219,780	7,118,253	8,132,720	12*
Edmonton	1,428,615	2,567,235	6,345,490	7,538,862	18*
Calgary	1,498,620	2,210,000	4,483,620	8,540,670	48*
Hamilton	550,000	670,600	3,391,450	3,145,600	8
Victoria	365,985	617,860	2,757,765	4,647,600	41*
Regina	810,995	1,048,830	2,726,130	2,549,770	7
Ottawa	578,650	417,750	2,646,505	2,120,000	25
Fort William	431,735	232,070	2,636,835	1,743,425	51
Saskatoon	249,310	1,601,000	1,859,395	4,634,000	59
Moose Jaw	551,610	531,555	1,667,895	2,194,525	24*
Medicine Hat	248,515	212,445	1,366,680	1,000,617	36
Maisonneuve	241,750	243,200	1,153,123	1,572,428	26*
London	155,653	140,558	1,063,867	509,598	109
Port Arthur	511,895	174,884	1,475,805	702,474	110
Prince Albert	304,600	278,900	1,055,690	1,008,300	4
North Battleford	352,600	335,285	736,095	565,190	30
New Westminster	139,875	96,850	719,135	785,578	8*
Windsor	183,125	114,125	513,790	433,330	18
Berlin	42,675	85,925	419,229	340,058	23
Lethbridge	24,112	103,503	402,555	719,345	44*
Kingston	49,960	75,335	354,295	224,059	58
Brandon	182,769	154,850	350,919	354,850	1*
Peterborough	94,806	67,095	305,165	187,858	62
Galt	31,810	28,080	256,737	209,032	23
Welland	34,976	19,313	229,186	124,186	85
St. Catharines	55,720	128,950	236,780	338,640	30*
Nanaimo	11,000	36,853	160,965	125,292	28
St. Thomas	22,100	5,280	74,570	40,645	83
Chatham	10,300	19,090	71,900	116,085	38*
	$16,231,344	$21,658,842	$79,787,919	$87,353,151	

A falling off of about 8 per cent.

*Decrease

Medicine Hat has approved of by-laws providing for very extensive civic expansion in roads, sewerage system, etc.

Galt shows the very creditable increase of twenty-two per cent., but finds building operations delayed by a lack of brick.

Nanaimo has recently been connected with the mainland by means of a telephone cable. This will doubtless facilitate business. Although handicapped by a miners' strike there has been an increase of twenty-nine per cent.

Winnipeg, although showing a slight falling off from last year, has issued nine and one-half million dollars worth of permits. A very satisfactory year surely.

Saskatoon—Mr. Vernon Knowles, while reporting a considerable falling off in the value of the building permits, is at the same time able to report a very substantial amount of building under way. There is no tone of uncertainty in the report. The Dominion Government is about to let the contract for a two million dollar interior storage elevator. Contracts for a Presbyterian College, a separate school and a large city hospital have been awarded. Residential building has increased. The falling off has occurred in the large structures owing to the difficulty of securing loans.

New Grand Trunk Pacific Hotel

Following out their policy of constructing a chain of hotels, the Grand Trunk Pacific Railway Company have commenced the erection of the Hotel Qu'Appelle at Regina, the capital of Saskatchewan. In some respects the site is similar to that of the Chateau Laurier, Ottawa, on Major Hill Park, immediately opposite the Central Union Station, and but a short distance from the Dominion Houses of Parliament. In Regina, the site selected is Wascana Park, at the corner of Sixteenth avenue and Albert street, two sides facing these thoroughfares and the other elevations overlooking the park and commanding a view of the Provincial Parliament Buildings. The architects, Messrs. Ross & Macdonald, Montreal and Winnipeg, have arranged with the owners to set the building back from the street line sufficiently to give it a setting and relationship to the surrounding landscape that takes advantage of the admirable situation to the fullest extent. Architecturally, like the other three G. T. P. hotels, it is of the Chateau type and promises to be equal to, and may even excel in design and detail, also in arrangement and equipment and structures completed and now under construction.

Immediately opposite the hotel, the new station will be erected, providing for tourists and travellers, as guests, convenient and immediate communication with the hotel. The station building will also include the power house, from which light, heat and power service will be transmitted to the hotel through a service tunnel under the streets.

The main entrance will be placed in the centre of the Albert street elevation. A few steps lead from the entrance to the concourse or rotunda, and immediately opposite this entrance, commanding also the ladies' entrance, the elevator, stair, palm room and dining room approaches, has been placed the office. Adjoining the rotunda the telephone and telegraph booths and the news and cigar stands will be situated. The palm room and main dining room overlook the park, and doors from the palm room open on to a terrace, from which steps lead down to the park.

The main dining room, palm room and rotunda extend through the height of two storeys, the main floor and the mezzanine. The mezzanine provides a musicians' gallery for the dining room, a gallery overlooking the rotunda and a spectators' view of the dining room. It also provides a private dining room, a small banquet room and manager's office, providing the facilities for private entertainment and gives the manager's office a key position in the administration of the building. Immediately upon entering and before ascending the few steps to the main floor, approach may be made to the grill room and bar by stairs leading left and right from this entrance landing. Above the main floor and the mezzanine, there will be seven floors for guests' bedrooms. All rooms facing Wascana Park and the streets, will have outside private bathrooms, all rooms to the main court will have running water, and on every floor will be provided ample toilet room accommodation.

Hotel Qu'Appelle, Regina.

There will be a total of two hundred and twenty-four bedrooms, almost all of which can be used as double rooms on account of their large dimensions. The grill room, bar, barber shop, general toilet, main service and kitchen are in the basement, and the laundry, stores, locker-rooms, elevator machinery and refrigerator equipment in the sub-basement.

In construction the exterior will be of a selected grey brick with stone dressings and finish; the interior will be of steel frame and re-inforced concrete. The typical floors of guests' rooms will be finished with hardwood doors and enamelled white trim.

The man who spends all his time looking after the little leaks of his business will have no time to spend in watching the big leaks. Make it somebody else's business to watch for the minor losses.

Corrosion of Lead in Various Mediums*

Nature of Corrosive Action—Imbedded in Concrete—Buried in Soil — Immersed in Water — Effects of Electrolysis

By Richard H. Gaines, Chemist Board of Water Supply, New York.

THE problem to determine what particular metal or combination of metals is best suited for a given purpose in engineering construction is sometimes one of great difficulty. A mistake in judgment may be at the expense of economy or durability or may even lead to a disaster. The decision of the engineer, to be correct, must be based on a thorough knowledge of the physical properties of the metals under consideration, and this is generally gained by experience.

In many constructions the choice of some of the materials is determined more by their durability under conditions of working than by their strength or other properties, a more expensive and weaker material being often chosen in preference to a cheaper and stronger one on account of superior resistance to corrosion. Examples of this are afforded by the frequent use of special bronzes in places where, except for their durability, the stronger and cheaper iron and steel would be preferable.

Incidental to a recent study to aid in determining whether it would be safe to substitute lead-lined steel pipe for bronze pipe where a material of great durability was required in portions of a water conduit some experiments were made and facts were collected from the experience of others bearing on the corrosion of lead. From the data obtained it was concluded that for the particular purpose in view the relative merits of bronze pipe and lead-lined steel pipe would hardly admit of comparison. Under whatever conditions lead withstands the action of water or acids, the bronzes are similarly unaffected, while under other conditions of service in which the bronzes are practically untouched by corrosive action lead would be destroyed. Lead-lined steel pipes no doubt have their uses in the chemical manufacturers, and may also find extensive application for the conveyance of hard waters, or acid waters of a certain character in mines, but they cannot be recommended for use in connection with city water supplies. Owing to its peculiar physical and chemical properties, lead affords a doubtful protection to iron or steel conduits from corrosion, and under some conditions might prove an absolute disadvantage, if not an actual menace, to the life of the pipe.

The Action of Alkalies

A peculiarity of lead is that it may be corroded either by alkalies or acids. Thus, lime mortar, lime putty and lime water will attack lead; if the mortar is very alkaline, the effect will be greater. Proof of this was established by experiment as well as from observation of lead service pipes in wet concrete.

The following experiment was made to test the effect of an alkaline seepage water on lead: A weighed sample of lead was immersed for a period of eight days in seepage water that leaked through the concrete walls of a tunnel. The sample was taken out daily, washed, dried and weighed, and the loss in weight noted. At the end of the test period it was found that progressive corrosive action had taken place, amounting to 0.132 per cent. in eight days, or at the rate of about 6 per cent. a year.

Several examples of corrosion of lead service pipes in wet concrete were observed, one of which will suffice to be mentioned here. In a bathing establishment in Brooklyn two lead pipes passed up through a concrete floor—one of the pipes was for hot water and the other for cold water. Owing to the free use of water on the floor the concrete was wet much of the time. Here the lead pipe for the conveyance of hot water was nearly destroyed by corrosion in five years, while the cold-water pipe was also deeply corroded. No evidence was found of leaking electric currents in the building to aggravate this action.

Corrosion in Concrete

A series of experiments was made to determine what loss lead suffers from corrosion as compared with steel and some other metals when embedded alone or in contact in very damp concrete.

Specimens of the following metals were weighed and embedded singly and in contact in damp concrete and allowed to remain therein for two months. At the end of the test period the concrete blocks were broken up and the metals taken out, carefully cleaned, dried and reweighed, the loss in weight representing the amount of corrosive action in each specimen.

Single Specimens

	Grams		Grams	Loss
	Wt., Jan.	Wt., Mar.	Loss	Grams
Metal:	2, 1912	4, 1912	2 mo.	sq. ft.
Manganese bronze ..	73.6655	73.6475	.0180	.32
Steel	39.1556	39.1481	.0075	.135
Lead	92.3806	91.7146	.6660	11.99
Copper	73.7630	73.7272	.0358	.64
Monel metal	62.9667	62.9646	.0021	.04
Metals in contact:				
Steel	37.0380	37.0270	.0110	.20
Manganese bronze ..	70.6864	70.6700	.0164	.30
Steel	37.1746	38.1700	.0046	.08
Lead	90.0399	89.5408	.4991	9.08
Steel	38.8055	38.8031	.0014	.03
Copper	70.1913	70.1348	.0565	1.04
Steel	38.6396	38.6271	.0125	.23
Monel metal	60.1092	60.1074	.0018	.03
Steel	34.5625	34.4626	.0999	2.48
Lead	83.8596	83.5163	.3433	6.77
Copper	68.9752	68.9626	.0126	.31
Steel	34.8702	34.8026	.0676	1.68
Fiber	....	....		....
Copper	64.1247	64.1122	.0125	.31

The resulting losses show but slight differences when in contact and alone, and therefore give no evidence of electrolytic action when the metals are coupled in concrete. With the exception of the lead, the corrosion loss of all the metals was small, that of the monel metal almost nil.

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* Engineering Record.

The action of the lead confirms results obtained from actual experience and shows that this metal may suffer very appreciably in an alkaline as well as acid medium. The corrosive action in this case was observed to be solvent in character, no protective coating being formed to hinder further change.

Sir William Crooks once said that lead was the first cousin of thallium, which Lothar Meyer called the ornithorhyncus of the metals. This strange Jurassic animal possessed the body of mammal and the beak of a bird. Whether such a doubtful order of relationship in the family of elements is true or not, it is a fact that the chemical properties of lead are very peculiar, and they present some remarkable contrasts. While lead resists the action of sulphuric and hydrochloric acids in a far higher degree than iron, zinc or tin, it is readily attacked by weak organic acids and is slowly dissolved even by pure water containing air.

With respect to corrosion the behavior of lead is decidedly inconsistent. Notwithstanding that lead is very slightly acted on by some of the strong mineral acids in the cold, it is soon extensively corroded when exposed to the action of moist air in the presence of carbonic acid and eventually becomes converted into a mass of white lead. Since carbonic acid is produced abundantly in the decay of animal and vegetable matter, metallic lead is much affected when kept in contact with such substances in the presence of air, the oxygen of which unites with lead to form an oxide which then combines with carbonic acid. The oldest process for the manufacture of white lead depends upon the corrosion of the lead by contact with decaying organic matter in this manner. Bloxam, in his work "Metals and Their Properties," makes this statement: "In breach-loading cartridges where grease is employed as a lubricator the bullets have sometimes become partly converted into white lead and thus increased so much in bulk as to burst open the copper case of the cartridge and render it useless."

The Corrosion of Lead in the Soil

The impression prevails among many engineers that in the absence of stray currents the corrosion of lead in the soil is neglible. This is not always true. The facts are that while in some soils lead is very slowly affected by corrosion, in others an active chemical change or deterioration of one kind or another takes place. For example, "the lead of old coffins is sometimes found to have become almost entirely converted into an earthy looking mass of basic carbonate of lead." (Bloxam, "Properties of Metals").

The Russian engineer A. N. Schensnovitsch, of Odessa, recently sent by his government to New York to examine our pier and dock system, told the writer of an interesting case with which he was familiar of the destruction of lead water pipes by corrosion that occurred in St. Petersburg during the '70s, before the days of industrial electricity or other conditions that could give rise to electrolysis. According to this engineer, in 1860-61, or thereabouts, a quarter of the City of St. Petersburg was served with water by a system of lead mains. In from ten to fifteen years these pipes had become so pitted by corrosion as to necessitate extensive changes. The cause of the trouble was attributed at the time to some local peculiarity of the soil, the exact nature of which was never ascertained. Mr. Schensnovitsch stated that the whole system was subsequently replaced by cast-iron pipes, which had proved durable and satisfactory. The superintendent of the waterworks of a suburban town in the vicinity of New York City told the writer that several years ago he had occasion to renew a number of lead service pipes on account of deterioration from corrosion. As he expressed it, "The pipes were pretty well used up, presenting the appearance of just having passed through a severe attack of smallpox. The lead, moreover, had the appearance of having lost all its vitality. There was no indication of electrolysis playing any part here."

In several cases reported by recent engineering periodicals accounts are given of the lead pipe in the earth "losing its vitality, becoming brittle and porous, rendering renewal necessary after a comparatively short period of service, or the substitution of some other kind of pipe." Cases are also reported where it was deemed necessary to lay the lead pipe in wooden troughs, to surround it with pitch, or to otherwise protect it from the corrosive influence of the soil.

The Corrosion of Lead in Water

So far as ordinary atmospheric corrosion is concerned, lead is one of the most durable of the common metals, undergoing no change in dry air or in water perfectly free from air. It is, moreover, only slightly affected by hard waters or dilute solutions of either hydrochloric or sulphuric acids. The latter acids quickly form coatings on the surface of the metal, which protect it from further action. Lead, however, is readily dissolved by water high in nitrates and by dilute nitric acid. It is also more or less rapidly corroded by weak organic acids in contact with moist air. Certain waters which actively corrode lead are those with a slightly acid reaction from peaty swamps. There are certain microbes associated with peat which are acid producing, and which impart acidity to waters which have been in contact with peat.

Soft waters are particularly unsuited for conveyance in lead pipes, and in such waters containing nitrates derived from decaying vegetation the amount of lead dissolved is large. Every plumber knows that pure soft water will attack, and sometimes destroy, lead pipes. For this reason it has often been found necessary to line lead pipes with tin.

When lead pipes are acted on by water the corrosion is more or less irregular, some portions being hardly attacked, while in other parts holes may be eaten through. This does not seem to be due to any irregularity in the metal but merely to accidental circumstances. One authority quotes various experiments to show that lead water pipes should be kept full of water all the time to prevent deterioration.

The corrosion of lead by pure aerated water takes place as follows:

Lead (Pb) + Dissolved Oxygen (O) = Lead Oxide (PbO)

PbO + Water (H_2O) = Lead Hydroxide (PbO_2H_2)

If exposed to the action of clean, soft water containing the normal quantity of dissolved oxygen, the lead is oxidized to hydroxide, which dissolves. After a time this is converted, by the action of the atmospheric carbon dioxide, in the basic carbonate of lead, $2PbCo_3$ and $Pb(HO)_2$. Lead hydroxide is then again formed, and thus the corrosive action may be continued.

Potable waters always contain a certain amount of salts in solution, and the corrosive action depends to some extent upon the nature and quantity of the salts present. The waters which act least on lead are those containing carbonate of lime, phosphate of lime, and, in a less degree, sulphate of lime. The waters which are most liable to act upon lead are those obtained from upland gathering grounds, waters which are soft and usually of remarkable purity. When highly oxygenated the latter form no protective coating against solvent action. On account of the quantity that may be thus dissolved lead has always been considered a more or less dangerous metal in connection with water supply for drinking purposes. Acting as a cumulative poison, its salts produce serious results if taken into the system, even in very minute quantities, for any length of time. Although indirectly related to the subject of corrosion, the experience of certain of the towns of Lancashire and Yorkshire in England should never be forgotten where the use of lead water pipes is under consideration. In these towns lead poisoning was prevalent for a considerable period, doing immense damage to the health of the inhabitants before its real nature was recognized and its cause discovered. Incidentally, it may be said that the compounds of lead are poisonous practically in proportion to their solubility. Thus the metal itself and its sulphide being incapable of absorption as such into the system are practically innocuous, while the soluble salts—nitrate, chloride and acetate—are active irritant poisons. The oxide, sulphate and carbonate are much less active, but continued exposure to lead fumes or to any atmosphere in which these substances are present in the form of dust brings on first "lead colic" and later, if exposure to the dust or fume is continued, a more chronic form of poisoning called "lead palsy," accompanied by great emaciation.

The Corrosion of Lead by Electrolysis

Instances are commonly reported of the electrolysis of lead pipes. In some of these cases, such as have occurred at St. Paul, Omaha and Paterson, N.J., all the phenomena of electrolysis were no doubt present. In others damage from stray currents has by no means been proved, while the observed phenomena rather suggest ordinary chemical corrosion. In several cases of lead-pipe deterioration, called electrolysis, it was found that molecular changes of another character had taken place in the metal, similar to what Milton and Larke (Proc. Inst. C. E.) described as decay.

The electrolysis of either lead or lead-lined steel pipe, however, is a very real trouble, and the interest attaching to it here is the ease with which it may occur and the rapidity with which serious damage may be done. A few years ago the Westinghouse Electric Company showed by experiments at Pittsburgh how readily buried lead pipe could be corroded by electrolysis. This company also made a series of tests in different soils to compare the corrosive action of stray currents an embedded lead and steel pipes. It was demonstrated that in some soils lead pipe was even more rapidly destroyed by electrolysis than steel. This accords with actual experience reported from several cities. At St. Paul, where considerable damage to lead water pipe occurred, presumably from electrolysis due to escaping current from electric railway lines, cast-iron pipe in the path of the same currents is said to have been little affected by corrosion. In New York City an engineer connected with the water department told the writer that in the few instances in which there had been any trouble from electrolysis of water pipe in Manhattan, "the lead joints were the first to go."

Improvement in Garbage Incinerators

By John Hammersley-Heenan

The amount of garbage or refuse that has to be disposed of daily in a city averages from about three-quarters to one ton per thousand of population, so that in a city of five hundred thousand people there will be nearly 500 tons to collect and dispose of every day.

In the early life of a town it is usual to collect and dump the refuse upon some waste ground at a convenient point in or near the town; but as the population increases, and the town spreads, it becomes more and more difficult to find available space for this purpose, and ultimately the city authorities are forced to turn their attention to other methods of refuse disposal.

The Garbage Incinerator—or Refuse Destructor, as it is more commonly called in England—has come very much into favor during the last ten years or so. In plants of this description the ashbin and other waste materials of a city are burned at a high temperature, the heat from the combustion being utilised to generate steam. The burning of refuse is not new; in fact it may be said to be very old, for it has been the practice of natives living in some hot climates to dispose of their refuse in this way for many centuries. Even with us the practice is by no means new, and if records could be traced it would be found to have existed for some hundreds of years. It was however not before the middle of the 18th century that the matter was seriously take up on a large scale, and a number of crude furnaces constructed in London.

These furnaces were improved upon from time to time, but it was not until about twenty-five years ago that certain engineers realised the possibility of utilising the heat generated. Setting to work, they designed new plants, the forerunners of those in operation today.

First Destructors Designed

It would be impossible to describe many of the earlier designs in an article of this kind without making it tedious. Let it suffice therefore just to mention a few of the most important and give a short description of one of the best known modern incinerators.

One of the first plants of any importance was that built by Messrs. Manlove & Alliott from the designs of Mr. Fryer in about the year 1876. The arrangement of this furnace is shown in Fig. 1. At the back of each cell there are two openings. Through the one the refuse is fed into the cell, and from the other the gases of combustion are carried off. These openings are clearly explained in Fig. 1, the right-hand half illustrating the charging inlet, and the left-hand half the discharge outlet through which the gases pass from the furnace to the large central flue or combustion chamber, and thence to the chimney stack. A number of these plants were built in England and some of them are still in use; but the type is rapidly disappearing.

About ten years after the first "Fryer" furnace was built, a new design appeared upon the market known as the "Beehive." It had several new features, but did not come up to the expectations of its designers. Mr. Young, of Glasgow, designed a furnace about this time, which was interesting inasmuch as he closed up his ashpit and used a fan. Following these was that of Mr. Horsfall (Fig. 2). The air supply in this furnace was forced by means of a steam jet. A year later the "Warner's Perfectus" appeared. It gave good results, and was a decided advance in design. During the year following a great many improvements were made and a number of new destructors appeared upon the market, notably those of Messrs. Bulnois & Brodie (Fig. 3) and Messrs. Beadman & Deas (Fig. 4).

Messrs. Meldrum Bros. and Messrs. Heenan & Froude were the next to appear upon the market with furnaces very similar in design. The principal feature in these designs was the adoption of what is known as the continuous grate and it was this principle combined with the other improvements made that has enabled these plants to become the efficient machines they are. As many of these plants are being installed all over the world, a short description of them should be of interest.

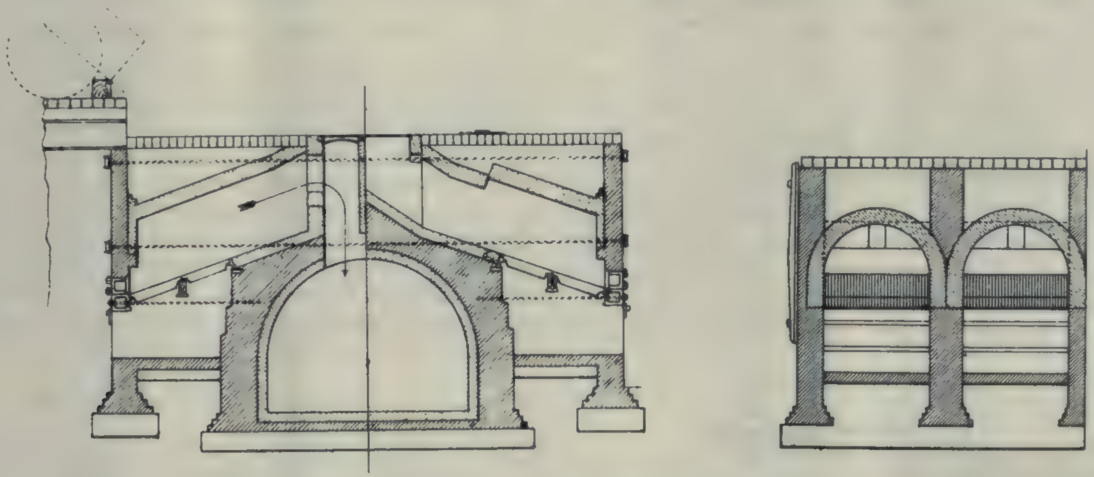

Fig. 1.—One of the first incinerators designed.

Large stations consist of a number of units all under the same roof, and connected to a common chimney, each unit consisting of a continuous grate, combustion chamber, boiler, air-heater, and fan.

The refuse is burned upon the continuous grates, hot air being forced through it from the ashpit. The gases of combustion pass off to the combustion chamber, where the combustion is further advanced. This chamber also acts as a trap for much of the dust carried over from the grates. The gases then pass through the boiler giving up most of their heat to the water, but as they leave the boiler still retaining a fair amount of heat, they are passed through an air-heater which transfers about half of this remaining heat to the air supplied for combustion.

The furnaces are constructed of brick, and lined with fire-brick where exposed to high temperatures, the whole being bound together by vertical steel channels connected with tie rods.

The continuous grate usually consists of three or four cells, connected, but having separate ashpits. The roof of the cells is an arch of fire-brick run from front to back wall. In the Meldrum, this arch runs straight from end to end of the cells, but in the Heenan it is forced with undulations, the makers claiming that these undulations cause the gases to be better mixed.

Cast iron fire bars are used, supported upon cast iron frames, the usual provision being made for expansion. The air space between the bars varies from ⅛ in. to ⅜ in. for average refuse.

To each of the ashpits is connected a duct, which supplies hot air for the combustion of the refuse and is controlled by a valve or damper actuated from the front of the furnace.

At the front of each furnace a door is provided, through which the firing is done and the clinker removed. There is also another door or opening located at the top or back of each cell. These doors are all made of cast iron and lined with fire-brick. They are suspended by a wire rope passing over two pulleys a balance weight being attached to the other end, thus enabling them to be easily opened. When closed they fit tight, the joint being made of asbestos cord.

The combustion chamber is placed at the end of the continuous grate. It is simply a brick chamber of liberal dimensions, open at one side to the grates and on the other to the boiler. Besides its other uses, this chamber serves to cremate the carcases of horses and other animals, for which purpose a door of suitable dimensions is provided at the front of the chamber.

Boilers now installed for these plants are more often of the water-tube type, and are built up just as they would be for coal firing, except that the grates not being required, are not installed. The hot gases pass in at the side from the combustion chamber and circulate round the settings in the usual way.

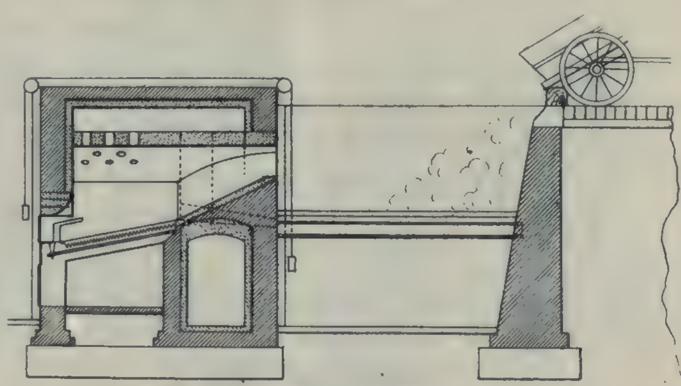

Fig. 2.—Air supplied by a steam jet.

The air heater plays a very important part in these plants, handing back to the furnace a portion of the heat which would otherwise go up the chimney. It consists of a number of wrought iron tubes traversing a wrought iron box. The hot gases pass through the tubes, whilst the air for combustion is drawn over the outside of them.

Air for the combustion is collected in a trough under the roof. It is sucked down a duct by a fan and then forced through the air-heater to the ashpits. In the Meldrum furnace, instead of a fan, steam blowers were used, one being provided for each ashpit.

Factors in Design

The design of an incinerator will depend to a great extent upon the nature of the refuse that has to be burned; therefore a careful examination of the waste should be made. It will be found that there is a considerable difference in its composition and quality as a fuel. The refuse of one district will not resemble that of an adjoining district, and the summer refuse will vary from that of the winter. Where coal is cheap, people are not very careful when cleaning out their fires, with the result that the refuse will be found to be rich in unburned coal. In parts of the world where people are very poor and coal is not extensively used, as, for instance, Bombay, a town in which these conditions are found, every particle of useful material is removed from the ashbins, so that there is little but incombustible material left for the incinerator.

To estimate the heat value of a refuse, it will be necessary to select an average sample, and to do this successfully needs some experience. Have the sample chosen picked over and separated out into its constituent parts. The addition of the heat value of each of the constituents will give the heat value of the whole sample. The calorific value of average refuse containing the usual amount of moisture will be found to be 3,000 B.T.U.

Sand mixed in the refuse will be found to affect the burning of a fire, as the silicate will be fused, and form into a liquid skin or layer which prevents the air being forced through the grates. The peel of some fruits, such as that of the pineapple, when burned in large quantities, gives off an acid that tends to put out the fire.

Selection of a Site

The selection of a site for an incinerator will depend upon local conditions and no definite rules can be laid down. In making a selection it should be born in mind that the cartage is a very heavy item, so that the more central the site the less the cartage will be. Residential property should be avoided as much as possible, and a site selected with plenty of room for the handling of the carts and clinker.

A well-designed modern incinerator can be arranged to consume refuse without causing any smell, smoke, or dust; but there is no getting away from the fact that the fuel these furnaces are burning is at times unpleasant, and this material is being continually carted through the streets approaching the plant, and this must at times prove objectionable to the residents.

The building should be large enough to accommodate the plant and to permit all carts to be unloaded under cover. This prevents any dust escaping and causing a nuisance to the neighborhood. All the approaches should be paved so that they can be washed down regularly.

In Europe the grounds surrounding the buildings have in several instances been planted with trees and shrubs. This has done much to annul the feeling of uneasiness caused by the knowledge of having a plant of this kind working in the district.

Methods of Feeding the Incinerator

Refuse is usually fed into the furnaces by hand, as owing to its variable nature, the problem of feeding mechanically has not been successfully solved. There is however one method known as the "tub system" which has found some success.

For hand-feeding, an aperture is provided either at the top or back of the furnace. The top feed would at first sight appear to be the more convenient, but in practice it is found open to the objections that the aperture is placed at the centre of the roof-arch thus weaking the latter at the point where it is exposed to the greatest heat, and that when the aperture is open the flames are apt to shoot up and inconvenience the firemen.

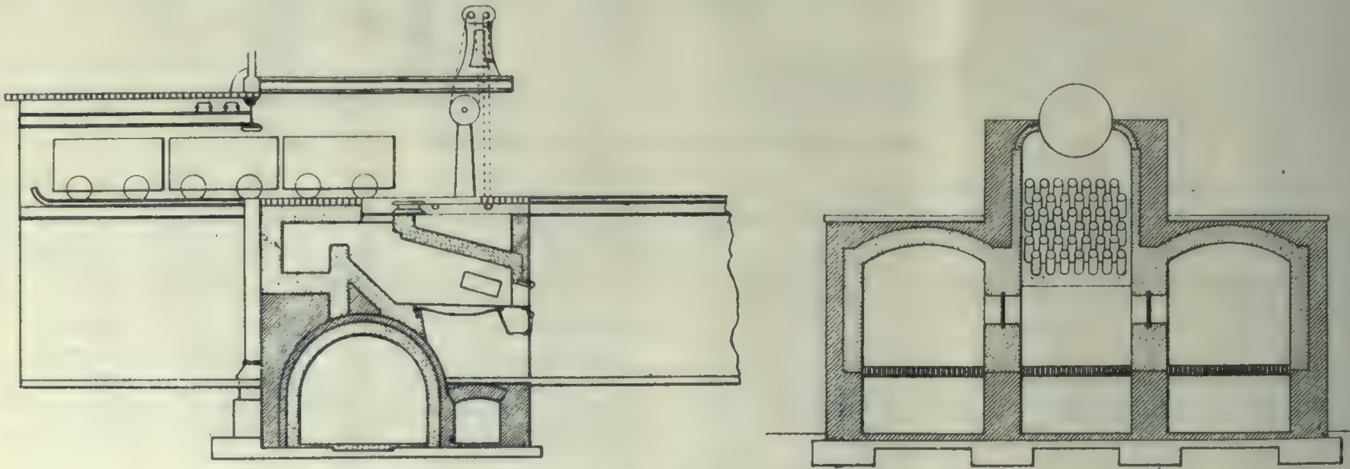
Fig. 3.—Improved design by Messrs. Bulnois & Brodie

In the tub-feed, the refuse is fed into the tubs, which are mechanically lifted up and placed over openings, on the top of the furnace, the furnace door and tub hopper door being then opened together, and the refuse shot into the furnace. The system has the advantage that the operation is done quickly, and the doors are not kept open for very long.

For a small plant of only a single unit a certain number of men are required to attend to it, and as these men can also attend to the feeding of the refuse, it is not often possible to justify the cost of installing any form of mechanical feed in such cases.

The firing and removal of clinker is done from the front of the furnace. The doors for this purpose should be larger than the feeding doors, and the bottom of the door should be slightly lower than the level of the top of the fire bars. The clinker is removed by hand, drawn into barrows, or on a suspended tray, and conveyed to the dump. It will be found that it can be more readily removed from the fire bars if a small quantity of steam is admitted into the ashpits with the hot air. The exhaust steam from the fan engine will be found sufficient for the purpose.

For hand working it has been found that a cell of about 25 sq. ft. of grate area is most convenient; but for tub feed smaller grates have been tried and found better. As previously explained, the cells are arranged in rows of three or four so as to form a continuous grate, but the ashpits are kept separate as this arrangement enables the air supply to each cell to be controlled. The advantage of the continuous grate is that a more uniform temperature, and thus higher average temperature can be maintained. For instance, in a three cell unit, when one fire is being cleaned theoretically the heat is reduced to 2/3, and in a four cell to ¾. In practice, however, the results are better than this would indicate, because when the fan is cut off from one cell, it tends to force up the remaining ones, thus increasing the temperature. Again after a cell has been recharged, instead of its taking some time to dry, and start burning, it is assisted by the other fires as they soon dry the moisture out of the new and in a very short time the cell is again in full blast.

The quantity of refuse burned will depend upon its nature, as 60 lbs per sq. ft. of grate has been burned, but unfortunately this high ratio cannot be maintained under normal conditions of working, and the quantity will generally be found to average under 40 lbs. per sq. ft.

Temperature to be Maintained

The temperature that must be maintained in the furnace is a very important point. To deodorize the gases, a temperature of not less than 1200 degs. F. will be required. On the other hand a temperature exceeding 2000 degs. F. will be found to be too severe upon the brick lining, and it will also tend to fuse the particles of dust passing over to the combustion chamber. Therefore, for economical working it will be found advisable to attempt to maintain a temperature at a little below 2000 degs. F. as it will then be found, that when a cell is being cleaned out, it will be possible to prevent the temperature falling below the lower limit.

By taking the air supply from a trough at the roof of the building, all fumes escaping from the furnace, or odours from the refuse, are sucked down into the furnace, and as there is an indraught induced at the doors and openings, any unpleasant smell is prevented from getting out of the building.

The fan is capable of delivering the air (which has been heated by the air-heater to a temperature of between 150 and 200 degs. F.) at a pressure which can be varied up to several inches of water.

The draught of the chimney and the fan pressure should be regulated so that the pressure above the grates is the same as that of the atmosphere. If the pressure above the grates be lower than the atmospheric pressure there will be an inrush of cold air every time the doors are opened, and consequently a drop in temperature in the furnace. If the pressure above the grates, on the other hand, be higher than the atmospheric pressure, higher temperatures will be obtained, but every time the doors are opened the flames will shoot out in a way that will be inconvenient to the firemen.

The combustion chamber should be constructed with ample dimensions, to catch the dust and have sufficient depth to hold an accumulation of it. The boilers used may be of the water-tube or Lancaster type. They both have their advantages, but the former seems to be more favoured; it certainly fits in better with the general arrangement, and is easier to clean. On the other hand the Lancaster boiler has a large storage capacity, which is an advantage for incinerator work.

The Foster Superheater has found some favour for this class of work as it consists of a number of cast iron rings shrunk on steel tubes. The cast iron rings store heat and so the superheating does not fluctuate to the same extent as it otherwise would.

Generation of Steam and Disposal of the Clinker

In concluding reference will be made to the steam generating qualities of these plants; and the disposal of the clinkers.

It must be borne in mind that the primary object of an incinerator is to burn the refuse in a sanitary way, and that steam raising, and the quality of the clinker produced are secondary considerations.

Under favourable conditions incinerators have been able to produce over 2 lbs. of steam per lb. of refuse from and at 212 degs. F., but it must not be imagined, from these results, that under ordinary conditions the average output will be nearly so high as it will be found to be nearer ¾ to 1 lb. per lb. of refuse. And when figuring the steam to be expected from a plant, it would be safer to take the lower limit.

One of the drawbacks to the use of the steam generated by an incinerator is the way in which the supply fluctuates. This is particularly noticeable when one small unit is working alone, but it becomes less and less perceptible as the number of units is increased. Another objection is the difficulty of conveniently varying the quantity of steam supplied. As for sanitary reasons the incinerator has to burn the refuse as it is delivered, regardless of the demand for steam, thermal storage has been suggested as a means of overcoming this difficulty but too large an addition to the capital expenditure would thus be involved. Perhaps the most satisfactory way of overcoming the difficulty is to work the incinerator in conjunction with a battery of coal-fired boilers; it is then possible to allow the incinerator to work continuously and to regulate the steam output by means of the coal-fired boilers.

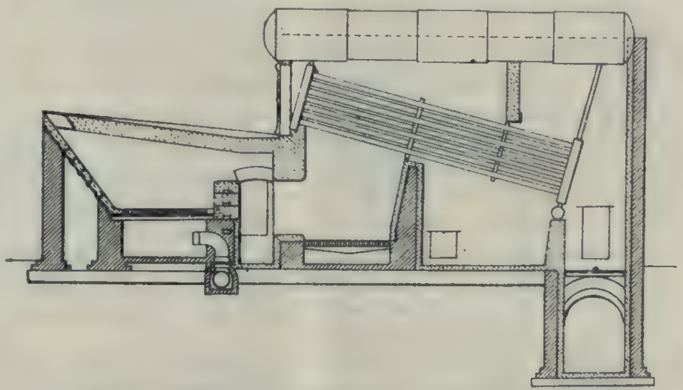
Fig. 4.—Designed by Messrs. Beadman & Deas

In most cities the clinker will be found to be a source of income. The quantity produced will vary from 25 to 30 per cent. of the refuse burned, so that proper arrangements should be made for its handling and storage. Much of it can be sold in the state in which it leaves the furnace, but sometimes it is found better to lay down a small plant to crush and screen it. In other cities it has been found advantageous to lay down a plant to make concrete paving slabs and building blocks.

The most valuable asset in any business or vocation in life is knowledge.

Union of Canadian Municipalities

The Union of Canadian Municipalities is holding its annual meeting at Saskatoon, July 15-17. After the address of welcome by His Worship Mayor Harrison of Saskatoon, and replies by the delegates and the presidential address by His Worship Mayor Lavallee of Montreal, the honorary secretary-treasurer of the Union, Mr. W. D. Lighthall, K.C., presented his report, the substance of which we give below.

In the report it was pointed out that upon the occasion of the previous visit of the Union four years ago, all had been struck with the wonderful prospects shown in the northwest cities. Since that time everything showed that these propects were being realized and now the delegates of the Union had returned to find to a very large extent the full fruition of the promises of the former visit.

Part of the work of the Union of Canadian Municipalities is to try to secure legislation which will prove beneficial to the municipalities. The question arising from the judgment of the Privy Council in the case of North Toronto and the Toronto and Niagara Power Company, which was the subject of one of the principal resolutions of the last convention and involved the great matter of control of streets in general, was the occasion of a large and influential delegation to Ottawa. In reply to the representations of the delegation the Dominion Government promised relief by legislation. Other questions were also involved in the pending revision of the Railway Act. Owing to the prolonged naval debate these questions were forced to stand aside for the time being. The International Municipal League suggested at the Windsor convention has been established and is getting into operation. The Secretary appointed,—the widely known Mr. Clinton Rogers Woodruff, Secretary of the National Municipal League of the United States,—has thrown into the matter all his usual zeal and ability. Several of the principal British Municipal Associations, and those of South Africa, New Zealand and Australia have taken favorable action, and negotiations are in progress with the International Municipal Association of Europe at Ghent this summer.

The secretary further indicated that the Union had taken up the question of the building of an interprovincial highway across Canada. The principal cities and towns are in favor of such a road. The Dominion Government has been approached upon the question and there is no doubt as to its ultimate construction.

The subject of town planning, which was one of the important questions of the day, has also received considerable attention and the establishment of a Dominion Department of Statistics for municipal purposes has also been pressed upon the government.

Other significant features noted in the secretary's report are as follows:

An event of some importance has been the organization of the Union of Quebec Municipalities which is ably officered, and from which good results may be expected. It will hold its regular convention this autumn.

A bill was again introduced into Parliament to prevent pollution of waterways by municipalities. It once more brought protests from Halifax and other maritime places, where its application would be objectionable. Would it not be wise to suggest that the opposing views be brought into harmony by exemption of certain regions or classes of localities? A resolution of this Convention might be of assistance.

The cement duty question came up again and the Union took the same stand as formerly. The government refused any rise in the duty.

A bill to allow the Postmaster General to fix rates of post office carriers on electric railways attracted some attention, being caused by a heavy demand by the Tramways Company in Montreal. But we found that the bill did not apply to municipally owned railways.

The work of our Bureau of Information and of the "Canadian Municipal Journal," our official organ, has been constantly effective.

This being the first of the years of celebration of the Hundred Years Peace, it may be fitting to remark on the propriety of a representative body such as this expressing itself on the subject, since no bodies are more interested in peace than the municipal governments.

The programme, which is one of unusual interest, announces that papers will be read by Mayor Hocken, Toronto, Mayor Short, Edmonton, Mayor Gray, New Westminster, Mayor Graham, London, and Mayor Oliver, Port Arthur. J. M. Bayne, Deputy Municipal Commissioner of Saskatchewan, C. J. Yorarth, City Commissioner of Saskatoon, T. L. Church, City Controller, Toronto, and W. D. Lighthall, Honorary Secretary of the Union, will also discuss questions of vital importance on municipal development in Canada.

Copper Clad Wire Litigation Dismissed

The first judgment in the important litigation in regard to Copper Clad Wire which has been contending in the United States Court in Pittsburgh, Pa., for the past two and a half years between Duplex Metals Company of New York, complainant, and the Standard Underground Cable Company, Pittsburgh, Pa., defendant, was given June 25th when the case came before the court on motion made by complainant to dismiss the bill in respect to Patent Infringement. The bill as originally filed charged infringement of the patent and infringement of a trade mark. The motion made by complainant was to dismiss without prejudice. The motion was opposed, defendant contesting that the bill should be dismissed in this regard and a dismissal should be on the merits of the question. The Court so ordered, the order reading:—

> "Complainant having admitted that defendant's product referred to in the proofs herein does not infringe the Monnot Patent in suit No. 893932 it is ordered adjudged and decreed that the bill of complaint herein, in so far as it is based on alleged infringement of said patent be, and the same hereby is dismissed on the ground that defendants have not infringed said patent."

The Order of the court directs that the complainant pay the costs. The only portion of the suit not thus disposed of is in regard to the right to use the trade name "Copper Clad," and which is expected to go to a hearing in the early fall.

Melbourne Suburban Railways

The Victorian Government, Australia, decided in December, 1912, to electrify the extensive system of suburban railways of Melbourne. The direct current system has been adopted in accordance with the advice of their Consulting Engineer, Mr. Merz, of London, who after thoroughly investigating the tenders submitted for alternating and direct current installations, came to the conclusion that in this case a direct current system would be the most suitable. A 1500 volt direct current system (multiple unit system) with overhead supply has therefore been chosen.

The total length of single track, including sidings to be electrified is about 323 miles.

The order for the machinery for the twelve sub-stations was placed with one of the Siemens Companies, of London, and comprises amongst other apparatus the following machines:—14 rotary converters, 2,000 kw. each; 10 rotary converters, 1,000 kw. each; 4 rotary converters, 500 kw. each, together with the necesary transformers.

The transformers are supplied with 3-phase current at 19,000 volts. The reactance necessary for obtaining the proper regulation of the rotary converters is built in with the transformers.

Six-phase current supplied to the three-phase side of the rotary converters, and on the direct current side current at 1500 volts, is supplied from a single commutator.

Extending Operations

The prosperity of the Standard Clay Products, Limited, with factories at St. Johns, P.Q., and New Glasgow, N.S., is plainly evidenced by their expansion at the latter mentioned city. The accompanying cut is a very good photograph of the plant they have been operating in New Glasgow. It consists of 2 sewer pipe presses, 4 wet pans, 10 kilns, each 34 feet in diameter, a 200 h.p. Corliss engine, three 16 by 6 foot boilers and 2 dry pans. The company is building in New Glasgow an additional sewer pipe plant of greater capacity. The new concern will have 15 kilns, 2 dry pans, four 8-foot wet pans and a 400 h.p. Goldie & McCulloch Corliss engine. The wet pans, sewer pipe presses, elevators and conveyors for this plant were supplied by the Stevenson Company of Wellsville, Ohio.

Plant now operating at New Glasgow.

Sarnia Waterworks

In connection with the recent ceremony of turning the first sod for considerable extensions to the waterworks of the Town of Sarnia, Ont., it is interesting to note that the waterworks commission have finally decided to install steam turbine-driven pumps, after having spent considerable time in investigating all other types, including the vertical high duty type of pumping engine.

The available speed of the pump is 1500 r.p.m., which is fixed by the fact that at some future time it may be required to connect the pump to an electric motor to operate on the Hydro-electric 25-cycle supply. Herringbone gears are used to connect the pump to steam turbine operating at 3600 r.p.m. By using this speed for the steam turbine, 20 per cent. less fuel is used than if steam turbines were run at the same speed as the pump. The gears are of the "Herring Bone" type which has been used successfully in powers sufficiently large to drive steamships. They are entirely enclosed in a cast iron casing and are practically noiseless.

There are two similar units to be installed. The pumps are of the well-known Mather and Platt stage turbine type, each capable of delivering three thousand imperial gallons per minute against 200 feet head. The complete contract has been placed in the hands of Canadian Allis-Chalmers Limited, and will be manufactured at their Montreal works.

Sixth General Annual Assembly

Calgary, Alta., September 15th and 16th, 1913.

The Sixth General Annual Assembly of the Royal Architectural Institute of Canada will be held at Calgary, Alta., on September 15th and 16th, 1913. A very interesting programme is being prepared which will include matters of interest to every architect in the Dominion. Every Canadian architect is cordially invited and is welcome at all sessions and entertainments, whether a member of the R. A. I. C. or not.

The programme will be sent early in August to all the members of the R. A. I. C. and will contain all the particulars concerning the Assembly. The Committee of Arrangements of the Assembly is composed as follows: J. H. G. Russell, F.R.A.I.C., G. M. Lang, F.R.A.I.C., L. M. Gotch, M.R.A.I.C., W. D. Cromarty, M.R.A.I.C., and Alcide Chausse, F.R.A.I.C.

Mainly Constructional

The News in Brief—From Coast to Coast

An English syndicate has bought a tract of coal lands near Canmore, Alta., amounting to 8,000 acres, at a cost of about $2,000,000.

A large force of workmen is engaged on the construction of Manitoba's agricultural college, and the exterior of some of the buildings is now nearing completion.

The construction of the Thorold section of the Welland Ship Canal will necessitate a diversion of the Grand Trunk Railway, for which room will have to be made on the west side.

Mr. Michael Sullivan, of Kingston, has been awarded the contract for the construction of the new military barracks at Long Branch, Toronto. The contract price is $644,000.

Rapid progress is being made in the erection of the new grand stand and main building at the Exhibition Grounds at Regina and prospects are that both will be finished in good time for the fair.

The Council of Westmount, P.Q., have made a beginning with a system of conduits for electric lighting. A contract has been let to Messrs. R. T. Smith & Company for laying a section of the conduits.

An addition of 250 feet is to be made to every pier at the west end of Montreal harbor. This will furnish accommodation for eight more steamers. The work will probably cost over a million dollars.

Negotiations are said to be under way for the purchase by an English syndicate of the Traders Bank building, at the corner of Yonge and Colborne streets, Toronto, at a price in the neighborhood of $1,250,000.

The Good Roads Year Book of the United States has just been issued. It contains a review of the whole road situation and indicates that there are upwards of $400,000,000 of good road bonds outstanding.

The Maritime Nail Company, of Fort William, states that construction on their proposed $700,000 plant will be commenced in a short time, and that the building should be well under way in the course of a couple of months.

An appeal is to be made in the cases of Messrs. Paradis and Trudel, who were ordered by the Superior Court, Montreal, to pay $1 each to the Association of Architects of the

Province of Quebec as a penalty for practising architecture without having been duly admitted members of the association.

The British American Nickel Corporation, Limited, of Toronto, has been incorporated with $20,000,000 capital. The company is authorized to acquire and develop nickel, gold, silver, copper, coal, salt, iron, and other mines.

The historic Roman Catholic Church of Saint Charles, in Centre street, Montreal, was burned to the ground on July 5th. The church was one of the oldest in the city and contained several valuable paintings. The loss amounts to $200,000.

It is expected that the city council of St. Thomas, Ont., will shortly secure estimates for a steam plant and an alternating current dynamo to supply customers who are suddenly deprived of the Hydro current, upon which they now rely absolutely.

The deal for the purchase of the Carling Block, London, Ont., for a post-office site was closed recently, the executors of the Carling estate accepting $140,000 for a frontage of 142 feet on Richmond street, and a depth of 144 feet on Carling street.

The John S. Metcalf Company, Limited, Montreal and Chicago, constructing engineers, has been awarded the contract for the re-building of the Roman Catholic Cathedral of Charlottetown, Prince Edward Island, destroyed by fire some months ago.

The former walls, which are partially standing, will be used as far as possible; and in the design for the re-building fireproof features will be incorporated. The estimated cost of work is approximately $150,000. The same company has received, from the C. P. R., a contract for extensive work in connection with the steel river house at elevator "D," Fort William, Ont. The cost is estimated at $45,000.

The Dominion Government has appointed Prof. C. D. Howe, of Dalhousie, N.S., supervising engineer of the grain commission. Mr. Howe has been professor of civil engineering at Dalhousie University and the appointment meets with general approvement.

A. S. Porter, a prominent citizen of Regina, and owner of very extensive coal lands in the southern part of the province, is organizing a company to be capitalized at $1,000,000, to generate power from the lignite coal deposits on Mr. Porter's property.

Mr. E. G. M. Cape, Montreal, has obtained the contract for constructing the first building of the steel plant of the Armstrong, Whitworth Company, at Longueuil, P.Q. It is intended to afterwards enlarge the plant, at which all kinds of steel work will be manufactured.

In another attempt to secure the old court house site as an open space for the city of Vancouver, the city council recently determined to re-open negotiations with the Provincial Government, portending either to making a trade or a cash offer of $500,000 for the land.

Favorable progress is being made on the new Y.M.C.A. building on College street, Toronto, which, when finished, will be the most up-to-date in the Dominion. The contractors are hopeful that the work will be completed in time for the proposed opening about September 15th.

A new hotel, to cost $300,000, is likely to be built at the Thousand Island Park, N.Y., to replace the hotel burned a year ago. The company putting it up will be distinct from the Park Association. The hotel will be fireproof, and will be placed nearer the river than was the old hotel.

The extension of all the piers in the harbor undertaking which may cost over $1,000,000, at Montreal, and which will consume the greater part of three years, is to be assumed by the Harbor Commissioners, according to an announcement made at the offices of the board recently. For several seasons complaints have been laid by the shipping companies and others interested that great inconvenience and often danger has been incurred by ocean-craft jutting out beyond the end of the piers. Several times this year collisions which only a good fortune saved from being serious have occurred.

The report of Dr. Hastings, M.H.O., of Toronto, for June, states that the test of the combination of mechanical and slow sand filtration at West Toronto, shows that the system "will be able to stand comparison as regards efficiency with any other known type of mechanical filter."

Work has been started on New Westminster's harbor improvement scheme, a building permit having been issued to the city, through Harbor Engineer A. O. Powell, to build a cedar pile quay wall on the fore-shore at a cost of $102,000. Messrs. Waugh, Meisner & Bailey, of Vancouver, have charge of the work.

The City of Montreal have for a long time been negotiating for the purchase of the plant of the Montreal Water and Power Company. The latter have now offered to go to arbitration as to the price to be paid. Originally the company wanted seven million dollars, but the city refused this on the ground that it was too high.

Investigation of the water-power resources of British Columbia for the Commission of Conservation at Ottawa is being continued by Arthur V. White, of Toronto, consulting engineer on water powers for the commission. Mr. White has with him on his expedition two engineers, C. J. Vick and Napier Simpson, both of Toronto.

The first concrete chimney to be erected in the maritime provinces is now in course of construction at West St. John, N.B., for the new C. P. R. elevator. This chimney, which will be 13 feet outside measurement at the base, will taper to 7 feet at the top and will be over 220 feet high. There is no doubt that the elevator will be ready for grain this fall.

A large block of property at Toronto, consisting of twenty-four houses and having a frontage of 400 feet on Richmond street and 200 feet on Portland street has been purchased by Pilkington Bros., Limited, whose head office is at St. Helen's, Lancashire, for a site for a large plate glass factory. The consideration for the whole parcel was $115,000.

It is reported that the Pacific Great Eastern Railway, whose bonds are guaranteed by the provincial government to build from Vancouver to Fort George, will immediately commence work in North Vancouver. The railway already has a thousand men working on the grade fifty miles north of Vancouver. Foley, Welch and Stewart are the contractors.

On the ground that the firm offers the most superior pipe, the city council, Calgary, acting on the recommendation of Commissioner A. G. Graves, supported by Water Engineer A. Ellison Fawkes and City Engineer G. W. Craig, voted Monday to award a contract to the General Supplies, Limited, for putting the new high pressure main under the Elbow river.

Plans for the new government-owned interior storage elevators which are to be built at Moose Jaw and Saskatoon, it is understood, will be ready within another week and tenders for construction will be called for immediately. The new elevators, which will hold from three to four million bushels, and will cost around a million each, will be under the supervision of the grain commission.

Plans are being prepared for a modern office building for the Molsons Bank, to replace the old three-storey structure now occupied by the bank on the southeast corner of Main street and Bannatyne avenue, Winnipeg. It is not yet known whether the new Molsons Bank will be six or ten storeys high, but it is understood that excavations will be begin this fall, and work on the superstructure commenced next spring.

With the filing on July 3rd at San Francisco of an application for a permit to construct a cottage, building applications since the fire of 1906 reached a total of approximately $400,000,000. This is in rough figures the amount of the city's loss of property in that disaster. The above application is numbered 50,000, the series dating from the first one issued after fire destroyed a large part of the city.

Messrs. P. W. St. George, J. A. Jamieson and F. A. Barbour, the experts appointed by the city of Toronto to examine the site of the filtration plant, have completed their report, and will place it in the hands of Mayor Hocken within the next few days. Already the general conclusions have been received at the City Hall, but it is said that the full text will not be made public.

Plans have been prepared and a permit is being issued for a new vaudeville theatre, at Winnipeg, which is to be erected at a cost of $180,000 for the Pantages circuit, an organization which has its headquarters in Seattle, and which has a big string of theatres in the western states. The site chosen is on the south side of east Market street, just east of the Iroquois Hotel. Work upon the excavation has already been commenced.

Tenders for the new $3,000,000 Provincial Legislature buildings were opened this morning at a meeting of the cabinet. But two firms are tendering, Peter Lyall Construction Company, Limited, Montreal and Winnipeg, and Thomas Kelly & Sons, Winnipeg. In view of the huge nature of the undertaking it was decided to submit the tenders for consideration to F. W. Simon, architect of the buildings and V. W. Harwood, provincial architect, for their report.

The Montreal Water and Power Company has still failed to submit the required particulars of its plant to the city. Some weeks ago the city notified the company that a delay till June 20 would be granted to allow the particulars to be filed, otherwise the property of the company would be expropriated ward by ward, beginning with St. Henri Ward. The June 20 came and went. No particulars were filed; and nothing definite was done by the way of expropriation.

Winnipeg has permanently reached the end of its water troubles so far as the supply is concerned. The pipe line is laid to the three new wells which are located from six to eight miles northwest of the city, and when they get into operation, Winnipeg will be pumping water from eleven wells. The eight wells at present in operation are pumping from 8,000,000 to 9,000,000 gallons of water a day, so that in two weeks this supply should be increased to over 12,000 gallons daily.

The city has struck water in eight other wells on the line to Poplar Springs, and the pumping machinery will be installed in all of these wells this fall, making a grand total of 19 wells in operation. The new 18,000,000 gallon reservoir will also be ready this fall.

The contract for the construction of the new filtration plant at Edmonton was awarded recently to the New York Continental Jewel Filtration Company at a price of $117,000. The work on the system will be started as soon as the contracts have been signed. The company will guarantee to have it completed and in operation on April 15, 1914. It will also guarantee that the plant will give a bacterial efficiency of not less than 97 per cent., and that the filtered water will be bright and clear and perfectly free from color turbidity.

Another international question, reopening the rather vexed issue of a division of international water powers, is involved in an application received by the Government from the Michigan Lake Superior Power Company. What is sought by the company is the privilege of damming St Mary's River at Sault Ste. Marie in order to increase the flow of water to the works of the Michigan-Lake Superior Company at the American Soo. Compensating works to prevent the levels of Lake Superior being injuriously affected are proposed. The application is accompanied by plans and profiles of the proposed work, and the compensative undertakings in connection with it. The matter doubtless will go to the Waterways Commission for full investigation.

Construction of what it is stated will be the only powder factory in the interior of British Columbia has been commenced on a 15-acre site at Granite, purchased by the Kootenay Explosives Company, Limited, which has been organized by Nelson business men to produce XL-Ite blasting powder, for which the Canadian rights have been secured by the company. Two hundred thousand dollars is the capital of the company, and its officers are: President, William Gosnell; vice-president, A. C. Towner; secretary and manager, F. E. Ransome; executive, George F. Motion, H. D. Farris.

The officers of the Department of Public Works are figuring out the lengthy schedules of tenders for the construction of the big dry dock at Levis, of which the estimated cost is $4,000,000. The tenders are not in bulk, but comprise 85 separate items. No report has yet been made, but when it is it will be confidential to the Government. It is learned that bids have been put in by very large firms of which the principal are Sir John Jackson and S. Pearson and Sons, big English contractors, M. P. Davis, of Ottawa, M. J. O'Brien, of Montreal, and a Quebec syndicate. It is probable that the contract will be awarded soon, though it may be delayed till the return of the Hon. Robert Rogers.

Canadian Railroad Development

Work on the Hudson Bay Railway is being rushed by the J. D. McArthur Company and the Hudson Bay Construction Company as rapidly as the conditions of the country through which the line passes will permit.

Before winter the C. P. R. will be running a double track service between Toronto and Guelph Junction, a distance of thirty-one miles, and next year will see another lap covered on the way to Windsor, 189 miles further west.

Work has commenced on extensive additions to the C. P. R. yards, Moose Jaw, Sask. Trackage in the west yards is being increased by approximately fifteen miles, which necessitates the construction of five culvert bridges.

About 4,000 men are at work on the Transcontinental line from Cochrane to Quebec city. The gap remaining to be completed is about twenty miles in length, but as there is some grading, the last rail uniting Cochrane with Quebec will not be laid probably until September. The entire line will be ready for traffic, both passenger and freight, during the month of November.

The Toronto and Eastern Radial line from Bowmanville into Toronto, will be ready for full operation early next spring. The grade between Bowmanville and Pickering will be completed shortly, and four hundred men will be set at work on the grade from Pickering west of Toronto. The steel is already laid from Bowmanville, half a mile west, and a large force of men are now to be placed on laying the steel between there and Pickering.

Work on the new C. P. R. bridge across the St. Lawrence is being pushed ahead. A little foundation work has still to be completed before the two 408-feet channel spans are launched, but this will be done before the first of these two is ready for swinging. The Dominion Bridge Company are busily engaged in erecting the first of these huge spans on the bridge, and it is expected that it will be ready to be put into place in about two months.

It is expected that the C. P. R. will construct in the near future a line connecting Saskatoon with Calgary via Milden and Empress. This line when compelted will open up a large territory and will parallel the C. N. R. Goose Lake line for a considerable distance.

The work of construction on the missing link of the Kootenay Central branch of the Canadian Pacific Railway is being pushed ahead by Messrs. Burns and Jordon, the contractors for the construction. Two of their steam shovels were brought in by boat recently and have been unloaded and set to work at intervals along the shores of Windermere Lake.

The Canadian Pacific Railway has obtained from the Minister of Railways and Canals the approval of a branch running from Snowflake in southern Manitoba, in a straight line westerly for 9 miles. This line will extend to a point about 9½ miles southeast of Crystal City. The application was granted without demur. Approval was given to the proposed extension of the Canadian Pacific from Gimli to Icelandic River, a distance of 26 miles.

Regulations with respect to railway safety appliance standards, designed to ensure trainmen against accident in the discharge of their hazardous duties, were issued by the Railway Commission on July 9th. They standardize safety appliance equipment to conform to the requirements of the United States Inter-State Commerce Commission. All railway companies in Canada must complete by December 31st, 1915, the work of reconstructing and standardizing their equipment.

Mr. J. W. Eber, General Superintendent of the T., H. & B. Railway, announced recently that that company would not join with the G. T. R. and C. N. R. in a common route scheme for Hamilton, and that the city could not offer any inducement that would cause it to do so. It has been the hope of the city officials that this company might agree to this proposal and thus solve the difficulty that has been met in connection with railways in this city. Hamilton will now wait to see what move the company may make regarding grade separation for the line.

The Canadian Pacific Railway have awarded a contract to the John S. Metcalf Company, Limited, Montreal and Chicago, for the construction of all the buildings along the new line of the C. L. O. & W. Railway, about 180 miles in length, extending from the present main line at Glen Tay, Ontario, near Smith's Falls, to the main line at Agincourt, not far from Toronto. The contract includes seven brick stations, twelve wooden stations, nine 40,000 gallon water tanks, a twelve-stall engine house with turntable, machine shop, coaling plant, ash pit and sand house; nine freight sheds, an ice house, seven station residences, twenty-five tool houses, and miscellaneous buildings. These make a total of about eighty-five structures. Work on the new line is progressing rapidly under the direction of C. W. P. Ramsey, Engineer of Construction, and it is the intention to have all the buildings ready for use by the end of the present year.

A $40,000,000 subway loan is to be permitted the city of Philadelphia by a legislative enactment recently passed by the Pennsylvania senate authorizing the return of all personal tax to counties and the use by Philadelphia of this resource as the basis of such a loan. The conference report was adopted, at the same time empowering the city to build, lease and operate subways and extending the time limit for starting work eighteen months. Both bills now await only the governor's signature to become laws.

Personal Mention

Messrs. Bovell & Molesworth, architects, have removed their office from Yonge street, Toronto, to Room 15 No. 2 College street.

Mr. R. B. Whitten, and Mr. Geo. A. Oman, architects, have formed a partnership under the firm name of Whitten & Oman, with offices at 413-415 Lougheed Building, Calgary, Alta.

Messrs. Mallory & Thatcher, architects, have dissolved partnership. Mr. J. A. Thatcher will remain in the present office, Room 24, 31 Queen W. Mr. W. H. Mallory is located in Room 25 of the same building.

Mr. Alexander Gray, Assistant Engineer of the Dominion Public Works Department, in charge of the Upper Ottawa Storage Dams, arrived recently at Liverpool. Mr. Gray is on a holiday trip in Great Britain and is accompanied by his wife and family.

Mr. W. A. Duff has been appointed chief engineer of bridges for the Intercolonal Railway. Until recently Mr. Duff, who is a graduate of the department of civil engineering of the University of Toronto, occupied the position of assistant bridge engineer for the Transcontinental Railway.

New Water Power Commission

The Dominion Government has decided upon the appointment of the new commission to be known as the St. Lawrence and Great Lakes Commission. The work allotted to this new organization is the study of the whole field of water power development from the head of the lakes to Montreal. It is expected that the commissioners will be Professor McLeod, of McGill University, Mr. Arthur Surneyer of Montreal, and Mr. C. R. Coutlee, of the engineering staff of the Dominion Department of Public Works. Another commission is already at work studying the St. Lawrence water powers below Montreal and will report to the Department of Marine & Fisheries. The work of the new commission will extend over a number of years and may lead to the establishment of a permanent water power bureau to which the government can go for expert information in connection with water power applications. Its reports will also be available for the work of the Canadian section of the International Joint Commission. This latter body is frequently called upon to deal with important technical questions, upon which there is little up-to-date information from the Canadian standpoint.

Grape seed oil is prepared in certain parts of France, Italy and Germany. That obtained cold from the first pressing is palatable; the oil obtained by pressing and heating, and that extracted by means of solvents, have a dark colour and a bitter taste, and after being purified by concentrated sulphuric acid and cleared with bone black, are used for lighting purposes and in the manufacture of soap; and, on account of the small cost, would, it is said, be a good substitute for the expensive oils used in the textile industry. Apart from the uses mentioned, and because some of its chemical properties are similar to those of castor oil, grape seed oil has suggested itself as a substitute for castor oil in the preparation of compounds used in the manufacture of red colors. It may be estimated that, on an average, the fresh refuse of the grape contains 25 per cent. of seeds. According to the variety of the grapes and their degree of ripeness, the quantity of oil which can be obtained from the seeds varies from 6 to 20 per cent.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
Sewage and drainage system, for Town Council. Clerk, W. H. McFadden. Engineer instructed to prepare plans for system north of Dale Estate.

Esquimalt, B.C.
Sewage system. Ratepayers passed by-law appropriating $400,000 for installation of a sewage system. Clerk, Thos. Shepherd.

Galt, Ont.
Extension to waterworks for Town Council. Clerk, Jos. McCartney. Ratepayers passed by-laws for $70,000 for extension to waterworks system and trunk water main.

Harriston, Ont.
Retaining hall for County Council. Reeve, Mr. Fox, Drayton, Ont. Cement construction, 70 ft. long.

London, Ont.
Abattoir equipment for City Council, Board of Health. Medical Health Officer, Dr. Hutchison.

Paving for City Council. Mayor, C. M. R. Graham. Chairman Board of Works, B. W. Bennett, 368 York street. Engineer, W. N. Ashplant. Reinforced concrete, block paving on Marley Place, $4,000. Reinforced concrete, block paving on Duchess Ave.

Niagara Falls, Ont.
Pavements, cost $27,000, 4th avenue and Jepson street, for City Council. Clerk, W. J. Seymour. City Engineer, F. J. Anderson.

Newmarket, Ont.
Water supply, cost $20,000, for Town Council. Clerk, J. E. Hughes. Committee appointed. Mayor, J. A. W. Allan. Reeve, Wm. Keith. Councillors, Boyd and B. W. Hunter. Plans ready.

Ottawa, Ont.
Lavatory, cost $15,000, City Hall Sq., for City of Ottawa. Mayor, Mr. J. A. Ellis. City Engineer, Archibald Currie. Underground lavatory, male and female apartments, wash rooms, also shine and telephone booths.

Owen Sound, Ont.
Storm sewers for Town Council. Tenders received by Chairman Board of Works, J. E. Woolrich, until August 1st.

Peterboro, Ont.
Pavement, Hunter, for City Council. Engineer, R. H. Parsons. Bitulithic or asphaltic concrete pavement, distance of about 4 blocks.

Toronto, Ont.
Street grading, cost $9,755, for Board of Control. Mayor, H. C. Hocken, City Hall. The Commissioner of Works recommends 42 ft. roadway on Oriole Parkway from College View Ave. to Eglington Ave.

Cement, concrete sidewalks, cost $26,813, for Board of Control. Mayor, H. C. Hocken, City Hall. The Commissioner of Works recommends construction of a number of sidewalks.

Pavements, cost $105,431, for Board of Control. Mayor, H. C. Hocken, City Hall. Above is recommended by Commissioner of Works. Materials, asphalt, concrete.

Waterworks system, Yonge St., for Board of Control. Mayor, H. C. Hocken, City Hall. City are planning a water system for the Industrial Farm. Sewage system is also under consideration.

Pavements, cost $25,166, for Board of Control. Mayor, H. C. Hocken, City Hall. Asphalt on Mountnoel, Mountalen and Mountjoy streets. Bitulithic on Arlington, Wineva and Williamson road.

Windham Twp., Ont.
Drains, cost $2,662, for Twp. Council. Clerk, J. T. Camfield, Windham Centre, Ont. By-law passed by Council.

CONTRACTS AWARDED

Montreal, Que.
Machinery for Board of Commissioners. Secretary, I. N. Senecal. Contracts for fixed concrete plant recommended to be given to the Bitulithic Paving Company, Room 1, 745 St. Catherine St. W., and for movable plant, to F. D. Cumner & Co., Cleveland, Ohio.

Ottawa, Ont.
Paving for City Council. Mayor, J. A. Ellis. Engineer, Archibald Currie, City Hall. Pavement on Albert St. awarded to Ottawa Construction Co., Central Chambers, Elgin St., $25,000. Asphalt pavements on Blackburn and St. Andrew Sts,, awarded to Union Construction Co., Bank St.

Stratford, Ont.
Main sewer, cost $12,270, for City Council (Board of Works). Clerk, R. R. Lang. Chairman of Board, Ald. Paul. Engineer-in-charge, A. B. Manson, City Hall.

St. John, N.B.
Sewerage system, Lancaster Parish, for County Council. Chairman of Sewerage Board, Wm. Golding, gas lighting, 58 Harding St., Fairville.

Stamford Twp., Ont.
Cement sidewalks, cost $4,500, for Twp. Council. Clerk, C. F. Munro, Southend. Engineer-in-charge, J. C. Gardner, Niagara Falls, Ont. General contractors, McRae & Campaigne, Niagara Falls.

The Pas, Man.
Sewer pipe for Town Council. Sec.-treas., H. H. Elliott, M.D. Con. Engineers, Murphy & Underwood, Ross Block, Saskatoon, Sask. General contractors, Hurst Engineering & Construction Co., 406 Ashdown Bldg., Winnipeg, $76,920.

Laying steel pipe for Town Council. Sec.-treas., H. H. Elliott, M.D. Con. Engineers, Murphy & Underwood, Ross Block, Saskatoon, Sask. General contractors, Murphy & Williams, Fort William, Ont.

Toronto, Ont.
Sewer, $898, Russell Hill Road, for York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E. General contractor, **W. E. Taylor, 122 Yorkville. Several sidewalks are contemplated.**

Railroads, Bridges and Wharves

Calgary, Alta.
C. P. Rly. Co. has been authorized to construct branch lines for B. Burns & Co., Calgary.

Earlton, Ont.
Station for Tamiskaming & Northern Ontario Rly. Chairman, J. L. Englehart, 25 Toronto St., Toronto. Will replace station destroyed by fire.

Hamilton, Ont.
Toronto, Hamilton & Buffalo Railway Co. has been authorized to construct spur crossing Hamilton Radial Electric Railway and Burlington street.

Havelock Sub.-Div., Ont.
C. P. Rly. Co. has been authorized to construct bridge over Salmon River near Ardendale, Ont.

Lisle, Ont.
Bridge abutments for Twp. of Tossorontio. Tenders received by Clerk, Thomas Irwin, Lisle, until July 24th, for concrete abutments and wing walls for steel bridge over Boyne River.

Medicine Hat, Alta.
Canadian Pacific Railway Company has been authorized to construct spur for Benjamin S. Spaulding.

Montreal, Que.
Alterations to Windsor station entrance, Windsor St., for C. P. R. Architect, C. P. R. Engineering Office, Montreal. General contrs., Geo. A. Fuller Co., Ltd., 210 Read Bldg. Tenders received by General Contractors.

Oshawa, Ont.
Station, Centre, for C. P. R. Architect, Company's architect.

Portage la Prairie, Man.
Canadian Pacific Railway Company has been authorized to construct extension to existing siding for A. Snyder & Co., Ltd. in Lot 69, Portage la Prairie.

Prince Albert, Sask.
Stations and buildings for C. N. Ry Div. Engineer, J. A. Crawford, Saska-

toon. Station buildings will be erected west of Prince Albert at Talmon, Balloch, Redberry, Hafford, Speers, Richards and Lilac. Plans ready.

Province of Ontario
C. P. Rly. Co. has been authorized to construct bridge No. 10.7 near Asphodel Station, and Bridge No. 30.8 near Kendry Station.

Simcoe, Ont.
Alterations to railway yards for G. T. Rly. Engineer-in-charge, Leslie Stone, London, Ont. Plans in progress.

Toronto, Ont.
C. P. Rly. Co. authorized to construct extension to existing spur for R. Home Smith, in lot 10, Con. C., Co. York, Twp. Etobicoke, Ont.

Bridge, Gerrard, for Board of Control. Mayor, H. C. Hocken, City Hall. Commissioner of Works, R. C. Harris has submitted new design showing 3 arch spans instead of 1 as originally designed.

Vancouver, B.C.
Wharf for Dom. Government, Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until August 21st. Plans at office of C. C. Wolrfold, New Westminster. J. S. Maclachlan, Victoria, J. G. Sing, Toronto and Postmaster, Vancouver.

CONTRACTS AWARDED

Prince Rupert, B.C.
Dry dock buildings for G. T. P. Rly. Co. General contractors, J. F. Wineland Bldg. & Constr. Co., 402 Abbott St., Vancouver. Engineer-in-charge, J. S. Pearce. Power house, 104 x 148, ship building shed, 160 x 300, boiler house and blacksmith shop, 76 x 150, structural steel and concrete, 1 each 10 x 15 ton travelling cranes, 6-400 h.p. water tube boilers, automatic stokers; 5,000,000 ft. of lumber will be used.

Unionville, Ont.
Bridge, cost $1,466, Eckhardt Bridge, for York County Council. Clerk, R. W. Phillips, 57 Adelaide St. E., Toronto. Engineer, E. A. James, 57 Adelaide E., Toronto. General contractors, Lewis Construction Co., Manning Chambers, Toronto.

Wellington Co., Ont.
Bridge for County Council. Concrete work, Cole & Bryson, Owen Sound, Ont., $1,000. Steel work, Welland Steel Co., Welland, $3,600. Bridge on line between Minto and Normanby Twps.

Public Buildings, Churches Schools, etc.

Cottam, Ont.
Hall, cost $5,200, for Cottam Orange Lodge. Interested, Rev. Wm. Sterling. Two storeys, white brick construction. Plans in progress.

Charlottetown, P. E. I.
Interior alterations to post office, cost $15,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Concrete floors, elevators, dumb waiters. Plans in progress.

Essex, Ont.
Addition to registry office, cost $5,000, for Town Council. Mayor, Dr. Bowie. Clerk, Geo. E. Wightman. One storey.

Hespeler, Ont.
Addition to church, cost $4,000, for Lutheran Church. Pastor, Rev. O. Lincke, Waterloo. White brick construction. Plans ready.

Ingersoll, Ont.
School, for Town Council. Clerk, W. A. Smith. Domestic Science & Manual Training School. Plans to be called for.

London, Ont.
Domestic science and manual training equipment, Chesley Ave School, for Board of Education. Secretary, R. M. McElheren, City Hall.

Boys college, cost $125,000, Sunshine Park, for R. C. Diocese of London. Interested, Bishop Fallon. Brick, ornamental stone, cement and steel construction. Plans ready.

Convent for Ursiline Sisters (Mother Van Antwerp, Sacred Heart Convent, London). Site has been purchased.

Furnishings, $15,000, for Ursiline Sisters, (Mother Van Antwerp, Sacred Heart Convent, London). Sisters contemplate remodelling seminary and will require furnishings.

London Twp.
School, Dundas St. E., for Trustees S. S. No. 23. Sec., J. Randall, Pottersburg P.O. One storey, 36 x 36, white brick construction. Tenders received by Architect, A. E. Nutter, Dom. Bank Bdg., London, until July 26th.

Montreal, Que.
School, Poupart, for R. C. School Commissioners, c/o W. Lafontain Com. Academy, 86 St. Catherine W. Architects, Venne & Labelle, 5 Beaver Hall Sq. Tenders are postponed until end of July.

Manitou, Man.
School for Manitou Consolidated School District. Sec.-treas., R. A. McIntosh. Architect, W. A. Elliott, 116 11th St., Brandon. Eight rooms, 2½-stys., brick and stone construction.

St. John, N.B.
Tuberculosis hospital, cost $25,000, Merritt, for Board of Hospital Commissioners. Chairman, H. B. Schofield, City Hall. Architect, F. Neil Brodie, 62 Princess St. Tenders will be called shortly.

Observatory, cost $25,000, Douglas Ave., for Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British-American Constr. Co., Ltd., c/o P. I. Ligon, Prince William St.

Sandwich, Ont.
Addition to registry office, cost $15,000, for Essex County Council. Clerk, J. Milne. One storey, 46 x 40, stone construction.

Toronto, Ont.
Club house, cost $20,000, Western Channel Site, for National Yacht Club, foot of Bathurst St. Secretary, Thos. Turrell. Plans approved by Harbor Commission.

The following will shortly have to move their club buildings to the Western Channel Site:—Queen City Yacht Club, Toronto Rowing Club, Argonaut Rowing Club and Toronto Canoe Club.

Uxbridge, Ont.
Church decoration, for Methodist Ch. Congregation. Committee, F. Dobson & Sharpe. Tenders received until July 19, for renovating interior of church.

Ville Marie, Que.
Vault for registry office for Municipal Council. Tenders received by Sec.-Treas. of above Municipality, until July 31st. Plans and specifications at office of Sec.-Treas.

Victoria, B.C.
School, cost $50,000, Chandler Ave., for Board of Education. Sec., W. T. C. Pope, 1127 Catherine St. Architects will have till July 23rd to prepare plans. Mill construction.

Windsor, Ont.
I. O. O. F. hall, cost $35,000, Wyandotte, for I. O. O. F. Lodge. Architects, Crane & Pennington. Time extended for receiving tenders to July 19th.

CONTRACTS AWARDED

Bracebridge, Ont.
Post office, cost $35,000, Manitoba, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. Builders, The Simcoe Construction Co., 16 King W., Toronto. Three storeys, structural steel and pressed brick construction.

Edmonton, Alta.
Church, cost $70,000, 23rd St., for Robertson Presbyterian Chuch. Pastor, Rev. D. G. McQueen, 408 4th St. General contractor, Robert Grant, 1626 Jasper Ave. W. 96 x 135, brick and artificial stone construction.

Hagersville, Ont.
Extension to church, cost $6,500, for All Saints Church Congregation. Pastor, Rev. H. J. Leake, M.A. General contractor, John Thew, Welland.

London, Ont.
Alterations to civic offices, cost $6,000, Dundas street, for City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Mason, Northey & Tulett, $3,360. Plumbing, T. L. Partridge, $2,760.

Medicine Hat, Alta.
Fire Hall for City Council. Clerk, H. Baker. Architect, J. W. Davey, Building Inspector. General contractors, Sackrider & Turner, Main and S. Railway Sts. Will erect fire hall at 3rd ave. and East Road allowance.

School, Elm street, for Public School Board. Architect, W. T. Williams, Porter Block. General contractors, Sackrider & Turner, Main and S. Railway streets. Two storeys, brick and stone construction.

Ottawa, Ont.
School, cost $140,000, Rosemount, for Public School Board, Elgin St. Architect, W. B. Garvock, Creighton St. School. Ventilating, Canadian Sirocco Co., Ltd., McDougall and Banwell Sts., Windsor, Ont.

Home, cost $27,000, Turner, for Home for Friendless Women, Mrs. Geo. Greene, 320 Waverly. Architect, C. J. Burritt, 193 Sparks St. Carpenter, Taylor & Lackey, 21 1st Ave. Painting not let yet. Three storeys, solid brick construction.

Orillia, Ont.
Armory, cost $25,000, West St., for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, E. Webb & Son. Two stys., brick and Longford stone construction.

Regina, Sask.
Assembly Hall, cost $20,000, Broad, for Salvation Army. Builder, A. McBain. Two storeys, brick construction.

Strathroy, Ont.
Hospital, cost $8,480, for Hospital Trust. President, W. P. Dymond, Campbell St. General contractor, R. W. Nicholson.

St. John, N.B.
Alterations to club house, Wellington Row, for Elks Club, c/o H. J. Fleming, 130 Pond St. Mason, A. R. C. Clark & Son, 51 Water Street. Architect, F. Neil Brodie, 42 Princess street.

Regina, Sask.
Grand stand, $20,000, Exhibition Grounds, for City of Regina. Architect, Storey Van Egmond, Credit Foncier Bldg. General contractor, J. Y. Graub. Two storeys, 79 ft. 6 in. x 192 ft. frame construction.

Toronto, Ont.
Military barracks, cost $644,000, Long Branch, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. General contractor, Michael Sullivan, Kingston, Ont.

Montreal, Que.
Post office fittings, St. Lambert, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, A. Venne, 76 St. Gabriel, Montreal. General contractor, E. Patenaud, 1289 St. Denis.

Church, cost $62,000, Hogan, for Fabrique St. Anselme, 350 Forsyth St. Architects, Viau & Venne, 6 St. Gabriel. General contractors, mason, carpenter, painting, iron and steel, E. N. & M. Boileau, 34 Garnier. Roofing, heating, plumbing and electric, Tremblay & Francoeur, 292 St. Denis. One storey, 160 x 133.

Army hall, City Hall, for Salvation Army, 341 University. Builders and masons, Reid, McGregor & Reid, 14 Guy Block. Carpenter, T. S. Hudson, B12 Board of Trade. Heating and plumbing, J. A. Gordon, 301 St. Antoine. Three storeys, 75 x30.

Addition to school, cost $17,000, Drolet street for School Commissioners, St. J. Baptiste, Montreal. Architect, J. A. Godin, 269 St. Denis St. General contractor and mason, P. J. Charlebois, 1234 St. Hubert. Heating and plumbing, J. & C. Brunet & Co., 223 St. Lawrence. General contractor will receive tenders for other trades. Four storeys, 30 x 30, stone and brick construction.

Catholic Y. M. C. A., cost $20,000, St. Dominique, near Mile End Station, for Rev. Emile Piche, cor. Bernard and Waverly. Architects, Gauthier & Daoust, 180 St. James St. General contractor, T Lessard, 210 Park Ave. Three storeys, 40 x 65, cement foundation, brick construction.

Church, cost $25,000, Huntley, for Amherst Park Congregational Church, c/o H. Moule, 1949b Christopher Columbus. Architect, J. Seath Smith, 779 Sherbrooke W. General contractors, Raymond Construction Co., 46 Alexander.

Welland, Ont.
Church, cost $6,500, Devon, for R. C. Corporation (Father Berardo). General contractor, W. J. Hickey, 91-93 Main St. E. One storey, 42 x 100, frame construction.

Windsor, Ont.
Alterations to police station, cost $1,498.50, for City Council. Mayor, Henry Clay. Architects, G. Jacques & Company. General contractors, Cadwell Sand & Gravel Co.

Winnipeg, Man.
Church, Qu'Appelle St., for Knox Presbyterian Church. Pastor, Rev. Dr. F. P. DuVal. Architect, J. H. G. Russell, 1110 McArthur Bldg. General contractors, J. McDiarmid Co., Ltd., Canada Bldg.

Business Buildings and Industial Plants

Brampton, Ont.
Factory, for J. W. Hewetson Co., Ltd., shoe manufacturers, 88 Terauley St., Toronto. Three storeys, 115 x 250. Town granted loan of $20,000.

Plant for Hough Litho Co., 96 Sapdina Ave., Toronto. Town granted loan of $15,000. Building will be remodeled, Hydro power to be used.

London, Ont.
Cattle sheds, cost $7,500, for Western Fair Board. President, W. J. Reid. Sec., A. M. Hunt. One storey, reinforced concrete and frame construction. Plans in progress.

Montreal, Que.
Garage and office building for Automobile Club of Canada. President, Howard Pillow. Sec., Geo. A. McNamee, 10 Cathcart St., Montreal.

Two stores and residence, cost $6,000, Sherbrooke W., for A. D. Quintin, 760 Ontario E. Architect, I. Denis, corner Carriere and Delorimier Sts. Three storeys, 25 x 65, cement foundation, brick construction. Plans prepared.

Market, cost $100,000, Maisonneuve (Ontario St.), for City Council. Sec., Mr. Ecrement. Tenders will be called shortly by Architect, M. Dufresne, Lasalle and Ontario, Bank of Toronto, for all trades except stone and steel work.

Business building, cost $150,000, for J. B. Baillargeon Express Co., 329 Ontario street east. Architect not chosen. Bldg. will not be started until spring, 1914. Four storeys.

Hotel alterations for C. P. R., Montreal. Architect, Mr. Videtto, C. P. R., Windsor Station, Montreal. Extensive alterations to interior of Place Viger Hotel, east wing.

Walpole Rubber Co., 8 McGill College ave., contemplated building a rubber factory.

Ottawa, Ont.
Addition to store, cost $6,000, Lewis, for Matthew-Lang Co. Architect, W. E. Noffke, Central Chambers. Solid brick construction. Plans ready.

Paris, Ont.
Opera house, Mechanic, for Syndicate. Representative, A. Campbell. Further information from Thos. McCosh, Paris. 126 x 62, white brick construction.

Preston, Ont.
Preston Chair Co. contemplate building a factory. By-law passed granting loan.

Quebec, Que.
Clothing factory, cost $5,000, St. Dominique, for St. Lawrence Clothing Co., 17 St. Dominique street. Architects, Talbot & Dionne, St. Joseph street. Three storeys, 25 x 54, stone foundation, red brick and structural steel construction. Plans in progress.

St. John, N.B.
Alterations to store and flats, Main, for Percy Steel, 519 Main St. Architect, Garnet Wilson, 50 Princess St. Wood construction. Plans ready.

St. Thomas, Ont.
Factory for L. E. Ewing, Findlay, Ohio, U.S.A.. Two storeys, 60 x 200, brick construction. Will manufacture motor trucks. Further information from W. K. Cameron, Barrister, St. Thomas.

Sarnia, Ont.
Garage for Hitchcock & Richardson. One storey, white brick construction. Plans under way.

Toronto, Ont.
Four stores and residences, cost $30,000, Queen and Kippendavie, for Stennet Bros., 1925 Queen E. Mason, Booth Bros., 51 Kingswood Rd. Carpenter, Can. Constr. Co., 311 Sherbourne St. Tenders received by Architect, W. H. Mallory, Room 25-31 Queen W., until July 19th, for heating. Three storeys, brick construction.

Welland, Ont.
Freight shed. Builders and owners, Interlake Line Ltd. Plans in progress.

Windsor, Ont.
Stores and flats, cost $35,000, for A. St. Dennis, 155 London St. W. Two storeys, 10 x 70, brick and tile construction, cement foundation. Tenders received by architects, Atcheson & Adams, Room 1, Thompson Bldg., till July 28th.

CONTRACTS AWARDED

Brantford, Ont.
Bank building, cor. Market and Darling, for Bank of Montreal. Local manager, A. Montizambert. Architects, Barott, Blackader & Webster, 508 New Birks Bldg., Montreal. General contractors, Messrs. Anglins Ltd., Montreal.

Campbellton, N.B.
Sulphite mill for The St. Lawrence Pulp & Lumber Corporation, Grand Pabos, Que. Interested, Mr. Whitmer, c/o Wm. Whitmer & Sons, Philadelphia. Builder, Owners. 100 ton capacity. 18 miles of railroad being built into mill site.

Cornwall, Ont.
Addition to plant, cost $6,000, for Toronto Paper Mfg. Co., Cornwall. Architect, C. P. Meredith, 126 Sparks street, Ottawa. General contractors, Owner. Reinforced concrete construction. Most of the work to be done by day labor.

Edmonton, Alta.
Store and office, cost $15,000, Spruce, for E. S. McQuaid, Gariepy Block. Architect, P. Marvin, Jackson Block. General contractors, Bishop & Webster, 699 Namayo Ave. Three storeys, 50 x 50, frame construction.

Warehouse, cost $15,000, Bellamy St., for British-American Paint Co., Laurel Point, Victoria, B.C. General contractor, F. Woodyard, 528 Clara St. Two storeys, 30 x 100, brick construction.

Fonthill, Ont.
Store and apartments for J. E. McCombs. General contractor, Harvey

McCombs. Three storeys, 36 x 44, frame construction.

Hamilton, Ont.
Three stores, Barton St., for Globe Realty Co., Ltd., Lister Chambers. Architect, E. B. Patterson, 167½ King St. E. General contractor, W. Inrig, Flatt Ave. Three storeys, brick construction.

Hamilton Inlet, Labrador
Pulp mill for The Labrador Pulp & Paper Co., St. Johns, Newfoundland. Vice-Pres., H. R. Reid, c/o Co. Builder, Owners. To have a yearly capacity of 90,000 tons.

London, Ont.
Remodelling store, cost $10,000, for J. H. Chapman & Co., Dundas st. Architect, McBride & Gilbert, Edge Block, London. General contractor, T. Copp, 31 Beaconsfield Ave., South London.

Medicine Hat, Alta.
Store and Warehouse for Dominion Grocery Co. General contractors, The Lussier Construction Co., Alberta Hotel.

Montreal, Que.
Warehouse and flats, cost $6,000, Clarke. Builder and owner, Medard Paquette, 18 Blvd. St. Joseph W. Three storeys, 42 x 38, stone foundation, brick construction.

Alterations to offices, cost $6,000, St. Sacrament, for Burnett & Co., 12 St. Sacrament. Architects, Hogle & Davis, 80 St. Francois Xavier. General contractor, R. Ryan, rear 697 Atwater. Two storeys, 48 x 20.

Offices, Beaver Hall Hill, for The Guarantee Co. of North America, 57 Beaver Hall Hill. Architect, K. G. Rae, 54a Beaver Hall Hill. General contractors, Geo. A. Fuller Co., Ltd., 210 Reed Bldg. Concrete, F. J. Jago, 10 Victoria street. Millwork, T. Pringle, Belleville, Ont. Roofing, Hickey & Aubut, 93 Dominion. Plastering, McNulty Bros., 182 Mountain St. Heating, plumbing and electric, W. N. Dietrich, Reed Bldg. Terro cotta, B. & S. H. Thompson & Co., Trans. Bldg.

Alterations to store and flats, cost $10,000, 212 Peel, for Samuel Ogulnik, 350 St. Catherine W. Builder and general contractor, L. Beaudry, 2320 Hutchison. Heating and plumbing, Felter Bros., c/o Builder. Electric, not given, call tenders later. Three storeys, 57 x 25.

Factory, cost $6,000, Larin Ave., for Malone Moulding & Framing Co., 48 Beaver Hall Hill. Architects and general contractors, Anglins, Ltd., 65 Victoria St. Other tenders called later. Two storeys, 25 x 75, cement foundation, mill construction.

Store and flats, cost $15,000, Maisonneuve (Adam), for L. Bois, cor. Adam and Aird. Builder, A. Chequette, 170 Bourbonniere. Brick, Prudent Desjardins, c/o Owner. Carpenter, painting and interior fittings, Builder. Roofing, F. X. Guay, 71 St. Germain. Heating and plumbing, Corin Surprenant, c/o Builder. Electric, F. Bouchard, c/o Builder.

Ottawa, Ont.
Stores and apartments, cost $40,000, Bank, for Thos. Clarey, Central street. General contractor, mason and brick, Owner. Other trades not let yet. Solid brick construction.

Stores and apartments, cost $15,000, Rideau. Architect and owner, S. Armour, c/o Royal Realty Co., Bank St. All work being done by day labor, inside fittings for stores will be commenced in a couple of weeks. Three storeys.

Garage and alterations to residence, cost $10,000, Laurier, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Carpenter, Taylor & Lackey, 21 1st Ave. Heating and plumbing, Holloway & Sons, 373 Somerset. Painting, plastering and electric not let yet.

Factory, cost $35,000, Nelson, for Crown Lithographing Co., Ltd., 188 Wellington St. Architects, Dore & Coyles, 72 Patterson Ave. General contractors, Toms & Copeland, c/o Architect. Lighting and plumbing, M. M. O'Connell, 212 Gloucester. Two storeys, 175 ft. x 60 ft.

Business block, cost $100,000, Bank, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Mason, Alex. Garvock, 136 Lewis. Carpenter, Alex. Christie, Elgin St. Painting, W. J. Carson, 293 Laurier W. Heating and plumbing, M. M. O'Connell, Gloucester St. Electrical, Marchand & Donnelly, 1282 Sparks St. Reinforced concrete construction.

Peterboro, Ont.
Factory, cost $65,000, Park, for Henry Hope & Sons, Ltd., Peterboro. Architects, Sproatt & Rolph, 36 North St., Toronto. General contractors, R. Sheeby, Finnie & Gordon, Peterboro. One sty., 182 x 220, cement foundation, reinforced concrete and solid brick construction.

Regina, Sask.
Industrial building, cost $20,500, Exhibition Grounds, for City of Regina. Manager of grounds, D. T. Elderkin, 201 Donahue Block. Architect, N. R. Darrack, Western Trusts Bldg., 11th Ave. General contractors, Parsons Construction Co., Scarth St. Two storeys, 165 x 180, frame construction.

Warehouse, cost $25,000, Broad, for Scott Fruit Co. General contractor, J. McDiarmid, Winnipeg. One storey, 50 x 100, brick and reinforced concrete construction.

Office building, cost $10,000, 6th Ave. Builder and owner, W. H. Joyce. Brick construction, cement foundation.

Offices, cost $10,000, Hamilton, for Commercial Lunch Co., Commercial Blk. General contractors, McDiarmid & Donnelly, Scarth St. Two storeys, brick and stone construction.

St. John, B.C.
Warehouse, cost $15,000, for M. E. Agar, Commissioner Public Works, City Hall. Work done by day labor. Cement foundation, stock brick construction.

Factory, Marsh Rd., for Oil Motor & Mfg. Co., Ltd. Director, M. L. G. Vincent, 126 Charlotte St. Architect, F. Neil Brodie, 42 Princess St. General contractor, Jas. Myles, 175 Wright St.

St. John, N.B.
Sugar refinery, Ballast Wharf, for Atlantic Sugar Refinery Co., c/o L. A. Wilson, Ballast Wharf. Architect, R. S. Kent, 115 Montague street, Brooklyn, N.Y. Engineer, Henry Holgate, Richelieu Bldg., Montreal. General contractors, Superstructure, Dominion Bridge Co., Ltd., Lachine, Que. Chief engineer, Jas. Finley, c/o company.

Stratford, Ont.
Factory, Douro, for Farquharson-Gifford Co., Douro St. Architect, J. S. Russell, 21 Downie St. Mason, Jno. L. Young, 240 Birmingham St.

Theatre, cost $10,000, Ontario, for William Gordon, Albion Hotel. Architect, J. S. Russell, 21 Downie St. Work done by day labor. One storey, 40 x 116.

Toronto, Ont.
Warehouse, cost $6,500, Bloor W., for F. Greenaway & J. C. Bolton, 1239 Bloor W. Architect, J. Hunt Stanford, Bloor and Ossington. General contractor, R. C. Bustard, Confed. Life Bldg. Two stys., 35 x 85, structural steel and brick construction.

Factory, cost $10,000, River street, for Stewart Hartshorn Co., River street. General contractor, D. A. Peacock, 577 Church street. Dry kiln, Grand Rapids Veneer Works, Grand Rapids, Michigan. One storey, 38 x 82, brick construction.

Windsor, Ont.
Factory, cost $50,000, Factory Dist., for Kelsey Wheel Co., Detroit and Windsor. Builders and general contractors, Wells & Gray, Windsor. One and two storeys, 360 x 60, 50 x 300, boiler, store rooms and dry kilns, reinforced concrete and brick construction. Few sub contracts to be let.

Store, cost $8,000, for Osterhout & Little. Architects, Leybourne & Whitney. Owners will do own work. Two stys., 85 x 26, brick construction.

Winnipeg, Man.
Store for W. J. Russell, c/o architect, Wm. Fingland, Enderton Bldg. General contractors, Fraser & Faulkner, 512 Gertrude ave. One storey and basement, pressed and common brick construction.

Bank, Elmwood, for Bank of Nova Scotia, Winnipeg. Architects, Jordon & Over, Can. Life Bldg. General contractor, Major Schurman, 34 Can. Life Bldg.

Improvements to hotel, cost $20,000, McDermot and Albert, for G. B. Campbell, Mariaggi Hotel. General contractors, H. L. Stephens & Co. Tile and maple floors, plate glass, refrigerators, boilers, oak finish. Fittings will be required for bar, kitchen, etc.

Stores and apartments, cost $35,000, College and Main, for W. B. Chambers, c/o Architect. Architect, Chas. S. Bridgeman, Can. Life Bldg. General contractors, Simmons Bros. Three stys., 34 x 48, brick and cut stone construction.

Residences

Berlin, Ont.
20 residences, cost $4,500 each, for R. J. Haley & Co. Plans in progress.

Dundas, Ont.
Residence, cost $5,000, Alma, for Jas. Doyle. Architects, Stewart & Witton, H. P. & L. Bldg., Hamilton. Two stys., 28 x 32, brick construction. Plans prepared.

Hamilton, Ont.
Addition and alterations to residence, Ravenscliffe, for Sir. Jno. M. Gibson, Government House, Toronto. Tenders received by Architects, Munro & Mead, Chancery Chambers. Three storeys and tower.

Exeter, Ont.

Three residences, cost $7,000, for Thos. Elliott. 1½-storeys, white brick construction. Plans ready.

Forest, Ont.

Apartment, cost $4,000, for Dominion Canners Ltd., Hamilton. Architect, Firm's architect. Two storeys, white brick and frame construction. Plans ready.

London, Ont.

Residence, cost $5,000, William. Architect and owner, W. H. Braddon, 546 King St. Two storeys, stone and cement construction. Plans ready.

Residence, cost $5,200, Sherwood Ave., for John Gunn, 136 Kent St. Architect, John M. Moore, 435½ Richmond street. Two storeys, red pressed brick construction.

Medicine Hat, Alta.

Residence, cost $5,000, for James Fleming, American Hotel. Architect, T. Millican, Portor Block. Two storeys and basement. Plans in progress.

Montreal, Que.

Two cottages, cost $12,000, Notre Dame de Grace Ward. Builder and owner Chas. Fyfe, 137 Park Ave. Only private tenders to be called. Two storeys, 25 x 42, cement foundation, brick construction.

12 flats, cost $10,000, Oxford, for L. P. Forest, 847 St. Joseph Blvd. Builder and carpenter, Owner. Mason, C. G. M. Martin, 212 McGill St. Roofing, J. Lamarche, 195 Blvd. St. Joseph T. Tenders received by Owner for heating, plumbing, painting and electric work. Three stys., 100 x 160, brick construction.

Cottage, cost $10,000, Outremont (Rock-land), for J. R. Rolland, c/o Architect. Concrete and carpenter, J. Deslauriers, c/o Architect. Other tenders received by Architect, J. A. Karch, 187 St. Denis St.

Three residences, cost $20,000, Outremont (Bloomfield), for A. Corbin, 1149 Van Horne. Architects, Viau & Venne, 76 St. Gabriel, Montreal. Three stys., 20 x 77, stone foundation, pressed brick construction. Mr. Lavalee is looking after work for Mr. Corbin and will receive tenders shortly. Address 1149 Van Horne.

Garage and residence, cost $5,000, Outremont (De Lepee), for Hon. T. Berthiaume, 203 St. Catherine Rd. Architect, J. A. Karch, 187 St. Denis. Concrete and carpenter, P. Brouillet, 79½ St. Elizabeth. Tenders for other trades received by Architect. Two storeys, 25 x 38, cement foundation, pressed brick construction.

Oak Bay, B.C.

Residence, cost $8,000, for Modern Homes Ltd. Architects, Jennings & Boulanger. Two storeys, frame construction. Plans ready.

Ottawa, Ont.

Residences, cost $5,000, Wilbrod, for Wolf Shenkman, 226 Friel St. 40 x 12, 35 x 24, brick veneer construction.

Residence, cost $10,000, Powell, for Mr. Quinn, c/o Architect. Tenders received by Architect, F. C. Sullivan, Castle Bldg., Queen St., until July 19th. Three stys., ornamental stone facing, solid brick construction.

Residences, cost $7,000, Coburg, for Wolf Shenkman, 226 Friel St. Two stys., 60 x 25, 27 x 15, brick veneer construction. Plans under way.

Residence, cost $18,000, Carling, for W. F. Powell, 570 Sussex street. Architect, W. E. Noffke, Central Chambers. 2½ storeys, stucco construction. Plans prepared.

Residence, cost $14,000, Monkland, for E. A. Band, Clarey ave. Architect, W. E. Noffke, Central Chambers. Stone and stucco construction, stone foundation. Plans prepared.

Toronto, Ont.

Residence, cost $5,200, Alexandra Blvd., for E. F. Whittemore, Hampton Mansions. General contractors, mason and carpenter, Forbes & Love, Kingsley Mansions. Painting, Corin & Jennings, 58 Geary Ave. Tenders received by General Contractors until July 24th for roofing, July 25th for plastering, July 13th for heating, July 18th for plumbing and electrical. 2½-storeys, 34 x 24.

Three attached residences, cost $6,000, Delaware, for C. S. West, Bloor St. Architect, J. H. Stanford, Bloor and Ossington. Owner will be ready for tenders about August 10th. Two storeys, 44 x 42, brick construction.

Residence, cost $25,000, Nina and Wells for J. Dinwoody, 28 Bracondale. Architects, Harvey & Haffa, Bay St. Mason, F. & A. E. Ham, 83 Salem Ave. Architect now open for other trades.

Three attached residences, cost $6,000, Bartlett. Builder and owner, L. E. Price, 870 Dovercourt Rd. Owner will let heating, plumbing, wiring and plastering. 2½ storeys, 48 x 42, brick construction.

Three attached residences, cost $6,000, Dufferin, for Greater Canada Improvement Co., 912 Bloor W. Architect, W. G. Hunt, 935 Bloor W. Owners employ regular staff. Will let heating, plumbing and wiring shortly. 2½-storeys, 46 x 44, brick construction.

Three attached residences, cost $9,000, Delaware. Builder and owner, C. Lurie, 82 Markham St. Owner now open for tenders. 2½-storeys, 48 x 44, brick construction.

Three attached residences, cost $6,000, St. David St., for H. Fine, 12 Milan St. Architect, R. A. Abraham, 23 Jordan. Two storeys, 48 x 44, brick construction. Plans prepared.

Three attached residences, cost $6,000, Nairn ave., for W. Pidgeon, 41 Nairn ave. Architect, J. H. Mason, 23 Westmoreland. 2½ storeys, 48 x 41, brick construction. Plans ready.

Two pair residences, cost $8,000, Wineva, for Cox & Cummings, 36 Canada Life Bldg. Owners do work with own staff. Will sublet heating, plumbing and wiring. Two storeys, 33 x 42, brick construction.

One detached residence, cost $5,000, Laburnam, for Mrs. M. A. Ford, 96 Dunn ave. Architect, J. A. Thatcher, 31 Queen St. W. Tenders now open, received by owner. 2½ storeys, 23 x 44, brick construction.

Vancouver, B.C.

Apartment, cost $153,000, Hastings and Jackson Sts., for Morden Thornton, c/o Architects. Architects, Braunton & Leibert, Exchange Bldg. Six storeys, brick and mill construction. Plans prepared.

Waterloo, Ont.

Bungalow, cost $7,000, for Ezra W. Schmitt, John and Mary Sts. Architect, Ornan G. Scheifle. 32 x 30, cobble stone foundation, tapestry brick and white stucco panelled construction.

Winnipeg, Man.

Two residences, cost $11,000 each, Wellington. Builders and owners, Simmons Bros., 290 Portage Ave. Plans in progress.

Residence, St. Vital, for Prov. Govt., Dept. of Public Works, Winnipeg. Architect, Provincial Architect, 261 Fort St., Winnipeg. Plans, specifications, etc., at office of architect. Tenders received for construction of a Principal's residence by Acting Minister G. R. Coldwell, Winnipeg, till July 22, 1913.

CONTRACTS AWARDED

Amherst, N.S.

Two residences, cost $6,000, Robie, for W. J. McNair. Architect, J. L. Allen. General contractor, Jos. Baxter. Two storeys, 23 x 33, "L" 12 x 15 each, cement foundation, frame construction.

Dunnville, Ont.

Residence, cost $5,000, for T. J. McCutcheon, Dunnville. Builder and general contractor, Geo. W. Hall, Brantford. Two storeys, 30 x 50, pressed brick construction.

Hamilton, Ont.

Residence, cost $15,000, Inglewood. General contractor and owner, W. A. Noble, 80 George St.

Residence, cost $25,000, Queen St., for J. W. Lamoreaux, 26 Canada St. Architects, Munro & Mead, Chancery Chambers. General contractor, W. H. Yeates, Jr., 24 Leeming street.

Four residences, cost $9,500, Balsam Ave. General contractor and owner, J. H. Sommerville, 28 Prospect Ave. Brick construction, concrete foundation.

Four residences, cost $12,000, Spadina ave. General contractor, H. Dunham, 719 Cannon St. E. One pair, walls up, 1 pair, roofing.

Montreal, Que.

Eight flats, cost $6,000, City Hall. Builder and owner, G. Osterman, 3004 City Hall. Two storeys, 25 x 43, cement foundation, brick construction.

Residence, cost $7,000, Lachine (10th Ave.), for A. N. Carriere, Strathmore. Architect, Dalbe Viau, 76 St. Gabriel St., Montreal. Owner doing all work.

Flats, cost $6,000, City Hall. Builder and owner, Moses Waxman, 540a Sanguinet. Three storeys, 36 x 65, concrete foundation, brick construction.

Four flats, cost $6,000, Regent. General contractor and owner, Jas. L. Rankin, 177 Mansfield. Owner doing all work. Two storeys, 50 x 69, concrete foundation, brick construction.

Ten residences, cost $33,000, Emard Ward. Builders and owners, J. A. Davis & Co., Ltd., Dom. Express Bldg. Cement foundation, brick and stucco construction.

Flats, cost $7,000, St. Zotique, for D. D. Gauthier, 111 St. Zotique. Architect, R. Charbonneau, 15 St. James St. Brick, J. Casavant, c/o Owner. Carpenter, A. Seguin, 1773 St. Lawrence. Other contracts not awarded.

Garage and alterations to residence, cost $20,000, Peel St., for Duncan McIntyre, 366 Peel St. Architect, H. C. Stone,

(Continued on page 70)

Tenders and For Sale Department

TENDERS

Tenders will be received up to the **19th of July** for the erection of two rooms to the present Primary Central School, Brampton.

Plans and specifications can be seen at the Secretary's office on and after the 10th of July.

Tenders will be received for all the work or any part or parts thereof.

The lowest or any tender not necessarily accepted.

T. J. BLAIN,
Secy. Brampton Public School Board,
Dated July 8, 1913. Brampton, Ont.
29

Building Contract Tender

Tenders will be received by the undersigned for the work and materials for an addition to the House of Refuge at Whitby to be completed on or before the first day of November, 1913.

For particulars as to work to be done apply to

Dr. LAVERY,
Superintendent of the House of Refuge,
Whitby, Ont.
or J. E. FAREWELL,
County Clerk and Solicitor,
Whitby, Ont.

Tenders will be received up to the 2nd day of August, 1913, and must be accompanied by a marked cheque for $150. 29

Sealed tenders addressed to the undersigned and endorsed "Tender for Toronto Harbour Works," will be received at this office until 4 p.m. on **Monday, August 25, 1913**, for the construction of a Sea Wall, Breakwater, Ship Channel and Retaining Walls at the City of Toronto, in the County of York, Province of Ontario.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineer, Confederation Life Building, Toronto, Ont.; **Harbour Commissioner's Office, 76 Adelaide St.** West, Toronto; H. J. Lamb, Esq., District Engineer, Windsor, Ont., and J. L. Michaud, Esq., District Engineer, Post Office, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 12, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44297. 29-30

Tenders for Debentures

Municipality of McIrvine

Sealed tenders addressed to the undersigned will be received for the sale of thirteen $1,000 twenty-year Sinking Fund School Debentures bearing interest at 6 per cent.

FRANK J. STRAIN, Clerk.
29-30 Fort Frances, Ont.

Notice to Contractors

Sealed proposals will be received at the offices of the Water Commissioner, City Hall, until 12 noon, **July 31st, 1913**, for the fabrication and laying of about 10¼ miles of 36-in. rivetted steel pipe and appurtenances on the line of the Sooke Water Supply pressure conduit, and in accordance with the requirements of the general specifications prepared by Wynn Meredith, Consulting Engineer for such construction, pursuant to the provisions of By-law No. 814.

Plans and specifications can be seen, and forms of tender obtained at the Sooke Water Supply Office, 1414 Douglas Street, Victoria, B.C.

The lowest or any tender not necessarily accepted.

C. H. RUST,
Water Commissioner.
Victoria, B.C.,
June 27th, 1913. 28-29-30

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Wharf at Vancouver, B.C.," will be received at this office until 4 p.m., on **Thursday, August 21, 1913**, for the construction of a Wharf at Vancouver, B.C.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C., The District Engineer's Office, Confederation Life Building, Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office Building, Montreal, Que., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and places of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 8, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44661.
29-30

Tenders Wanted

Sealed tenders, addressed to the undersigned, marked "Tenders for Automatic Street Flushing Machine," will be received up till 4 o'clock in the afternoon of the **29th day of July, 1913**, for supplying an Automatic Street Flushing Machine of at least 600 gals. capacity.

Tenderers must supply their own specifications and designs.

A marked cheque for $200 must accompany each tender, made payable to the order of the City Treasurer, which cheque will be subject to forfeiture in case of failure on the part of the successful tenderer to enter into a written agreement and bond with the City of Windsor with approved sureties when called upon to do so.

The lowest or any tender not necessarily accepted.

M. E. BRIAN.
City Engineer.
28-29

PRICEVILLE, ONT.

Tenders for Steel Bridge and Abutments

Sealed tenders marked "Tender," addressed to the Reeve, Township of Glenelg, Priceville, will be received up to **August 1st** for the construction of a bridge at Traverston, near Markdale.

Tenders will be received as follows:—

1. Two concrete abutments.
2. Reinforced concrete floor, 110 x 14 ft.
3. Steel bridge, 110 ft. span, 14 ft. wide.

An accepted bank cheque for 5 per cent. of contract, payable to the Treasurer of Twp. of Glenelg, shall accompany each tender and will be returned on non-acceptance.

Plans and specifications may be seen at the offices of the Reeve or Engineer.

The lowest or any tender not necessarily accepted.

THOS. NICHOL, Reeve.
Priceville, P.O.
R. McDOWELL, Engineer,
29-30 Owen Sound, Ont.
Priceville, July 14, 1913.

TOWN OF BASSANO, ALBERTA

Sewage Disposal Works

Sealed tenders, addressed to the undersigned, will be received up till 18 o'clock on **Friday, 15th August, 1913**, for all labor and materials (except filter distributors) necessary for the construction of sewage disposal works, consisting of tank and filter and relative works near the Town of Bassano.

Tenders must be accompanied by an accepted cheque for five per cent. of the amount of the tender, or alternatively by the bond of an approved guarantee company.

Plans and specifications and other information may be obtained at the offices of the Consulting Engineers at Winnipeg and Calgary, on deposit of $25, which will be returned to bona fide tenderers on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

GEO. B. R. BOND, Sec.-Treasurer,
July, 1913. Bassano, Alta.

The John Galt Engineering Co., Ltd.,
Consulting Engineers. 29-30

Tenders for Bridge

Tenders will be received up to noon, **July 24th, 1913**, for the erection of a steel bridge 90 ft. c. to c. I. W. on lot 20 x 21, Con. III. S. P. R. Bentinck. Also for two concrete abutments for same. Plans and specifications may be seen with Henry Metcalf, Hanover, or James Warren, Engineer, Walkerton. A certified cheque for $200 to accompany each tender.

Signed, ALEX. WILSON,
Elmwood, Ont.
Bentinck, July 7, 1913. 28-29

Tenders Wanted

Sealed tenders, addressed to the undersigned, marked "Tenders for Incinerator," will be received up till 4 o'clock in the afternoon of the **29th day of July, 1913**, for supplying all labor, tools, and machinery for the construction of an Incinerator of a capacity to dispose of at least 25 tons per day of garbage and refuse. Incinerator must also be capable of destroying all kinds of refuse, including night soil and dead animals.

Contractors must supply their own specifications and designs, including brick or reinforced concrete building.

A marked cheque for 10 per cent. of amount of tender must accompany each tender, made payable to the order of the City Treasurer, which cheque will be subject to forfeiture in case of failure on the part of the successful tenderer to enter into a written agreement and bond with the City of Windsor with approved sureties when called upon to do so.

Incinerator must be guaranteed for at least one year from date of operation.

The lowest or any tender not necessarily accepted.

M. E. BRIAN,
City Engineer..

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, July 22nd, 1913**, for the construction of the following sewers:—

Leslie St., Danforth Ave. to North City Limits.
Hastings Ave., Gerrard Street to Doel Avenue.
Fielding Avenue, Leslie Street to Jones Avenue.
Furniss Avenue, Leslie Street to Jones Avenue.
Fifth Avenue, Leslie Street to Jones Avenue.
Skipper Avenue, Leslie Street to Jones Avenue.
Butternut Street, Jackman Ave. to Ellerbeck Ave.
Chatham Ave., Greenwoods Ave. to 554 ft. West.
Lark Street, Queen Street to Kingston Road.
Lockwood Avenue, Queen Street to Dixon Ave.
Pendrith St., 300 ft. E. of Shaw St. to 327 ft. E.
Lane 1st S. Bloor St., Shaw St. to Roxton Rd.
Lane 1st N. Queen St., Triller Ave. to Callender.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties, or in lieu of said sureties, the Bond of a Guarantee Company approved of by the City Treasurer.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, July 8th, 1913. 29

PETROLIA, ONT.

Tenders for Concrete Trunk Sewer

Tenders will be received by the undersigned up to 5 p.m. on **Monday, the 28th day of July, 1913**, for the re-construction with cement concrete work of about 1,000 lineal feet of outlet to Trunk Sewer in the Town of Petrolia.

Plans and specifications may be seen at the Town Clerk's office.

The lowest or any tender not necessarily accepted.

29-30 J. McHATTIE, Town Clerk.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on

Tuesday, July 29th, 1913

for the supply of

Portable Sewage Pumping Engines

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

The tenderers shall submit with their tender the names of two sureties or in lieu of said sureties, the bond of a guarantee company approved of by the City Treasurer.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, July 7th, 1913. 29

Tenders For Bridge

Tenders will be received for the erection of a steel bridge 45 ft. c. to c., 14 ft. roadway, at Lot 26 Town Line Arron and Elderslie. Tenders received up till noon 22nd July, and opened at the site at 3 p.m. A cheque for $100 to accompany each tender. The lowest or any tender not necessarily accepted. Plans may be seen with James Warren, Engineer, at Walkerton, or the undersigned.

Signed, S. K. EUART.
Chesley, July 7th, 1913. 28-29

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont.
29-t.f.

Tenders for Dredging

Sealed tenders will be received at the Clerk's office, Chatham, Ont. (where plans and specifications can be seen) up to 12 o'clock noon, on **Thursday, July 31st, 1913**, for dredging about 9 miles of drainage work in the Township of Dover, County of Kent. The work to be let subject to the final passing of the By-law.

The lowest or any tender not necessarily accepted. Tenders must be marked "Tenders for Dredging," and each accompanied with a marked guarantee cheque for $2,000.

Dated, June 17th, 1913.

H. M. BEEHARD, Reeve.
JOHN WELSH, Clerk,
26-30 Chatham P. O.

Town of Carlyle, Saskatchewan

Waterworks and Electric Lighting

Sealed tenders, addressed to the undersigned, will be received up till 18 o'clock on **Friday, 1st August, 1913**, for the following contracts:—

1. Construction of brick power house and concrete reservoir, and laying approximately 800 lineal feet of pipe in trenches, and relative works.
2. Supply of Air-Lift Pumping System.
3. Supply of Duplex Steam Pump.
4. Supply and erection of two H. R. T. Boilers and Stack.
5. Supply and erection of compound vertical steam engine.
6. Supply and erection of Generator, Exciter and Switchboard.
7. Supply of Poles, arms, hardware, copper wire, transformers and meters.
8. Supply of Series Tungsten street lighting apparatus.
9. Erection of Pole Line.

Tenders must be accompanied by an accepted cheque for five per cent. of the amount of the tender, or alternatively by the bond of an approved guarantee company.

Plans and specifications and other information may be obtained at the office of the Consulting Engineers at Winnipeg and Calgary. A deposit of $25.00 will be required on Contract No. 1, which will be returned to bona fide tenderers on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

F. J. STENT,
Secretary-Treasurer,
Carlyle, Sask.
The John Galt Engineering Co., Ltd.,
Consulting Engineers. 28-29

28-29

CITY OF LONDON, ONTARIO

Sealed proposals addressed to the Chairman and Members of No. 2 Committee, will be received at the office of the City Clerk until 5 p.m. on **Thursday, July 31st, 1913**, for the construction of the necessary substructure for the proposed highway bridge over the River Thames at Wharncliffe Road, the substructure is comprised of two plain concrete piers, and two reinforced concrete winged abutments containing approximately 620 cu. yards of concrete, and 17,000 lbs. of steel reinforcement.

Plans, specifications and form of tender may be seen at and obtained from the office of the City Engineer.

Contractors must enclose a marked cheque for five (5 p.c.) per cent. of the amount of their tender.

The lowest or any tender not necessarily accepted.

B. W. BENNETT,
Chairman No. 2 Committee.

WM. N. ASHPLANT,
City Engineer.
29

Pump For Sale

A Blake compound duplex, 10 x 16 x 16 x 18, 12-inch suction and 12-inch discharge, good condition, suitable for town or village supply, cost about $2,000. We offer, if taken at once, for $700. Mills Machine Co., Lawrence, Mass., U. S. A. 29

NOTICE

Extension of Time

On page 73 of this issue there appears a tender advertisement for steel bridge on lot 20 x 21 Con. III. S.P.R. Bentinck. The time for the closing of these tenders has been changed to noon, **Monday, August 11th.**

Signed, ALEX. WILSON,
Elmwood, Ont.
Bentinck, July 15, 1913. 29

BARGAINS!

1 Thew Steam Shovel, used less than 90 days, shop number 690; like new	$3,300
30 1½-yd. dump cars, 36-in. gauge; practically new. Each	30
1 American Well Air Compressor, 12 x 12 x 14, 340 ft. capacity, new	440
1 Rand Belted Air Compressor, 10 x 14; A.1.	240
1 Buckeye Trenching Machine, steam driven; cuts trench 27-in .wide to 8 ft. deep. Overhauled and A.1.	2,500
2 American, 6¼ x 10, D.C., D.D. Hoisting Engines with boilers and boom swingers, A.1. Each	725
1 Three-drum Stronsburg 7 x 10 Hoisting Engine with boiler; practically new.	725
1 Gates No. 5 Crusher, 2 arm Spider, rear drive (Rebuilt B.) Exceptionally low price.	

For anything else second-hand, write

WILLIS SHAW MACHINERY CO.

New York Life Building, Chicago, Ill.

Residences

(Continued from page 67)

84 St. Francois Xavier. Mason, J. H. Hutchison, 64 St. Ambroise. Other work being done by day labor under Architect's supervision. Two storeys, 23 x 25, residence three storeys, 14 x 30, stone foundation, brick construction.

20 flats, cost $18,000, St. Dominque. Builder and owner, Denis Magnan, 2816 St. Dominique. Mason, E. Meloche, 304 Eighth Ave., Rosemount. Roofing, electric, heating and plumbing, Napoleon Turcot, 1556 St. Lawrence. Carpenter and painting done by day labor. Plastering, A. Chalifoux, Casgrain St. Three storeys, 125 x 20, felt and gravel roofing. Mr. Magnan contemplates more flats for the fall.

Flats, cost $25,000, St. Lawrence, for Gilbert Demers, 1215 St. Denis St. Brick and carpenter not yet awarded. Roofing, heating, plumbing and electric, Roch Ouimet, 128 Bleury.

Residences, cost $36,000, Outremont, Champagneur, for H. Plante & Co., 1807 Chateaubriand. Builder and architect, general contractor and carpenter, Owner. Brick, A .Bourassa, c/o Owner. Painting, Geo. Fanson, c/o Owner. Plumbing, H. Lemieux, c/o Owner. Electric, Gauthier Gagnon, c/o Owner. Plastering, O. Renaud, 414 St. Hubert.

Flats, cost $12,000, Belgrave, for A. Desjardins, 140 Villeneuve E. Architect and builder, Owner. Brick, A. O'Leary, c/o Owner. Mason, A. Choquette, Grand Blvd. Roofing, heating, plumbing and electric, J. F. Lemieux, 2337 St. Lawrence. Painting Alderic Tasse, 6 Cazelais St. Two storeys, 60 x 52.

Flats, cost $7,000, Clarke, for Medard Paquette, 18 Blvd. St, Joseph W. Architect and builder, owner. Building to start about October. Other flats on St. Lawrence to be built in the spring. Stone foundation, brick construction.

Ottawa, Ont.

Residence, cost $12,000, Marlboro, for Lt.-Col. F. Gourdeau, 27 Golbourn. Architect, C. P. Meredith, 126 Sparks St. Carpenter, Richards & Co.

Residence, cost $7,000, 1st Ave., for J. G. Davidson, 273 1st Ave. General contractor, J. G. Howe, 324 Mutchmore. Brick construction.

Residence, cost $5,000, Fentiman. General contractor and owner, B. A. Grison, 100 Fentiman ave. 2½-storeys, 30 x 34, artificial stone construction.

Residence, cost $9,000, Allan, for E. C. Powell, 341c Kenniston Apts. Architect, W. E. Noffke, Central Chambers. All contracts being done by day labor under supervision of owner.

Quebec, Que.

Residence, cost $5,500, for Ulric Dube, 5th Ave., Limoilou. Architect and general contractor, J. Savard, Limoilou. Three storeys, 36 x 36, concrete foundation, red brick construction.

Two residences, $12,000. Owner, N. Cauchon, Turnbull St. Builder and general contractor, Owner. Three storeys, stone foundation, reinforced concrete and structural steel construction, felt and gravel roofing, gas and electric lighting, hot water heating, fire escapes and extinguishers, ventilating system, concrete and maple floors.

11 residences, cost $120,000. Owner, Hon. S. N. Parent, Ottawa, or 280 Grande Allee, Que. Architects, Tanguay & Lebon, d'Aiguillon St., Que. General contractor, mason and carpenter, Jos. Gosselin, Levis. Architects have been changed.

Residence, cost $8,000, for Isidore Trudel, 369 St. Joseph St. General contractor, masonry and carpentry, M. Paradis, St. Joseph street. Three storeys, stone foundation, artificial stone and structural steel construction. Other contracts not let.

Regina, Sask.

Residence, cost $5,000, Rae St. Builders and Owners, Constructors Ltd., 1602 12th Ave. Two storeys, frame construction.

Residence, cost $5,000, Rae St. Builder and owner, P. D. Steuart, 1934 Retallach St. Two storeys, brick construction.

Residence, cost $5,500, Ottawa St. Builder and owner, R. M. Jaques. Two storeys, brick and frame construction.

Residence, cost $5,000, Cameron. Builders and owners M. Kay Construction Co., 1818 Scarth St. Two storeys, brick construction.

Residence, cost $9,000, Smith St. Builder and owner, T. Bernard. Two storeys, brick construction, cement foundation.

Residence, cost $5,000, Victoria. Builder and owner Beech Bros. Two storeys, frame and brick construction.

Terrace, cost $56,000, 18th Ave., for C. G. Henderson, Darke Block, 11th Ave. General contractors, McDiarmid & Donelly, Scarth St. 2½-storeys, 30 x 128, brick and frame construction.

St. Thomas, Ont.

Two residences, cost $7,000. Builder and owner, Samuel Axford, Elgin street. 1½-storeys, red pressed brick construction.

Toronto, Ont.

Residence, Wilcox, for Harry Rottenburg, Anderson and University. Tenders received now by Architect, I Feldman, 199 Yonge St., for all trades. 2½-storeys, brick construction.

Four pair residences, cost $16,000, Hazelwood Ave. Builders and owners, Muir & Lumb, 857 Carlaw Ave. Two storeys, 33 x 42, brick construction and foundation.

One pair residences, cost $7,000, Enderley. Builder and owner, W. H. Clay, 2172 Gerrard E. 2½-storeys, 40 x 56, brick construction.

Two pair residences, cost $8,400, Hastings. Builders and owners, Hudson Bros., 202 Jarvis St. Two storeys, 34 x 40, brick construction.

Two pair residences, cost $8,000, Fernwood Park. Builder and owner, Geo. A. MacKay, 44 Elmer Ave. Two storeys, 33 x 42, brick construction.

Two pair residences, cost $8,000, Sherwood. Builder and owner, S. C. Hurlburt, 74 St. Clements. 2½ storeys, 34 x 40, brick construction.

Vancouver, B.C.

Residence, cost $14,975, Shaughnessy, for Dr. W. J. Lea, Crown Bldg. Architect, J. G. McKenzie, 330 Homer St. General contractor, M. Arveson, 304 Carter Cotton Bldg. Two storeys and basement, 41 x 56, hot water heating, gas and electric lighting.

Winnipeg, Man.

Residences, cost $10,000, Bertourney St., for R. R. Dobell, 52 Smith St. Architect, C. W. U. Chivers, 52 Keewaden Bldg. 2½-storeys, 24 x 34, stone foundation, brick veneer construction. Work being done by day labor under supervision of Architect.

Apartment, cost $40,000, Evanson St., for R. C. Samwell, Builders' Exchange. Architect and builder, Owner. Three storeys, 31 x 76, stone foundation, brick construction. Owner doing work by day labor.

Residence, cost $5,000, Alice, for Dr. A. G. Snell, Essex. Architects, G. Jacques & Co., Windsor. Work done by day labor. Two storeys, 25 x 37.

Windsor, Ont.
Residence, cost $8,000, Louis, for G. Adams. Architects, G. Jacques & Co. Carpenter and interior fittings, Elmer Gignac. Painting, Wm. Laesser. Heating and plumbing, Pennington & Brian. Electrical, Gilbert Campeau. Lath and plastering, John Reid.

Power Plants, Electricity and Telephones

Ayr, Ont.
Hydro-electric system for Village Council. Clerk, A. J. Reid. By-law to be voted on July 21st.

Bright, Ont.
Hydro-electric system for Village Council. By-law will be voted on July 21st. Address clerk for further information.

Carlyle, Sask.
Power house and reservoir for City Council. Sec.-treas., F. J. Stent. Con. Engineers, The John Galt Engineering Co., Ltd., 314 Kennedy Bldg., Winnipeg. and 233 Judge Travis Block, Calgary. Plans, etc., at office of con. engineers. Tenders received by con. engineers till 18 o'clock August 1st for power house and reservoir, pipes, pumping system, steam pump, 2 boilers and stack, vertical steam engine, generator exciter and switchboard, poles, copper wire, meters, transformers, tungsten street lighting apparatus and pole line.

Drumbo, Ont.
Hydro-electric system for Village Council. Clerk, J. S. Cowan. By-law will be voted on July 21st.

Montreal, Que.
Underground conduits, cost $12,671, for City of Westmount. Engineer, Mr. Jarman. General contractors, R. T. Smith & Co., 175 Metcalf ave.

Oldcastle, Ont.
Lighting system for church for St. Stephen's Congregation. Architects, Leybourne & Whitney, Windsor. Architects wish information and prices for lighting system for church.

Ottawa, Ont.
Exchange, cost $45,000, 1st ave., for Bell Telephone Co., Queen street. Architect, J. Albert Ewart, 193 Sparks St. General contractor, Geo. Crain, Clemow ave. Carpentry, J. & C. Low, 262 Catherine. Iron and steel, Dominion Bridge Co., Sparke street.

Plattsville, Ont.
Hydro - electric system for Village Council. Address Clerk for further information. By-law to be voted on July 12th.

Toronto, Ont.
Car barn for Board of Control. Mayor, H. C. Hocken, City Hall. Site selected, Benson and Bracondale. Plans in progress.

Steam reserve plant, cost $1,000,000 contemplated for Toronto Hydro-electric system, 226 Yonge street. Site not decided.

Winnipeg, Man.
Electrical supplies for School Board, Sec.-treas., R. H. Smith, Alexandria School. Commissioner of School Buildings, J. B. Mitchell, William & Ellen Sts. Tenders called for electrical supplies required for Kelvin and St. Johns Technical Schools.

CONTRACTS AWARDED

Amherst, N.S.
Extension to transformer station, cost $5,000, South Park street, for Maritime Coal, Railway and Power Company. Engineer and architect, J. L. Allen. General contractors, Rhodes, Curry & Co. One storey, 36 x 40, 22 ft. high, cement foundation, red stock brick construction.

Elmira, Ont.
Hydro-electric system, cost $10,000, for Town Council. Clerk, J. H. Ruppel. Engineer, Mr. Surtee. Poles nearly all up from Waterloo to Elmira, also nearly all up around town. Power station almost completed, ready for installation of machinery.

London, Ont.
Addition to power house, cost $20,000, for Ontario Hydro-electric Power Commission, Bay and Richmond streets, Toronto. Chairman, Hon. Adam Beck, London. General contractors, Hyatt Bros., Egerton street, London. Special brick construction.

Miscellaneous

Berlin, Ont.
Fire Hall for City Council (Fire and Light Com.). Clerk, A. H. Miller, General contractor, J. Baetz, Sr., Mill St. Heating and plumbing, Hollinger and Durst, Frederick street.

Goderich, Ont.
Fire alarm system, cost $1,700, for Town Council. Clerk, L. L. Knox. Chairman Com., Mr. Vanatter.

Hull, Que.
Ladder truck, cost $6,000, No. 3 station, for City of Hull Fire Dept. Mayor, Mr. Dupuis. Fire Chief, Tessier. By-law passed.

Milverton, Ont.
Fire equipment for Town Council. Fire Chief Hartmeir. Clerk, W. D. Weir.

Montreal, Que.
Town council of Greenfield Park wish to purchase 20,000 ft. lumber to complete sidewalks. Sec.-treas., F. W. Humphrey.

Lumber for J. B. Brosseau, 240 Papineau ave. (any length 3-in. spruce) .Laurentian Lumber Co., 507 Board of Trade Bldg. (require lumber, spruce and pine especially) H. Bourgoin, Dominion Express Bldg. (all kinds of pine). Fred Smith, 310 Board of Trade (spruce and pine of all kinds). Abel, Fortin & Co., Desjardins ave., Maisonneuve (any size spruce, pine, hemlock and basswood).

Sprinklers and sweepers for Board of Commissioners. Secretary, L. N. Senecal. Council will be asked to pass item of $13,500 for purchase of three motor-driven sweepers manufactured by Durey-Sohys, Paris. Also $6,820 for purchase of a vacuum cleaner from Mussens Ltd., 318 St. James street.

Tilbury, Ont.
Natural Gas Equipment for Union Natural Gas Co. (J. W. Kerr, Chatham, Ont.). Further information from owners.

Windsor, Ont.
Incinerator for City Council. Mayor, Henry Clay. Tenders received by Engineer, J. E. Brian, until 4 p.m. July 29th.

Street flusher for City Council. Mayor, Henry Clay. Tenders received by Engineer, M. E. Brian, until 4 p.m., July 29, for automatic street flusher. Tenderers to supply own specification and plans.

Woodstock, Ont.
Gas mains. Promoters, Geo. H. Orme, Jno. F. Carmady, Brantford; W. R. Tudhope, 165 Yonge street, Toronto. Town Clerk, John Morrison. By-law to be voted on.

Business Notes

Montreal, Que.
St. Charles R. C. Church, 401 Centre street, destroyed by fire. Loss $200,000. Rev. A. Lacasse, Parish Priest, 399 Centre street. Will rebuild. $15,000 organ destroyed. $5,000 electrically controlled chimes. All covered by insurance.

Three storey office and light manufacturing building, 146 St. Urbain, owned by Succession David Ouimet, 8th Floor, 136 St. James, destroyed by fire. Loss, $25,000. Owner will rebuild shortly after appraiser gives estimates.

Ottawa, Ont.
Hall, etc., Albert, owned by J. H. Ferguson, 590 Gilmour street, destroyed by fire. Solid brick building. Loss $55,000. A business block with stores is contemplated.

Tenement row, Elizabeth, owned by Wm. Tucker, 46 Elizabeth street, destroyed by fire. Loss $8,000. Will rebuild.

St. John, N.B.
Grish mill, City Road, owned by J. Harvey Brown, 2 Mill street, c/o W. Lafontaine Com. Academy, 86 St. Catherine W., destroyed by fire. Loss $20,500. Machinery destroyed. Owner may rebuild.

Sarnia, Ont.
Grain elevator, Point Edward, of Point Edward Elevator Co., destroyed by fire. Loss $400,000. Interested, G. T. R. and Thos. Cook, Thos. Kennedy, Sarnia.

St. Joseph Du Lac, Que.
Hotel owned by Victor Labelle destroyed by fire. Loss $12,000. Insured, will rebuild.

New Companies

General Power Corporation, Limited, was incorporated recently with a capital of $5,000 for the purpose of manufacturing and using electricity for producing light, heat, power or other purpose. The head office is at Toronto and the privisional directors are R. W. Hart, G. M. Miller, Pearl Stokes, Elsie Sutherland and Elizabeth Glen.

The Kipawa Power Company, Limited, has been incorporated with a capital of $1,000,000, for the purpose of acquiring and developing water powers and the developing and distributing of electricity in all its forms. The head office is to be at Toronto and the incorporators are Messrs. W. A. Case, J. B. Taylor, D. D. Fish, J. A. Christlaw and C. G. Lynch.

The Canadian Metal Manufacturing Company, Ltd., has been incorporated with a capital of $30,000, for the purposes of manufacturing and installing heating and ventilating apparatus, and other metal goods and to contract for any kind of metallic roofing. The head office is to be at Montreal and the incorporators are Messrs. F. W. Montgomery and J. K. Wells, Boston, Mass., and L. E. Urquhart, E. R. Montgomery and T. J. Bryan, of Montreal.

The Canadian Abrasive Wheels Limited, was recently incorporated with a capital stock of $500,000, for the purpose of manufacturing and dealing in abrasive material, machinery, pipe coverings and hardware. The head office is at Dundas, Ont., and the incorporators are Messrs. H. E. Sherk and G. R. Harvey of Hamilton, and Mary Brown, Gertrude McManamy and Ethel Phillips, of Dundas, Ont.

White Rock Water Works Company, Limited, was recently incorporated in British Columbia with a capital stock of $10,000 for the purpose of sinking wells and shafts, to build reservoirs, canals, aqueducts, etc., and to carry on the business of a waterworks company in all its branches. The head office is at Victoria, B.C.

The Crookston Stone Company, Limited, has been incorporated with a capital of $50,000, for the purpose of quarrying, crushing and manufacturing limestone, granite or other rock products. The head office is at Toronto and the incorporators are Messrs. J. A. Jelly, Shelburne, Ont., L. E. Allen, Belleville, Ont., R. Cooke, Harold, Ont., E. B. Price, Toronto, and T. H. Thompson, Madoc, Ont.

The Marsh-Hutton-Powers Company, Limited, has been incorporated with a capital of $200,000, to carry on business as a general land and building company, with head office at Port Arthur. The provisional directors are H. E. D. Hutton, financial agent, L. C. S. Hallam, real estate agent, of Port Arthur.

Electric Supply Company, Limited, has been incorporated in British Columbia with a capital stock of $25,000 for the purpose of carrying on the business of electricians, mechanical and hydraulic engineers. The head office is at Vancouver, B.C.

The Reid Todd Construction Company, Limited, has been incorporated in British Columbia with a capital stock of $10,000, for the purpose of building and operating any and all kinds of public and private works and to carry on a general contracting business. The head office is at Vancouver, B.C.

Napanee Brick and Tile Company, Limited, has been incorporated with a capital of $100,000, to manufacture and deal in all kinds of builders' supplies, with head office at Napanee. The provisional directors are E. M. Young, barrister, of Picton, and Clarence Sands Madill, broker, of Montreal.

Mountville, Limited, incorporated with a capital of $40,000, to carry on business as a general land and building company with head office at Hamilton. The provisional directors are F. W. Reinke, manager, T. M. Chambers, real estate agent, and J. E. Peart, gentleman, all of Hamilton.

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220 King Street West **TORONTO**

For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Contract Record, Toronto Ont.

If you write

"Interlock Welded Necks and Atwood Line Welds"

into your piping specifications, you avoid three-fourths of your joint troubles. The **Interlock Welded Neck** eliminates the use of cast fittings for branch lines. The **Atwood Line Weld** permits the fabrication of pipe into maximum shipping lengths with a consequent reduction of line joints. Both are our patents. Each is as strong as the pipe itself.

PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION COMPANY
Pittsburgh, Pa.

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should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario

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Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

Standard Compression Hydrant

Send us your Specifications and Enquiries.

Prompt attention given.

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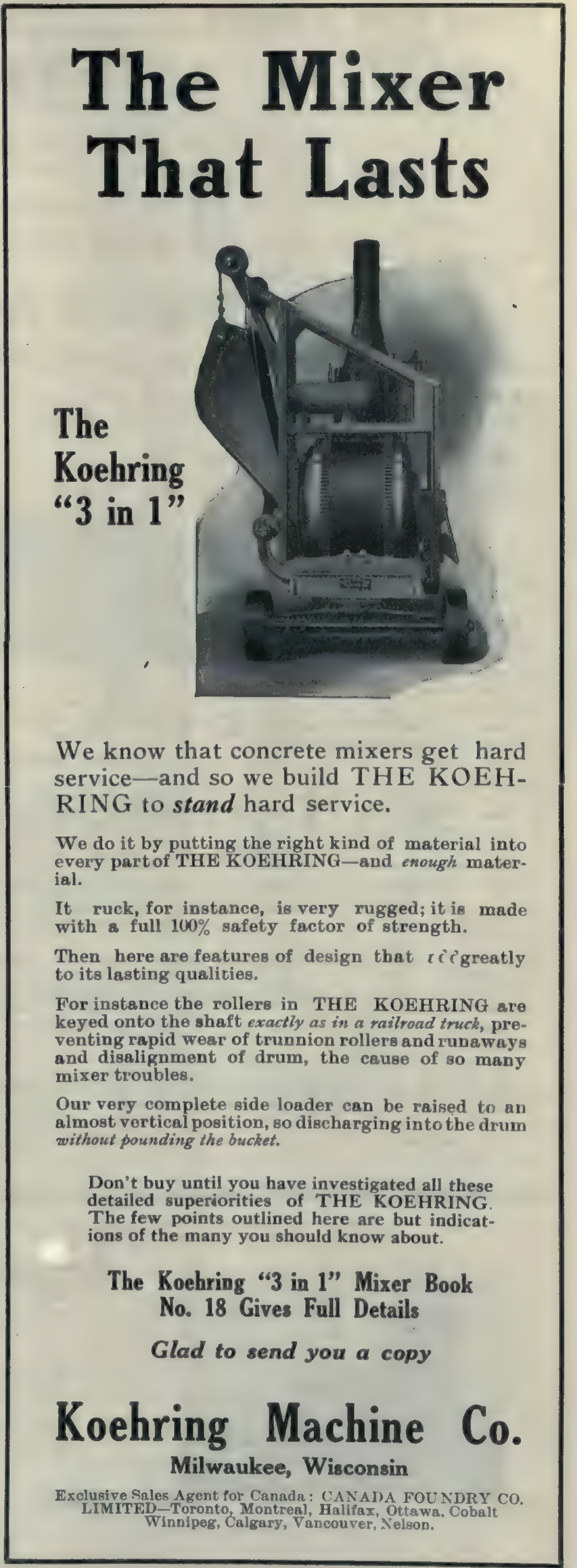
LIMITED
WALKERVILLE, ONT.



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The Koehring "3 in 1"

We know that concrete mixers get hard service—and so we build THE KOEHRING to *stand* hard service.

We do it by putting the right kind of material into every part of THE KOEHRING—and *enough* material.

Its truck, for instance, is very rugged; it is made with a full 100% safety factor of strength.

Then there are features of design that add greatly to its lasting qualities.

For instance the rollers in THE KOEHRING are keyed onto the shaft *exactly as in a railroad truck*, preventing rapid wear of trunnion rollers and runaways and disalignment of drum, the cause of so many mixer troubles.

Our very complete side loader can be raised to an almost vertical position, so discharging into the drum *without pounding the bucket.*

Don't buy until you have investigated all these detailed superiorities of THE KOEHRING. The few points outlined here are but indications of the many you should know about.

The Koehring "3 in 1" Mixer Book No. 18 Gives Full Details

Glad to send you a copy

Koehring Machine Co.
Milwaukee, Wisconsin

Exclusive Sales Agent for Canada: CANADA FOUNDRY CO. LIMITED—Toronto, Montreal, Halifax, Ottawa, Cobalt Winnipeg, Calgary, Vancouver, Nelson.

Current Prices of Building Material.

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	18 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	26 00	30 00
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	24 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 10 per cent.; lead waste, $9.00, less 10 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 35 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, $9.00 in car lots.

Lime, per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil, in bbls., 63c. per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 60c. per gal. of 9 lbs.

Turpentine, in barrels, 60c. per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Argenteuil Granite Co., Limited
42 Craig Street West, MONTREAL

We are in the market to bid on your plans for granite on buildings.

Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

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HOISTING ENGINE REPAIRS

We carry a full line of repair parts for our hoisting machinery at all times. Prompt shipment made on anything you require.

Send for Descriptive Sheet showing Parts and number to order by.

Hoists of all kinds, Winches and Derrick Irons supplied on shortest notice.

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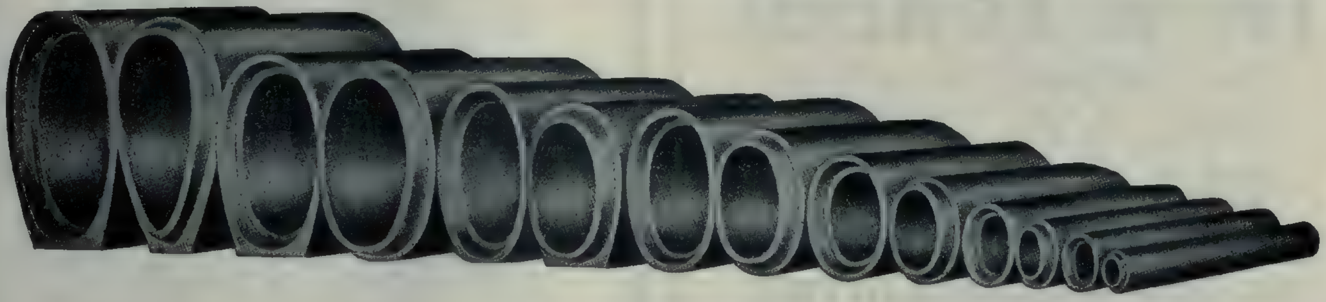

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properly built of properly made

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LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application.

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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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Iron Fences

Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

The GEO. B. MEADOWS
Toronto Wire Iron and Brass Works Co., Limited
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40 years continuous service and the bearings still in good condition

Steel Pressure Blower, one type of

Sturtevant

(REG. U. S. PAT. OFF.)

Stock Fans

Read this letter from the Master Mechanic of the Georgia Railroad:—
"We have a No. 7 **Sturtevant** Fan, which we have had about 40 years. It has just given out; that is, the fan part has worn out; the shaft, bearings, etc., are all in good condition. All we want is the movable part of the fan. Can you furnish it to us. Please advise us promptly. I have endeavored to find some date on it, but there appears to be nothing on it except the size, No. 7, and your advertisement in raised letters."

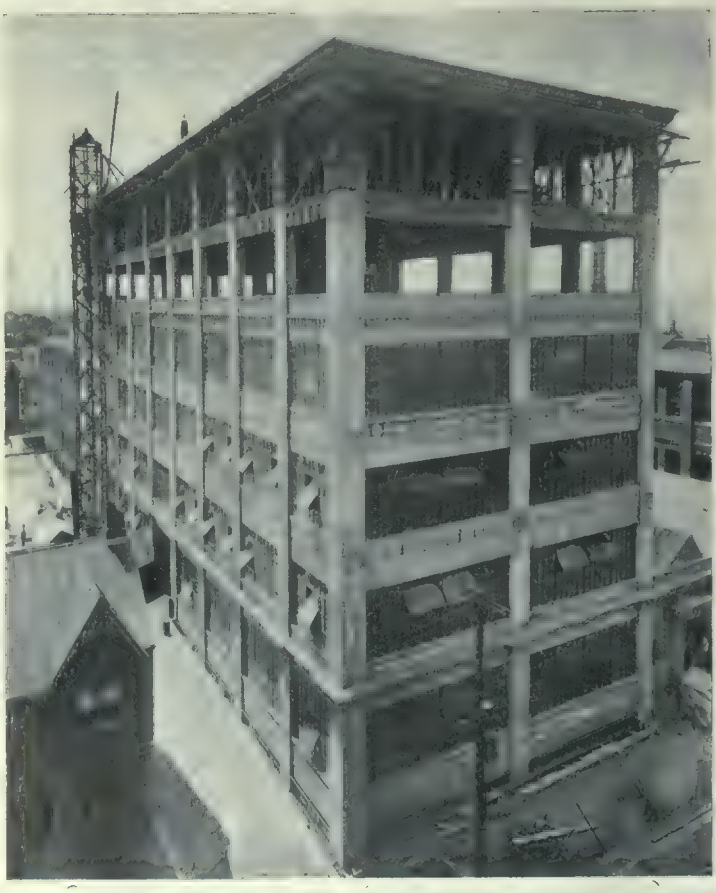
Why They Last

The best materials only are used in their construction. The wheels are carefully balanced, the shafts are made of the best quality steel, turned and ground to exact size, the bearings are large and lined with the highest grade anti-friction metal.

Sturtevant Stock Fans are built in all types and sizes, and are carried in stock ready for immediate shipment at our works at Hyde Park, Mass., and at our Philadelphia, Chicago and San Francisco warehouses.

Bulletin No. 134Z describes these fans in detail.

B.F. Sturtevant Co. of Canada, Ltd., Montreal, P.Q.



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Fireproof factory
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Gutta Percha & Rubber
Co., Limited

O'Hara Ave., Toronto

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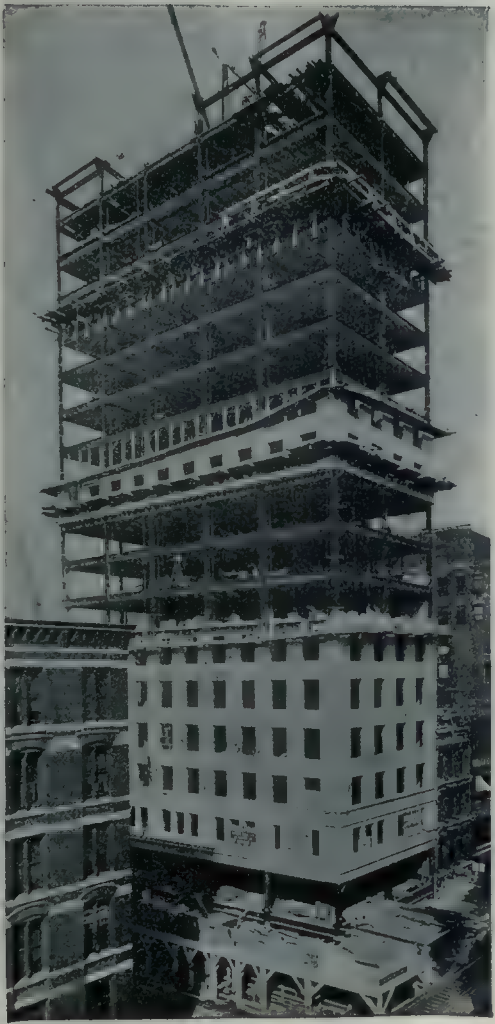

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into your piping specifications, you avoid three-fourths of your joint troubles. The **Interlock Welded Neck** eliminates the use of cast fittings for branch lines. The **Atwood Line Weld** permits the fabrication of pipe into maximum shipping lengths with a consequent reduction of line joints. Both are our patents. Each is as strong as the pipe itself.

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FOUNDRY & CONSTRUCTION COMPANY
Pittsburgh, Pa.

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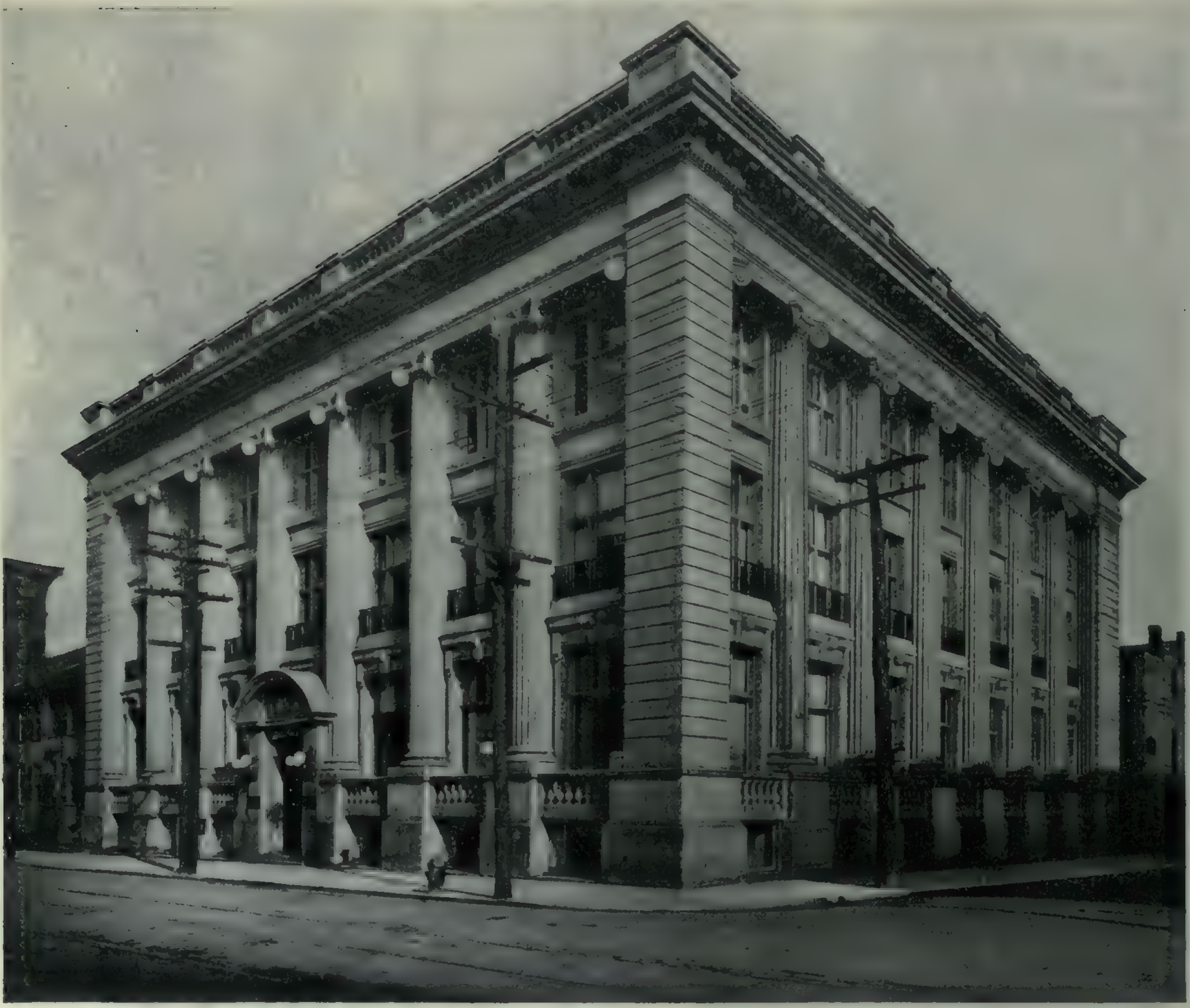

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TRADERS BANK BUILDING
TORONTO

August 16th. 1912.

Dear Sirs:

In issuing your final certificate for the stone work of the Graphic Arts Building, permit me to say that I have been very much pleased with the manner in which you handled this important contract. The material is of an excellent quality, and deliveries were up to promises. The careful attention and courtesy of the officials of your Company has done much to facilitate the rapid completion of the building.

Yours truly,

F. S. Baker

Architect.

The Roman Stone Co. Ltd.,
Temple Building,
Toronto.

The Roman Stone Company, Limited, Toronto, Ontario

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Prompt Shipments are necessary if your lines are to be laid before frost.

We make all sizes, from 3" to 84"

UNITED STATES CAST IRON PIPE AND FOUNDRY CO.

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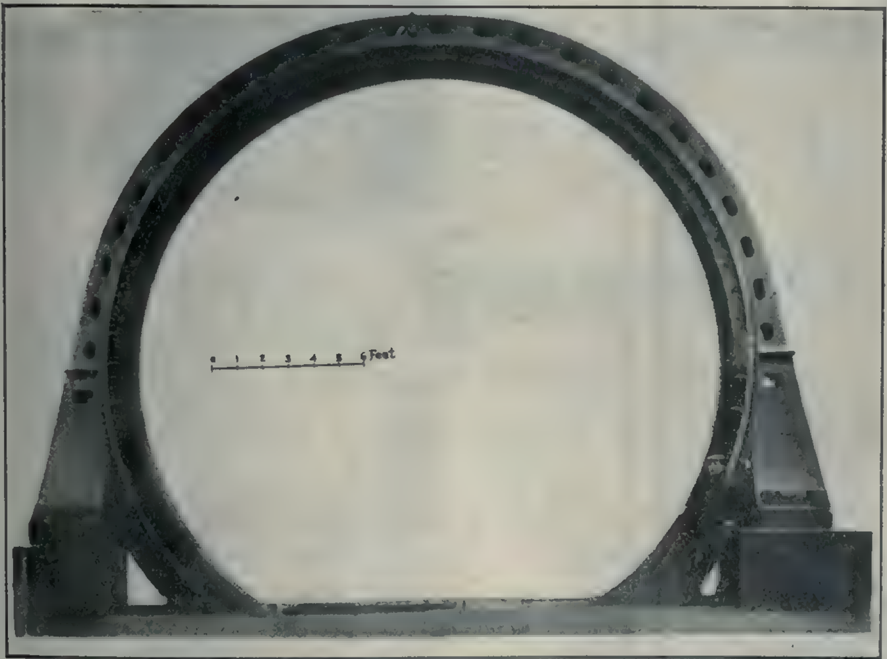

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**Alphabetical Index of Advertisers
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Advantages of Detailed Planning

THE phrase "Scientific Management" has become hackneyed in the descriptions of manufacturing processes and construction operations. Nevertheless the idea which it represents is finding fruition in many directions. One of these developments is the organization of a planning department in connection with large institutions. Two kinds of planning bureaus have been put into practice. The first is a large central department preparing the details for the whole institution. The second is a small central organization with a branch managing the detailed planning of each part of the works.

The work of this department is carried on by men whose experience has made them experts in this work. Those who plan aim to become acquainted with the details and state clearly the steps in the operation and to keep careful and accurate record of all costs to be used in making estimates and instituting comparisons.

The work of planning is generally carried on under three heads, namely, an investigation into the cost of labor applied directly to the material; an estimate of the value of the material and waste through inconvenient and unnecessary handling; a computation of the indirect labor used in the production of a given article. In direct labor the problem is to avoid wasting the time of skilled and high-priced mechanics. The loss is incurred through stoppages to decipher plans, to fetch material, or to sharpen tools. This loss is met by having the planners write out fully details of plans and unskilled labor fetch materials. In considering the question of material those in charge of the planning aim to use something that comes within the demands of the contract and yet is most readily workable. They also aim, where permissible, to have the product in a form that lends itself most readily to manipulation and arrangements are made to have as little handling as possible. A carefully prepared list of all usable second-hand material is constantly kept and is found to effect a great saving in repair work where it may be used as satisfactorily in many cases as a new article. The question of indirect labor is more difficult to deal with. By indirect labor is meant, supervision, depreciation, labor and material for cleaning shops and other items, general in character, yet a proportional part of whose cost should be located against each job in progress.

The planning department has worked efficiently in the manufacture of new material and has been particularly effective where repairing on a large scale is undertaken. Here the unusual character of the work frequently causes long delays and careful planning to a large extent makes it possible to avoid these delays.

Economical Engineering

TO-DAY most engineers would claim that their profession is reduced almost to an exact science, and that given certain conditions to meet, a relatively fixed quantity of material and labor are necessary to carry out a particular piece of work. At the same time a considerable amount of waste and inefficiency is apparent when the subject is investigated and we purpose to point out a few of these and give possible remedies.

Probably the most glaring waste relates to the preparation of estimates. Every enquiry sent out entails some amount of work, and in most cases the determination of quantities occupies the greatest time. If a design is asked for as well, the work is proportionately greater.

Very few enquiries are sent to one firm only, and each firm asked to quote will cover the same ground.

In quite a number of cases those requiring the service think they will escape the cost of professional advice by a consulting engineer. As a matter of fact they actually pay for the services given by the firms tendering on the work, perhaps not directly and probably not in a fair proportion every time.

It is, however, very evident that someone has to pay for the work done in preparing estimates, as this is one of the fixed charges on an industry, and probably from thirty to fifty per cent. of the salaries of the designing and estimating staffs are paid for the kind of work mentioned.

From a practical point of view the best consulting service should be given by a firm actually producing the article, and I should advocate, that all firms without a designing staff of their own for the particular work required should call in one of the firms from whom they propose to get a quotation, and pay them a reasonable figure for the work of designing and estimating quantities whether they give them the order or not.

This work, once done and approved, can then be submitted to as many other concerns as considered desirable. It should, however, be borne in mind that the figures and weights should be guaranteed, and not as some firms do at the present time, disclaim all responsibility for the accuracy of their work which naturally entails a check by the people quoting on the job.

Where your own organization is capable of dealing with the design and estimate of quantities follow the same course.

If you think somebody else will pay for your share of this present unnecessary expense don't lose sight of the fact that you may be paying for the other man's portion, and it may be really larger than your own. Estimates are not given free and never were given away for nothing.

One of the first things in this direction which could be readily changed, and I think with great advantage to all concerned are bridges, particularly highway bridges. The need for these is very great at the present time, and more than one economy might be effected.

Each particular province has some special requirements, and at the moment separate specifications. It would be comparatively easy to reconcile these various requirements into a few general types which would suit all conditions necessary.

In addition either a government or separate provincial departments with a properly equipped designing staff drafted from the manufacturers establishments capable of making fully detailed working drawings, bills of material, estimates of weights, etc., should be established. The work would thus be standardized and instead of making a series of bridges with only a few inches or feet difference in span, the abutments would be fixed to suit the standard bridges.

Some of the effects of this policy would be as follows:—

The elimination of about six designs and estimates for each new standard bridge.

The saving of the above work altogether on standard bridges used more than once.

The preparation of one set of working drawings, bills of material, weights, etc., for each standard bridge.

The uniformity in design, and the possibilities of stocking the exact material required, would facilitate deliveries.

Better opportunities for getting the most economical distribution of material.

The adoption of standard templates as a result of careful analysis and comparison.

That such a system run by a business government could be made a commercial success there is not the slightest doubt, and the saving effected would be enormous, both in labor and material.

Addition to Filtration Plant

COMMISSIONER Harris and Drs. Hastings and Nasmith, Toronto, have presented to the Committee of Works their report on the addition to the filtration plant now in operation at the Island. The report recommends the establishment of a mechanical filter in conjunction with the present slow sand filter at a cost of one million dollars.

The arguments upon which it is determined to establish a mechanical filter are cogent enough. During seasons of storm fine particles of sand are carried into the present filter and threaten to destroy its usefulness. A portion of the slow sand filter must always be out of use for cleaning purposes. During the winter it is practically impossible to clean the sand used in filtration and this must be taken out and stored for cleansing in the spring. A mechanical filter is more costly in operation but overcomes the difficulties mentioned in the sand filter. Owing to the amount of money—$800,000—already expended on the Island filter, Commissioner Harris and Drs. Hastings and Nasmith did not care to recommend the abandonment of that plant. However, they expressed doubts as to its permanency and some fears as to the result upon its efficiency, of the dredging and harbor work soon to be undertaken by the Harbor Commission.

The information they presented, however, was comprehensive enough to give the Board of Works grounds upon which to deal with the matter in an effective way. Since there is doubt as to the permanency of the Island plant and since, as it was pointed out, subsidiary plants will be needed in the eastern and western portions of the city, not a few wonder why the commissioners should risk a million dollars and the health of the citizens of Toronto. To many sound judgment would indicate that the money should be employed in the construction of one of these suggested plants at Garrison Common or at Scarboro Heights, where, at either of these points, permanency and efficiency could be secured.

Editorial Comment

NEW York city is spending large sums of money in order to facilitate rapid subway transit. The Public Service Commission reports that up to June 15th eighty-one million dollars were being expended on twenty-seven miles. As each tunnel contains four tracks it may be said that they have one hundred under construction. The work is being done by fourteen contracting firms, who give employment to about six thousand men daily.

* * *

THE report of the factory inspectors for the province of Ontario contains a number of interesting details. During the year the inspectors visited shops in which the aggregate of employees was 238,257. In making their visits the inspectors travelled a distance of 55,000 miles. The accidents for the year 1912 were 1,502, a seeming increase of 417 over the year 1911. This is probably only an apparent increase as the improved methods and greater strictness in enforcing the reporting of accidents is bringing to light many cases which were formerly unnoticed. The fatal accidents for the year totalled sixty-two. The inspectors find some little difficulty in maintaining the regulations with regard to protected machinery. The workmen themselves find the protective appliances in the road and discard them.

* * *

A GROUP of English and Canadian financiers, known as the Mexican Light & Power Company, has just completed at an enormous cost, one of the largest, if not the largest, power plants on this continent. The works are situated within ten miles of the city of Mexico and comprise two large power houses with four smaller plants. The total output is one hundred and fifty thousand h.p. The reservoirs are considered a remarkable engineering feat. They were built high up in the mountains and tunnels were bored through the intervening spaces in order to allow water to pass from one to the other. The largest has a capacity of six million cubic feet of water. The work occupied a period of ten years and at no time for the last three years has there been less than six thousand laborers employed.

The Quantity System of Estimating*

Loss Occasioned by Present Method—The New System — Cost Surveyors — Method of Work — Advantages

By Alexander Wright, Architect, M. A. I. A., San Francisco.

THE ever-increasing amount of unproductive time, and usually money, which contractors are called upon to expend in preparing, gratuitously, quantities, as well as prices, often for an owner's benefit, suggests that the time has arrived when all concerned should take up, and seriously consider, the possibility of adopting a modern and more sensible system of estimating, such, for example, as has been long in successful operation in older communities. Not a mere copying of such methods, for I advocate the creation of a standardized method of our own, practical above all things; a system that will be in line with our otherwise progressive building methods; a system that shall be clear and accurate, and that shall stand for square dealing between contractor and owner—in short, a system that shall give every man his due, no more and no less; a progressive system, free from the defects of other systems, such as unnecessary elaboration, and yet one that will reveal to the bidder, at a glance, the actual quantity of material and labor in a structure, in any individual trade. When bidders are invited to submit bids, they are theoretically asked of course to submit competitive prices, but in actual practice their bids are based upon competitive quantities, before the competition in prices commences; which, in my opinion, is as unjust to the contractor as it is ridiculous. A building can only contain a certain amount of material, and no amount of figuring by contractors against each other can make that quantity any more or any less. Where, then, is the sense in a dozen or more general contractors competing against each other in taking quantities? One or more bidders, through being hurried, or being unable to take off the quantities accurately, leaves something out. What happens? Their bids are consequently low, and the owner benefits, at the low bidder's expense, because his quantities are more accurate, or because there may have been room for uncertainty when figuring the plans and specifications.

Those of us who know something of the unsatisfactory conditions under which bidders are often obliged to figure, time after time without result, have realized that hundreds of thousands of dollars in time and money are taken from contractors' pockets every year, simply because they do not, so far, limit competition between themselves to the matter of prices. They go on competing, and I suggest gambling, with each other as to the quantity of material a building will take, whereas I contend that this is a question of fact, and that competition in the quantities between contractors never can, and never will, in any way, change the fact that a certain fixed quantity of material and labor is necessary to do every job. There can be no legitimate competition in taking off quantities of materials, except that unfortunate competition which bidders make themselves when they take off too much, or, as too often happens, too little.

Now let us consider, for a moment, a few of the disadvantages of existing methods:

First—The time usually given for figuring is far too short for the accurate taking off of quantities, in addition to the pricing and figuring out of the many items. A bidder usually has contract work in progress, and other matters to be attended to during the day time; other plans are to be figured by a certain time, and but little can be accomplished in the eight-hour working day, and so advantage must be taken of the night hours. Only those who have worked under these conditions and over blue prints at night, hour after hour, taking off items, can appreciate the many difficulties, pitfalls, and liability to error through figuring against time, after the real work of the business day is over. But the plans must be returned first thing in the morning, or the bid must be in by a certain hour the next day. Nothing but hurry—hurry—hurry. In not a few cases more information is necessary; something is not quite clear. The plans and specifications do not agree on some point. Which is right? There is no time to find out, the only person who can enlighten you is asleep, perhaps, while the careful estimator is burning the midnight oil, and wrestling with problems which can be avoided and entirely eliminated under a more modern system of estimating.

Again, the careful bidder who honestly tries to get in all the items, and figures to do the work as called for, is frequently beaten by a less competent bidder, who forgets something, or who, maybe, is willing to take a chance anyway, in order to get the job. True, omissions in lists of materials are sometimes unavoidable, under existing methods, which unfortunately aim at speed rather than accuracy.

It is, to say the least, disappointing to a careful bidder on a large job to find his bid just above the lowest, and after the low man has signed up the contract, it develops that the painting, or some such item, was left out. This, however, could not occur with the Quantity System.

A Bill of Quantities

Now we will investigate a bill of quantities, such as we are considering. What is it? and how is it used?

First of all, it is a document, handed free of expense to each bidder, lithographed or similarly duplicated, in order that all bidders' copies may be exactly alike. It will contain everything which it is essential for a contractor to know when making up a figure, with a separate section for each trade, such as excavation, concrete, brickwork, and so forth. A general summary is provided at the end of the bill, in which is entered the net cost of each trade; this summary is footed up, the profit the bidder expects to make is added, plus the cost of the quantities, the result being, of course, the amount of the bid.

The methods of measurement must conform to the standards used by each individual trade, and through the bill the greatest care is taken to have everything systematized; all cubic, square and lineal feet, and numbers of items, will be found all together under their respective heads. In this way, immediate reference may be made to any item required, even though the entire bill may contain hundreds of items, and so every item has its proper place—nothing is left to chance. Detail sketches also appear in the margin whenever necessary, to show a bidder at a glance what is required. These, as we know, are of more value to an estimator than the long written descriptions one sometimes finds in specifications. The key-note of the Quantity Surveyor is accuracy. In going through the drawings and specifications he has come across all those doubtful questions which always crop up when figuring under present methods. He will have taken them all up with the architect, and adjusted them, before the quantities are handed to bidders, so that everything is all plain sailing.

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* Abstract of an address to the General Contractors' Association of San Francisco, April, 1913.

Further, and right here, lies one of the greatest advantages of the Quantity System. It is not necessary, except in a general way, for a bidder to study the drawings and specifications at all, and he certainly does not have to figure them. He simply prices the bill of quantities, and, in these days of hurry and bustle, this is as much as a contractor can be expected to do for nothing. This enables the competent contractor (the one who has unit prices at his finger ends) to make up a bid for, say a $100,000 building, in a few hours, and he has the satisfaction of knowing, when the unit price is placed against each item, that nothing has been forgotten; in other words, he only contracts to furnish so much material and labor—and surely this is absolutely right in principle. Good reasons exist why the general contractor should have faith in his own judgment and accustom himself to price items in every trade which goes to make up the building business. It is the only consistent method of estimating, for anyone who claims to be a general contractor. Experience has taught most competent men that it pays to do it. The mere getting together of figures from subbidders, and footing up the totals of the lowest, is not estimating at all. That is mere schoolboy work. However, I am led to believe that this is now the exception among general contractors in San Francisco rather than the rule. The ideal contractor is the one who makes up his own estimates, and not he who is dependent, for any reason, upon sub-contractors, who thus become the real estimators. If every general contractor would keep a prime-cost book of all trades, and quantities were supplied to him, he would soon be in a position to give a fairly close figure upon any sized structure, without first taking sub-bids, and this I suggest is the most consistent, satisfactory, and profitable method to pursue, when bidding upon work as a whole; but of course it requires care and experience.

Further, one of the greatest arguments in favor of letting contracts as a whole is, of course, the fact that a general contractor has the ability to figure all trades in his own office, and that he knows how to, and will supervise the work of sub-contractors, if any. If architects can be assured of this being done, it would be better for all concerned.

In general practice I believe the accuracy of the bill of quantities should be guaranteed. Such a document might well be made the basis of the contract, equally with the drawings and specifications; if this were done, the chief cause of disputes between owner and contractor would be removed.

This, I submit, is entirely logical and right—a certain quantity of work for a certain sum of money, the owner to determine the former and the contractor to fix the latter. Surely this is morally just and fair.

Quantity Surveys

It may be asked, Where are these competent surveyors to be found? And it would be a natural inquiry, as it is no part of the duty of architects to prepare such quantities. In fact, the relation of the architect to the contractor should preclude him from having anything to do with furnishing quantities. This should be attended to by a disinterested specialist—the quantity surveyor. In older countries, young men of education are now apprenticed to practising surveyors, and it has become a recognized profession. Years ago these quantity surveyors frequently came from the ranks of the architects; others possessing the necessary education were possibly contractors, building superintendents or estimators. I have known contractors' representatives who commenced life in the workshop, who, after securing the advantages of special training, made experienced and very competent quantity surveyors. There must be a beginning to everything, and doubtless there are many men in this country who, after some little training in the technique of this work, should make reliable quantity surveyors. The principal qualifications are honesty of purpose and a knowledge of architecture and construction. The surveyor should be a neat draughtsman and have actual experience in conducting building operations. He should possess the ability to readily detect discrepancies or conditions which might give rise to misunderstandings during construction, and last but not least, the necessary mentality to act disinterestedly. He must do what is right in measuring, as between the contractor and the owner. The usual custom is for the architect to furnish the quantity surveyor with a set of drawings and a draft specification, and the latter then commences work in his own offices. During this period the architect and surveyor are in frequent consultation, to the end that all uncertanties are cleared up and adjusted upon the drawings and specifications. In short, no effort is spared to obtain perfect clearness and accuracy before bidders commence figuring.

Taking Off Quantities

Three distinct processes are involved, and each process calls for different operations.

First—"Taking off" and entering every item (or "dimension," as it is called) upon the dimension sheets. This is always done in exactly the same order, in every building; no dimension, however small, is omitted—no guess-work of any kind is permitted. The exact location in the building of every dimension taken is carefully noted, and every figure or note taken is carefully preserved for future reference.

It is impossible to illustrate here the work in detail involved in taking off each trade, but the following may serve to show the general idea: Let us follow a surveyor for a moment in taking off his dimensions for a few items of—we will say, common brick work. He always commences taking dimensions at the same point on each floor plan; every length of wall from one angle to the next is measured separately and the dimensions entered in "waste," as it is termed. We will assume that it takes, say, fourteen dimensions to go clear around a building—these fourteen dimensions and their locations are permanently recorded, footed up, and the total lineal feet is then placed immediately below this, and a line drawn across the column to separate it from the next item. The dimension is squared, i.e., the number of square feet these figures represent is figured out, and opposite to the total we find a description, thus, for example: 21-inch wall of standard common brick work laid up with lime, mortar and Portland cement, gauged three to one pointed with flat joints one side for whitewash and raked out the other side for cementing.

In good practice it might be best to give the number of square feet superficial of wall, and give the thickness. The same method is adopted with each storey, with its varying thicknesses of walls, every dimension being entered in precisely the same order, with its particular location noted.

Then we come to deduction of openings. Those with inside and outside reveals (as in the case of box-frame windows) are taken separately, door openings the same. Those of one size and one thickness of wall are "timesed," as we say, and entered in the dimension column, so: "Ddt. 9/3 feet 9 inches x 7 feet 13 inches outside wall, fifth floor."

Then should follow an item, "extra labor," to so many 8-inch common brick segment arches in, say, three half-brick row-locks to 4-foot 6-inch openings with 3-inch rise in 8-inch wall, include for cutting skewbacks, etc., and for wood-turning piece and setting and striking. In case richer mortar was specified for arches, it would be so stated, and the proportions.

When rough cutting to brick work is required, every square foot of it would be measured. Brick work in footings or foundations, or walls below ground or at unusual heights, should be all segregated and given separately, with full descriptions.

Such items as the following are then taken by the square yard or square foot—viz., selected common brick facing. If joints are struck and cut (as face work), it is taken as a separate item, as should be the case with any portions that are to be pointed with special or colored mortar. Cementing by the square yard if on ordinary plain surfaces, but if in widths of 12 inches or under, then this is separated and taken by lineal foot; should this work occur on circular surfaces, it would be so described, kept separate, and the radius given. Lineal dimensions are taken of all rough splays and chambers, flues, pointing to flashings, projecting courses, with the number of mitres, splays, or stops in same; brick sills, with the returns, are numbered, if any. The labor of forming quoins, square or splayed, and (in certain cases) the lineal feet of plumbing angles and reveals, might be taken, also leveling up for joists, bond iron and the like.

The foregoing applies to common brick work, as before stated. Now, where face brick are used, the entire surface of such facing is measured by the square foot, including reveals and soffits (but openings deducted), the kind of mortar and the labor of pointing being given. Here would be taken such items as face arches. Fair cutting by the square foot on the same principle as mentioned for common brick work. Then come lineal feet of each course, of which figured sketches should appear. Raking mouldings or belts separate; then follow the number of external, internal, raking, skew or other mitres; also square ends, etc. (if any). All other lineal feet items follow, in their proper order, and then in a similar way, concluding with numbered items, which would be described and (if necessary) sketched in the margin. I am aware that this is but a very elementary illustration of the detailed method of taking off, but the principle applies throughout every department, in every trade, from the excavator to the painter, but it would be too great an undertaking to go fully into details here in each case.

Surveyors' quantities are usually measured net, and it is so stated in the preamble of the bill—upon the understanding that the unit price for each item is to be made, by the contractor, to cover trade customs, etc., which differ in each locality.

The before-mentioned dimension sheets are usually checked over with the drawings by a second person, and then all totals are abstracted; that is to say, they are transferred to abstract sheets, under separate headings. In this way many similar items of the same value are collected together and footed up and checked. This reduces the number of items which appear eventually in the finished bill, which is written direct from those abstract sheets, and any further sketches or descriptions necessary for the bidder to thoroughly understand what is required are then finally added. When completed, a sufficient number of copies of these bills are lithographed, or otherwise duplicated, and a copy is sent by the surveyor to the list of prospective bidders, whose names and addresses have been previously furnished him by the architect.

Advantages of Quantity System

Some of the advantages of the Quantity System of estimating to the contractor are as follows:

1. Saving of time and money.
2. Greater precision in measuring.
3. No uncertainty as to interpretation of plans or specifications (the quantities should govern).
4. No visits to the architect's office when figuring, for explanations or otherwise.
5. No other work is contracted for except the quantity set forth in the quantities.
6. The contractor, if he so desires, can check up the quantities before signing a contract. The quantities should, I think, form part of the contract.
7. No bidder can inadvertently leave out anything, and so in this way arrive at too low a figure.
8. Not having to spend time taking out his quantities, the contractor has time to attend to more profitable business.
9. Systematically arranged bills of quantities duly priced (whether work has been secured or not) form excellent data for making future estimates.

Two driven wells in Immigration Canyon have been sunk to augment the water supply of Salt Lake City, Utah, where the maximum consumption in summer runs to 34 to 40 million gallons daily, an amount equivalent to 400 gal. per capita. The average consumption is about one-half the maximum. Last winter during a severe cold spell an attempt was made to run the consumption beyond this amount, but the water was not available. About 1800 services were frozen and four thawing machines were kept busy night and day. To prevent a recurrence of this experience the water department is putting down six wells at a narrow point in Immigration Canyon and hopes to develop 3,000,000 to 5,000,000 gal. daily.

An electrically propelled motor dust cart, shown in the illustration, has been placed on the markets by a German manufacturer. The body is end dumping, the control being by means of a lever at the driver's seat. The body is so balanced that tipping is easy. According to German practice, one man only goes with the vehicle, attending to both loading and unloading. The single wheel in front makes it possible to drive the car about on crowded streets. The car may also be used as a sand distributor, a small motor operating a distributing device. The wagon body can be removed and its place taken by a seat. Power is supplied by an electric battery, which will carry it about 50 miles.

Construction of the Kamloops Reservoir

By N. M. Hall, Resident-Engineer

As a result of a movement on the part of the Kamloops City Council to enlarge and improve the municipal waterworks system and adapt it to the needs of the rapidly increasing population, the east half of lot 24, in the Beckman addition was obtained as a site for a new reservoir of one and a half million gallons capacity.

Until the present year the city had been using a concrete reservoir designed to hold 150,000 gallons, but this capacity had been greatly reduced by a flaw in the wall and it was far from adequate to handle the overflow at times of small demand, or supplement the pumps at periods when much water is consumed. During the irrigation season as much as 350 gallons per head is used, which on a basis of a population of 5,000 people amounts to 1,750,000 gallons per day.

In order to meet the increasing demands of the district the city council commissioned their engineers to design and supervise the erection of a new reservoir, with the result that about March 15th, 1912, the contract was let and construction commenced soon after. The location of the new reservoir is south of the eastern portion of the city, and lies between 8th and 9th Avenues, at an elevation giving a maximum of 300 ft. stake head over the city. The 14 in. steel main running up 9th Avenue connects westward with the old power station through the city distribution system, and eastward through a 14 in. and 16 in. main with the new power and pumping station, now being installed in the eastern part of the city. This pipe was supplied by the National Tube Company of Pittsburgh, through Crane Company, their Vancouver representatives. It is lap welded with Matheson joints and in addition to the regular coating has an extra wrapping of burlap as a protection against the strong alkaline reaction of the soil in the Thompson River Valley at Kamloops.

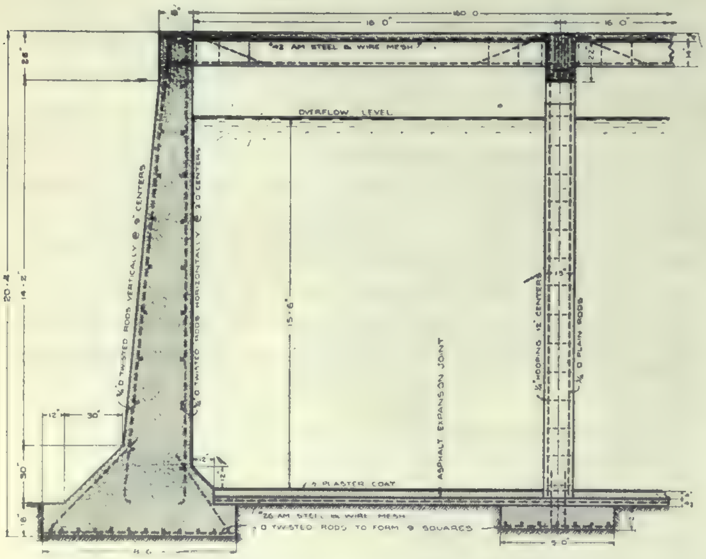

Fig. 1—Longitudinal section through main wall.

Only one pipe connects with the reservoir and the water flows in or out depending on whether the demand is less or greater than the supply of the pumps. The site is on a gentle slope and the whole so submerged that the excavation just counterbalanced the top covering of 18 in. deep and the back filling and grading of the adjacent ground. The excavation was somewhat in excess of 8,500 cubic yards and consisted of volcanic ash with traces of gravel and sand. It provided an ideal foundation for the structure.

Design Selected

The design decided upon was a totally enclosed reinforced concrete tank, with interior dimensions 160 x 96 feet, and a depth of water of 15 ft. 6 in. at the eastern end. The roof consisted of a 4 in. slab resting on a beamwork supported on square columns 16 ft. centres each way. The floor had a slope eastward of one foot in its length, and as the columns were all the same length the roof had a similar grade. The closed and backfilled type was chosen on account of the extremes of temperature and frequency of dust storms. Four tall galvanized iron ventilators and slits under the eaves of the gatehouse allow ample ventilation. The three main walls are shown in section in Fig. 1, and the fourth wall in Fig. 2. This latter will serve as the intermediate wall when the reservoir is extended southward to double the capacity, for which every provision has been made. The main walls are 18 in. at the top and 3 ft. at the bottom, not including the bevelling. The footing is a slab 18 in. thick and 8 ft. 6 in. wide. The intermediate wall is 24 in. at the top and 4 ft. at the bottom and stands symmetrically on a slab 18 in. x 10 ft. wide. The reinforcement in all walls consists of ¾ in. square twisted rods, 9 in. centre to centre, and 2 in. from each face. The horizontal rods are the same size and at 24 in. centres in each face. Additional short rods in the bevels extend into the footings lapping the verticals, and are securely tied to them. The footings of all walls have ½ in. square twisted rods placed to form 9 in. squares.

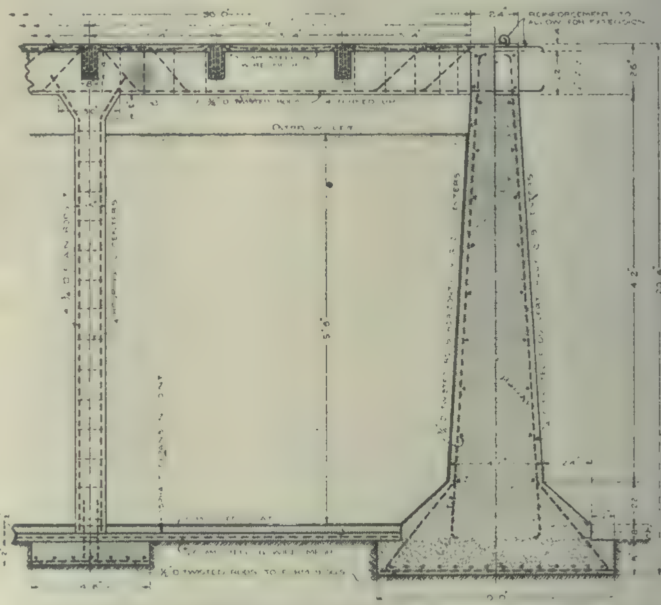
REINFORCEMENT TO ALLOW FOR EXTENSION
2' 6"
4' 2"
23' 4"
15' 6"
24"
½" O TWISTED RODS TO FORM 9" SQS
10' 0"

Fig. 2—Section through intermediate wall.

The columns are 15 in. square with 4 ¾ in. plain square rods with ¼ in. hooping at 12 in. centres. These rest on footings 12 in. thick and 4 ft. 6 in. square, reinforced, as are the wall footings.

The main girders span the roof merging at the columns with 9 in. x 12 in. haunches. They are 15 in.

wide and 26 in. deep being reinforced with 7 rods, ¾ in. square twisted, of which four bend up as shown in Fig. 2. The five stirrups at each end are ½ in. square steel.

The beams at 5 ft. 4 in. centres span between the girders and are 8 in. wide and 14 in. deep with 4 rods ¾ in. square twisted, of which two turn up, as shown in Fig. 1. They are of ⅜ in. steel square twisted.

The roof consists of a 4 in. slab reinforced with No. 42 mesh made by the American Steel and Wire Company. This provides .151 sq. ins. per foot width and will carry 275 to 300 lbs. per square foot. The floor was laid in two distinct layers. The first floor poured before any forms were erected, was 4½ ins. thick and poured directly on the ground lapping the steps allowed on the wall footings, and covering the wall footings through which dowel rods projected for connection with the column steel. This floor had embedded in it No. 26 mesh. After all forms had been removed the final layer, 4 in. thick of selected materials, was put on without any particular bond with the first floor beyond carefully washing it down. No mesh was laid in the final layer and ⅜ in. x ¼ in "V"-joints were left about 10 feet from the walls at the end of each days work. This floor and the wetted area of all walls, which was purposely left rough, was given a plastered coat of 1:1½ well trowelled in, on which was put a glazed finish of neat cement and water. The "V" joints were then poured with hot asphalt.

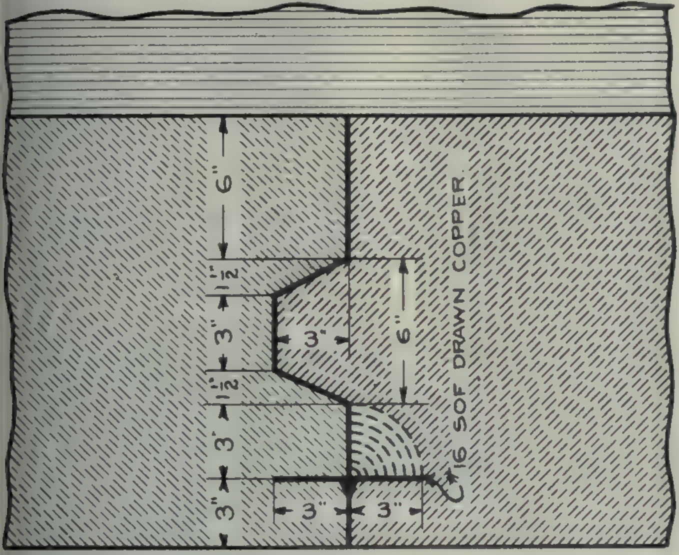

Fig. 3—Expansion joints in walls.

Fig. 5—Top runways for pouring the walls.

Expansion joints, as shown in Fig. 3, divide the walls vertically into sections about 32 feet long. These were formed by allowing no special bond between sections, apart from a dovetail and a 6-inch No. 16 gauge copper strip with a ½ in. "V" notch across the joint. The details and method of locating in the forms are shown in Fig. 3.

The Gate Well

The Gate Well shown in Fig. 4 is 13 ft. x 8 ft. with 12 in. walls with vertical ½ in. square twisted rods centrally located, 18 in. centre to centre and horizontal ¾ in. rods at spacing varying from 9 in. at the bottom to 15 in. at the top. These were located in the inner face to resist the earth pressure. This well contains the operating valves on the inlet pipe and the slush-out drain and overflow. The gate house (Fig. 4) covers the well and extends over the roof sufficiently to enclose the main manhole containing the only ladder descending into the reservoir. The walls are 6 in. thick with ½ in. rods 12 in. each way. The roof is a 3 in. slab with No. 42 mesh. There is a standard door and two stationary windows having heavy wire insertion glass in galvanized iron frames. As stated above slits under the eaves provide ventilation.

The 14 in. flanged cast iron inlet pipe passes through the gate well into the reservoir 18 in. above the floor and extends about three-quarters the length, terminating in an elbow and 12-foot vertical length. A check valve just inside the reservoir permits the water to run out but forces incoming water to enter by the upright length thus providing circulation and preventing stagnation. Within the well is the 14 in. controlling gate valve and a long radius wye for connection with the future extension. The 14 in. overflow and depressed drain with control gate lead into a common pipe to the sewer, provision having been made here also for conecting the future reservoirs. The

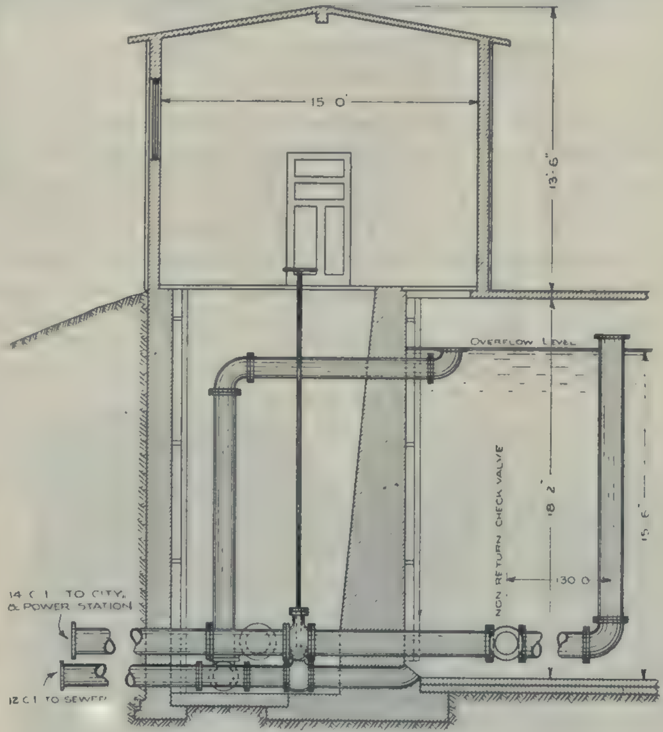

Fig. 4—Section through gate house.

main walls were designed as simple retaining walls to withstand the earth and water separately. In the worst case the resultant fell 8 in. beyond the middle third and the effect of the roof was considered sufficient to restore the resultant within that area. The intermediate wall was thickened due to the reversing stresses when acting as a dividing wall and to have sufficient width at the top for extension of roof and girders.

A second manhole with raised coping and cast iron cover was put in to assist in cleaning out. All reinforcement was lapped at least thirty diameters to form the splice. Concrete 1:2½:5 mix was used in the rough floor and all footings, and 1:2:4 mix elsewhere excepting the plaster coat of 1:1½. Various brands of cement were used owing to the shortage of the market, the principal brand being that of the Canada Cement Company of Exshaw, Alta. The sand and gravel were obtained from a hill a short distance away and were brought down in a chute 160 feet long, screened en route and run into the respective bunkers of 15 and 35 yards capacity. These were arranged for dumping into waggons driven underneath. The dry system was first employed, but owing to the continual damp weather this was replaced by the wet system, the sluicing water being pumped to the upper platform to which the material was brought by slip scrapers. After washing, the aggregate was first quality being hard, gritty and well graded.

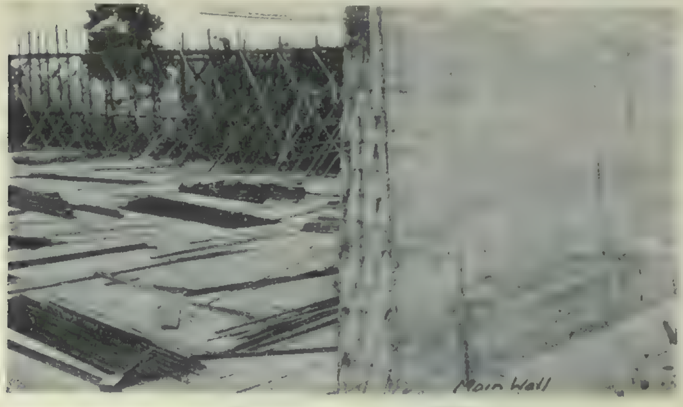

Fig. 6—Bulkheads and horizontal ¾" square twisted rods, 24" centre to centre.

Work of Construction

The lump sum contract was let about March 15th, 1912, and construction commenced soon after.

The excavation after loosening with a plow was easily removed by a slip scraper. About a month was so occupied and in the meantime the office, cement shed and chutes were erected and the mixer set up. The footings and rough floor were now trimmed up and the concrete poured without forms, and the rods in the bevels and also the dowels located. The wisdom of pouring the floor at this stage was soon apparent as it furnished a first-class area for workmen and also for storing material. The wall footings were surrounded by a line of 4 in. jointed tile laid in a bed of stone sprawls with joints covered with burlap. The wall forms in removable vertical sections in full height and 4 ft. wide were now erected and the bulkheads with dovetails and copper strips, as shown in Fig. 3, located in order to allow pouring in sections 32 feet long. The walls were poured partly from an intermediate staging and completed from the top runways as shown in the accompanying views. A wet mix requiring little or no tamping was used and rigid bracing prevented bulging or distortion of the forms. The top of the walls was coped and the rods arranged to provide a maximum bond for the roof slab and beam work. The gate well was poured in one operation. All piping and ladders were located in the forms and care taken to clean the former and pack the concrete around it. The column and roof structure forms and steel were now put in place. The columns were poured several days ahead to allow for full settlement and contraction. The roof slab was next poured, leaving 6 ft. x 16 ft. openings at each end for pouring the final floor and removal of forms. The interior was then thoroughly cleaned of all formwork and debris, washed clean and the final floor poured. Simultaneously the plastering coat was put on and the "V"-joints cleaned out and poured with hot asphalt. The finishing of the gate house and grouting in of the roof openings made the reservoir ready for the backfilling and the 18 in. earth covering. On September 15th, 1912, the remaining piping was installed and the whole carefully scoured out several times. Then filling commenced, four feet at a time being run in, in order to load the structure gradually. On September 24th the reservoir was put into permanent commission. The wisdom of putting in the expansion joints was apparent as cracks soon appeared in the walls which were in every case isolated at those joints and rendered harmless by the copper strip and subsequent plaster coat. A careful examination six weeks later showed no traces whatever of leakage all drains being perfectly dry. The grading and backfilling had not settled appreciably and everything was satisfactory.

The contractors were the C. F. Graff Construction Company of Seattle and the cost of the work was almost $33,000 not including the piping which cost about $2,000 which figures were comfortably under the engineer's estimates. The designing and supervision was carried out by Messrs. Dutcher Maxwell & Company (now DuCane Dutcher & Company), of Vancouver, with Mr. R. S. Lea acting in an advisory capacity and Mr. N. M. Hall as Resident Engineer.

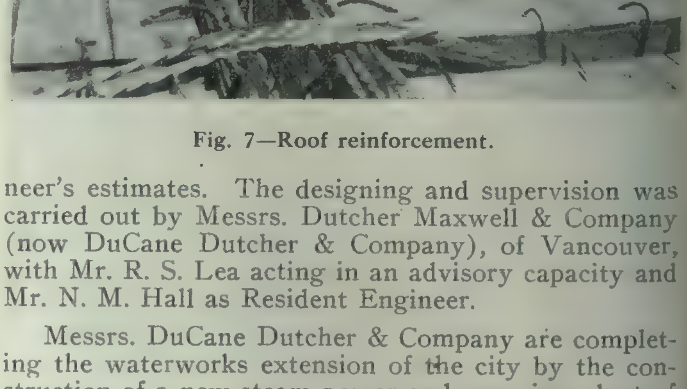

Fig. 7—Roof reinforcement.

Messrs. DuCane Dutcher & Company are completing the waterworks extension of the city by the construction of a new steam power and pumping plant of 2000 horse-power capacity, to cost about $200,000 which will act as an auxiliary and reserve plant to the hydro-electric plant they are building on Barriere River, of 10,000 h.p. with an immediate installation of machinery of 2000 h.p., which will be conveyed to the city over a transmission line, forty miles in length.

Brick Surface on Concrete Foundation For Roads

(Contributed)

SERVICEABLE as macadam has been in its day, it must surely be displaced in favor of the hard surfaced roads, according to County Engineer Frank R. Lander, of Cuyahoga County, Ohio, who is the guiding spirit in a movement which has given the vicinity of Cleveland more miles of modern highway than is possessed by any similar locality in the world.

Cuyahoga County tried macadam first, but was fortunate in its early discovery that macadam cannot be made to withstand power traffic. In a recent lecture to engineering students at Ohio State University, Engineer Lander said:

Canal Road, Cuyahoga Co., Ohio

"Extraordinary changes in traffic conditions cannot be foreseen and provided for, and when they come they destroy the pavement that was not designed for them. One of the most striking examples of this change, and one so general in its effect as to be felt all over the country is the tremendous growth of the automobile industry, which is completely revolutionizing our traffic conditions and compelling engineers to look to new methods in road building to take care of a demand that is here to stay.

Before the advent of this new problem in road construction the plain macadam of a more or less crude construction was generally accepted as the most economical and efficient method of surfacing our roads in the rural districts. It was considered the very best type that could be constructed at the price answering all the ordinary purposes of the usual traffic of a farming community, meeting these two conditions of cost and efficiency it has obtained a wide spread use in our state.

Without doubt every county has some of these stone roads while many of them have extensive systems involving a large mileage so that it is impossible to estimate the total amount invested in this form of construction. But whatever the capital invested, it has suffered a marked and sudden depreciation from the introduction of this new method of transportation. The automobile is the natural enemy of the old style road, as the most casual observation will convince most any student, and when this traffic assumes any considerable proportion it will either ruin the road or else involve a maintenance cost that is in itself prohibitive.

I might add that the various treatments applied to macadam for the purpose of preventing the destructive action of the automobile has not up to date proved very satisfactory as demonstrated in the parks and boulevards of the city of Cleveland, and they have tried out nearly everything in the way of patented preparations and processes.

I can safely say keeping within the bounds of conservation that Cuyahoga County has suffered financially to the extent of approximately $200,000 largely through the introduction of this new method of transportation with its destructive effect upon one form of pavement alone, namely, waterbound macadam, not to mention several miles of crushed slag road.

The time was when we based large hopes and expectations on limestone macadam and believed that it solved the problem of durability and cheapness in the improvement of country roads. We made a careful investigation of the general subject of stone roads and a special study of local conditions along each proposed improvement. We made a careful selection of materials, adopted the most approved methods of construction, had the co-operation of the contractors in an honest effort to construct a successful road, but in a comparatively short time, even before the abutting property owners had completed paying the assessment for their proportion of its cost every foot of these macadam roads had made way for a more permanent form of improvement, and the old improvement was not even utilized as a base upon which to construct the new surface. Under the existing laws at that time the county could not repair these roads and the lesser municipalities would not, so the result was just what a road man would predict under such circumstances—a total loss.

Centre Road, Cuyahoga Co., Ohio

Passing now from these general observations on road improvements to the more specific subject of the construction and maintenance of roads in Cuyahoga County we may well be pardoned for expressing a little local pride and indulging in a little personal exultation over our system of roads in the county for we have every reason to believe that we have the finest and best roads for any county in the state and they rank high among the roads of the entire country.

This distinguished position, however, has not been easily or cheaply obtained. We have paid the price in unceasing efforts, unpleasant experiences and discouraging failures, but through it all our officials have held true to their course, and final success seems to have been the reward of their efforts.

After careful study of the heavy traffic conditions of our country, containing within its boundaries a city of over 600,000 inhabitants and possessing a tax duplicate of over $900,000,000, after experimenting with various types of pavements, and observing the experiments of the city of Cleveland and of the smaller municipalities with other types, we have reached the conclusion that the type of improvement that comes the nearest to satisfying all the conditions of traffic in our country is a brick surface laid on a concrete foundation.

Having reached that conclusion we have held to it persistently, advocates of other styles say fanatically, until the county has a network of splendid brick roads leading out in every direction from the county seat to the county line, bringing practically every farm in touch with the city markets all the year around and bringing the farmer and his family in touch with his neighbors as well as the city in every season of the year.

Our experience as to cost in maintenance of these brick pavements since the introduction of the concrete base may be estimated very closely.

At the expiration of the guarantee period of three years some of the contractors preferred to pay into the county the sum required to place their work in condition for final acceptance. We have permitted this in a few cases where the contractor was a non-resident.

The engineers in these cases made a careful estimate of the amount necessary to make these repairs and then required the contractor to deposit a certified check to double that amount to insure the completion of the work by the county after which he was permitted to withdraw the 5 per cent. guarantee fund.

Road	Contract Price	Miles	Estimated Cost Repairs	Amount Retained
Broadview No. 1... ..	$80,000	2.55	$——	$——
Canal No. 1	120,000	4.30	60	120
Fisher No. 1	85,000	3.31	50	100
Lake Shore Blvd. No. 1	83,000	3.01	100	200
Wooster Road No. 2 ..	25,650	1.07	——	——

Addition to Toronto Filtration Plant

THE question of Toronto's water supply has been the occasion of much discussion, the cause of wide comment and a source of great outlay. The citizens fully expected that with the completion of the tunnel under the Bay and the installation of the Island filtration plant that all troubles concerning the water supply were at an end. However, it was soon discovered that there was something wrong and that the filtration beds were not sufficient to meet the city's requirements. A committee composed of Mr. R. C. Harris, Commissioner of Works; Geo. G. Nasmith, Director of Laboratories, Department of Health, and Chas. J. Hastings, Medical Officer of Health, have made investigations. They visited a number of cities where filtration plans were in operation and conducted a series of experiments on mechanical filtration at West Toronto. On July 10th they presented their report to the Committee of Works. The report is illuminating and while it recommends mechanical filters for Toronto it points out the dangers in connection with the present site and recommends the expenditure of a million dollars to increase the capacity of the present filtration operations. The Committee of Works adopted the report. As the matter is one of general importance and interest we give below the full text of the report of the special committee.

There are two standard methods of filtration, viz., slow sand and mechanical, both of which are capable of giving equally effective results. In the former system, the raw water, without chemical treatment, is passed through beds of sand and gravel at the rate of from three to five million gallons per acre per day, and the effluent is carried by gravity to a clear water reservoir, from which it flows to the distributing pumps. In the mechanical system, the water is pumped from the source, and a coagulent, usually in the form of sulphate of alumina, is applied before entering a coagulating basin, where sedimentation takes place for several hours. The water is then passed through rapid sand filters at the rate of from seventy-five to one hundred and fifty million gallons per acre per day, then flowing to a reservoir for distribution by pumping.

The slow sand process is particularly adapted to purifying water without color and with comparatively little suspended matter. The mechanical process will successfully handle any type of water, regardless of color or turbidity, and operates at maximum efficiency when raw water conditions are worst. Ordinarily, the first cost of a mechanical filter installation is considerably less than that of slow sand, and occupies but a fraction of the area required by the latter, while the operating costs are considerably higher than the slow sand method, due largely to the necessity for using coagulent.

For the purpose of acquiring information to enable us to advise the administration, we visited mechanical fifter plants at Montreal, Que.; Little Falls, N.J.; Cincinnati, O.; Columbus, O., and Niagara Falls, N.Y. We also viewed the slow sand plants at Philadelphia, Pa.; Pittsburg, Pa., and Washington, D.C. At each of these cities the type of plant used was giving satisfactory results. At Philadelphia, we found that prefiltration was necessary before admitting the water to the slow sand beds. This pre-filtration was accomplished by what is known as a "roughing filter," which is in effect a mechanical filter without the use of coagulent, and which removes from the water the greater portion of the suspended matter, thereby enabling the slow sand beds to be used at a rating much above normal. At Pittsburg, they were having considerable trouble with the water, and were making plant additions to overcome same. This, however, was not due to any demerit of the slow sand method, but is accounted for by the chemical quality of the raw water. At Washington, the water travels many miles from the source before it reaches the filters, sedimentation taking place in the channels and in certain basins en route.

The mechanical filters above referred to were also giving excellent satisfaction. Especially good results were obtained at Cincinnati, which may, in a measure, be accounted for by the fact that the water is allowed to settle for several days in reservoirs, prior to entering the plant. The works at Montreal are the most recent in point of construction. The Medical Officer of Health and Alderman Rowland, Chairman of the Local Board of Health, also visited a mechanical plant at New Orleans, La., which is giving excellent results. The plants of both types visited were handling river waters.

The slow sand plant located on Toronto Island, consists of twelve beds, having an area of .8 acres each, designed to handle a maximum of five million gallons per acre per day, or four million gallons per filter, making a maximum of forty-eight million gallons per day. However, it is necessary to have at all times at least two filters out of operation for cleaning purposes, making the average output of the plant forty million gallons per day. As a matter of fact, we have, for a considerable time, been operating at the rate of forty-three to forty-eight million gallons per day—considerably in excess of its designed rating.

To make provision for a maximum daily capacity of one hundred million gallons, Mr. Allen Hazen, the expert retained by the City, advises an addition of thirteen slow sand beds, each having an area of .8 acres, which would guarantee an average daily output of sixty-seven million gallons, after making allowance for the beds inoperative because of cleaning operations. For short periods this output could be increased to ninety million gallons per day. This addition, together with the necessary pumping plant and appurtenances, would cost approximately one million dollars. The cost of operation per million gallons, excluding pumping and capital charges, is estimated by Mr. Hazen at $1.83. This seems to be a fair figure.

A mechanical filtration plant, capable of delivering a maximum of sixty million gallons per day, would cost approximately one million dollars—equal in amount to the slow sand filtration.

While we have hereinbefore stated that the first cost of a mechanical filtration plant is considerably less than that of a slow sand, it does not hold good under local conditions, where very expensive foundation work must be provided owing to the sand formation of the Island.

The first cost of each type of plant being practically identical, the annual charges on capital account are not included in the comparisons following. In mechanical filtration, an additional head is required to operate the filters, over and above that requisite in the slow sand method. Making provision for this additional lift, Mr. Hazen estimates the cost of operation per million gallons, exclusive of capital charges, to be $4.80, which, having regard for our investigation, appears a reasonable figure.

For the purpose of illustration, assuming the average daily pumpage for the year 1914 to be fifty-five million gallons, handled exclusively by slow sand filters, the approximate cost, excluding pumping and permanent charges, would be $36,737. If thirty-two million gallons were filtered through the present slow sand beds (their average normal rating), and twenty-three millions through mechanical filters, the annual cost would approximate $61,670, showing a difference of $24,933 in favor of slow sand. In later years, if the proportion of the total supply through mechanical filters largely increased, as it naturally would, the cost difference in favor of slow sand would be greater. From the foregoing, you will observe that, from point of operating cost, the slow sand process is very much cheaper than the mechanical.

We have found in the operation of the Island plant that, at times of easterly storm, the suspended matter carried from Scarboro, and particularly the fine sand carried in the water, has rendered the filters almost inoperative. Our experience in 1912 showed this condition to obtain for four periods, and while by dint of great effort, we have never come to the point where actual cessation of filtering operations was necessary, we feel that a long continued easterly storm would probably so clog the filters as to render the use of raw water necessary.

Again, from the inset of frost in the fall until the advent of warm weather in the spring, it is not possible to wash the sand scraped from the filter beds, by the methods provided, inasmuch as the pipe lines, etc., would freeze and burst, and the sand and water would be frozen during the washing process. To overcome this, it was found necessary last summer to build a storage sand bin in each filter, wherein the sand scrapings for the winter were held. We have been working night and day since spring to wash this accumulation, plus the sand from the beds in operation, and the quantity necessary for re-sanding.

The complete construction of a slow sand filtration plant would take approximately three years, while a mechanical unit should be installed and in operation within eighteen months.

We deem it unfortunate that the Filtration Plant should have been erected at Toronto Island. The ideal place for such installation would have been on Garrison Common, which is within a convenient distance of the Main Pumping Station, and would have been the strategic point at which, if necessary, other than lake water could have been filtered. However, the fact that upwards of $800,000 has been invested in the Island plant compels the retention of the Island as a filtration site, unless the present plant be abandoned, which we, of course, cannot advise.

The formation of the Island is such as to render it an undesirable location for permanent construction of this nature, and the very extensive dredging operations which the Harbor Commissioners purpose undertaking, may cause such changes as to imperil the present or any future installation which may be built thereat. This possibility may be remote, but is of sufficient moment to justify us directing your attention thereto.

The continuity of a filtered water supply for 365 days per year, is in our opinion the dominant factor in the consideration of this proposition. A shut-down during a storm period would entail the use of raw water by the citizens, at a time when it is usually most dangerous, least amenable to chlorine treatment, and liable to produce epidemic.

While the slow sand method shows, on a pumpage basis of fifty-five million gallons per day, a saving of $24,933 per year over the mechanical system, we, your officials charged with the duty of providing an absolutely continuous and safe supply of water, are, irrespective of cost considerations, forced to recommend the adoption of the mechanical system of filtration.

THE total loss by fire as reported in Canada and the United States for the month of June reaches the almost incredible sum of twenty-four and one-half millions, an increase of approximately fifty per cent. over June of last year and twenty per cent. over June of 1911. The loss for the first six months of the present year, however, is considerably less than for the same period of 1911 and 1912. The loss occasioned by fires for the first six months of this year is given as over one hundred and eighteen million dollars. Every organized effort to prevent loss of this kind should be encouraged.

An improved in granite-block paving has been adopted in Philadelphia in the repaving of Broad street between Cumberland and Silver streets. The street was laid with granite-block paving of the old type with large blocks and wide joints. The old pavement was removed and the old blocks were cut in half and relaid with the cut end uppermost and the joints between the blocks were grouted with Portland cement mortar. The pavement obtained in this way has a much smoother surface than the pavement originally laid and the cost of the work was a little less than half the cost of laying a new granite-block pavement.

Waterproofing of Concrete[*]

Report of Committee—Permeability of Concrete—Effect of Foreign Substances — Asphalt Application — Conclusions

THE committee reports that while it has not been able to arrive at sufficiently definite conclusions to enable it to formulate specifications for the making of concrete structures waterproof or for materials to be used in such work, it has reached certain conclusions which may be of assistance to the constructor in securing the desired result of impermeable concrete. Early in the investigation, the work was found to sub-divide naturally into three branches, and the conclusions reached will be grouped in order under these sub-divisions, which are:

1. The determination of causes of the permeability of concrete as usually made from mixtures of Portland cement, sand and stone, or other coarse aggregate, in proportions of from 1 cement, 2 sand and 4 stone, to 1 cement, 3 sand and 6 stone, and the best methods of avoiding these causes.

2. The rendering of concrete more waterproof by adding to ordinary mixtures of cement, sand and stone, other substances which, either by their void-filling or repellent action, would tend to make the concrete less permeable.

3. The treatment of exposed surfaces after the concrete or mortar has been put in place and hardened more or less, either by penetrative, void-filling or repellent liquids, making the concrete itself less permeable or by extraneous protective coatings, preventing water having access to the concrete.

Considering these several sub-divisions separately and in the order named, the committee finds:

Causes of Permeability of Concrete

That in the laboratory under test conditions using properly graded and sized coarse and fine aggregates, in mixtures ranging from 1 cement, 2 sand and 4 stone, to 1 cement, 3 sand and 6 stone, impermeable concrete can invariably be produced. That even with sand of poor granulometric composition, with mixtures as rich as 1 cement, 2 sand and 4 stone, permeable concrete is seldom, if ever, found and is a rare occurrence with mixtures of 1 cement, 3 sand and 6 stone. But the fact remains, nevertheless, that the reverse obtains in actual construction, permeable concretes being encountered even with 1 cement, 2 sand and 4 stone mixtures and are of frequent occurrence where the quantity of the aggregate is increased. This the committee attribute to:

(a) Defective workmanship, resulting from improper proportioning, lack of thorough mixing, separation of the coarse aggregate from the fine aggregate and cement in transporting and placing the mixed concrete, lack of density through insufficient tamping or spading, and improper bonding of work joints, etc.

(b) The use of imperfectly sized and graded aggregates;

(c) The use of excessive water, causing shrinkage cracks and formation of laitance seams;

(d) The lack of proper provision to take care of expansion and contraction, causing subsequent cracking.

Theoretically, none of these conditions should prevail on properly designed and supervised work, and are avoided in the laboratory and in the field, under test conditions, where speed of construction and cost are negligible items, instead of being governing features as they must be in actual construction. Properly graded sands and coarse aggregates are rarely, if ever, found in nature in sufficient quantities to be available for large construction, and the effect of poorly graded aggregates in producing permeable concrete is aggravated by poor and inefficient field work. Even if we could afford the added expense of screening and remixing the aggregates so as to secure proper granulometric composition to give the density required to make untreated concretes impermeable, it is seemingly a commercial impossibility on large construction to obtain workmanship even approximating that found in laboratory work. It therefore seems that we can secure impermeable concrete most economically by adopting some special waterproofing treatment.

Addition of Foreign Substances to Cement or During Mixture

The committee finds that in consequence of the conditions outlined above, the use of substances calculated to make the concrete more impermeable—either incorporated in the cement or added to the concrete during mixing—has become general. This has resulted in the development and placing on the market of numerous patented or proprietary waterproofing compounds, the composition of which is more or less of a trade secret.

While it has been impossible for the committee to test all of the special waterproofing compounds being placed on the market, it has investigated a sufficient number of these, as well as the use of certain very finely-divided, naturally-occuring or readily-obtainable commercial mineral products, such as finely-ground sand, colloidal clays, hydrated lime, etc., to form a general idea of the value of the different types. The committee finds:

(a) That the majority of patented and proprietary integral compounds tested have little or no permanent effect on the permeability of concrete and that some of these even have an injurious effect on the strength of mortar and concrete in which they are incorporated;

(b) That the permanent effect of such integral waterproofing additions, if dependent on the action of organic compounds, is very doubtful;

(c) That in view of their possible effect, not only upon the early strength, but also upon the durability of concrete after considerable periods, no integral waterproofing material should be used unless it has been subjected to long-time practical tests under proper observation to demonstrate its value, and unless its ingredients and the proportion in which they are present are known;

(d) That in general, more desirable results are obtainable from inert compounds acting mechanically, than from active chemical compounds whose efficiency depends on change of form through chemical action after addition to the concrete;

(e) That void-filling substances are more to be relied upon than those whose value depends on repellent action;

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[*] American Society for Testing Materials.

(f) That, assuming average quality in sizing of the aggregates and reasonably good workmanship in the mixing and placing of the concretes, the addition of from 10 to 20 per cent. of very finely divided void-filling mineral substances may be expected to result in the production of concrete which under ordinary conditions of exposure will be found impermeable, provided the work joints are properly bonded, and cracks do not develop on drying or through cutting change in volume due to atmospheric changes, or by settlement.

External Treatments

While external treatment of concrete would not be necessary if the concrete itself, either naturally or by the addition of waterproofing material, was impermeable to water, it has been found in practice that in large construction, no matter how carefully the concrete itself has been made, cracks are apt to develop, due to shrinkage in drying out, expansion and contraction under change of temperature, and moisture content and through settlement.

It is, therefore, often advisable on important construction to anticipate and provide for the possible occurrence of such cracks by external treatment with protective coatings. Such coating must be sufficiently elastic and cohesive to prevent the cracks extending through the coating itself. The application of merely penetrative void-filling liquid washes will not prevent the passage of water due to cracking of the concrete. The committee has, therefore, divided surface treatment into two heads:

(a) Penetrative void-filling liquid washes;

(b) Protective coatings, including all surface applications intended to prevent water coming in contact with the concrete.

While many penetrative washes are efficient in rendering concrete waterproof for limited periods, their efficiency is apt to decrease with time and it may be necessary to repeat such treatment. Some of these washes may be objectionable, due to discoloring the surface to which they are applied. The committee, therefore, believes that the first effort should be made to secure a concrete that is impermeable in itself and that penetrative void-filling washes should only be resorted to as a corrective measure.

Asphaltic Coatings

While protective extraneous bituminous or asphaltic coatings are unnecessary, so far as the major portion of the concrete surface is concerned, provided the concrete—either in itself or through the addition of integral compounds—is made impermeable, they are valuable as a protection where cracks develop in a structure. It is therefore recommended that combination of the two methods—integral and extraneous waterproofing—be adopted in especially difficult or important work.

Considering the use of bituminous or asphaltic coatings, the committee finds:

(a) That such protective coatings are often subject to more or less deterioration with time, and may be attacked by injurious vapors or deleterious substances in solution in the water coming in contact with them;

(b) That the most effective method for applying such protection is either the setting of a course of impervious brick dipped in bituminous material into a solid bed of bituminous material, or the application of a sufficient number of layers of satisfactory membranous material cemented together with hot bitumen;

(c) That their durability and efficiency are very largely dependent on the care with which they are applied.

Such care refers particularly to proper cleaning and preparation of the concrete to insure as dry a surface as possible before application of the protective covering, the lapping of all joints of the membranous layers, and their thorough coating with the protective material. The use of this method of protection is further desirable because proper bituminous coverings offer resistance to stray electrical currents, the possible attack from which is referred to later.

So far, the committee has considered only concretes of the usual proportions, namely, those ranging from 1 cement, 2 sand and 4 stone, to 1 cement, 3 sand and 6 stone. It has been suggested that impermeable concretes could be assured by using mixtures considerably richer in cement. While such practice would probably result in an immediate impermeable concrete, it is believed by many that the advantage is only temporary, as richer concretes are more subject to check cracking and are less constant in volume under changes of conditions of temperature, moisture, etc. Therefore, the use of more cement in mass concrete would cause increased cracking, unless some means of controlling the expansion and contraction be discovered. With reinforced concretes the objection is not so great, as the tendency to cracking is more or less counteracted by the reinforcement.

It has also been suggested that the presence in the cement of a larger percentage of very fine flour might result in the production of a denser and more impermeable concrete, through the formation of a larger amount of colloidal gels.

Neither of these suggestions have been especially investigated by the committee. Both appeal to the committee, however, for the reason that they substitute active cementitious substances for the largely inactive void-filing materials previously recommended, thus increasing the strength of the concrete.

Conclusion

In conclusion, the committee would point out that no addition of waterproofing compounds or substances can be relied upon to completely counteract the effect of bad workmanship, and that the production of impermeable concrete can only be hoped for where there is determined insistance on good workmanship.

The production of impermeable concrete has assumed greater importance since the appointment of this committee, owing to the well-known injurious action of saline or alkaline waters and to the suggested possible effect of the moisture in concrete occasioning or aggravating electrical action from stray currents.

Originally, the question of waterproofing involved mainly the physical troubles resulting from water passing through concrete without any special consideration of its effect on its durability, or other than a gradual leaching out of the cement. Recent developments suggest the possibility that owing to the increased conductivity of damp concrete to electrical currents, such currents, if present, may so affect damp concrete as to seriously lessen its integrity, and this possibility further emphasizes the importance of the recommendation that no waterproofing compound of unknown chemical composition be added to concrete, as recent tests seem to show that the action of electrical currents is aggravated by the presence of certain solutions.

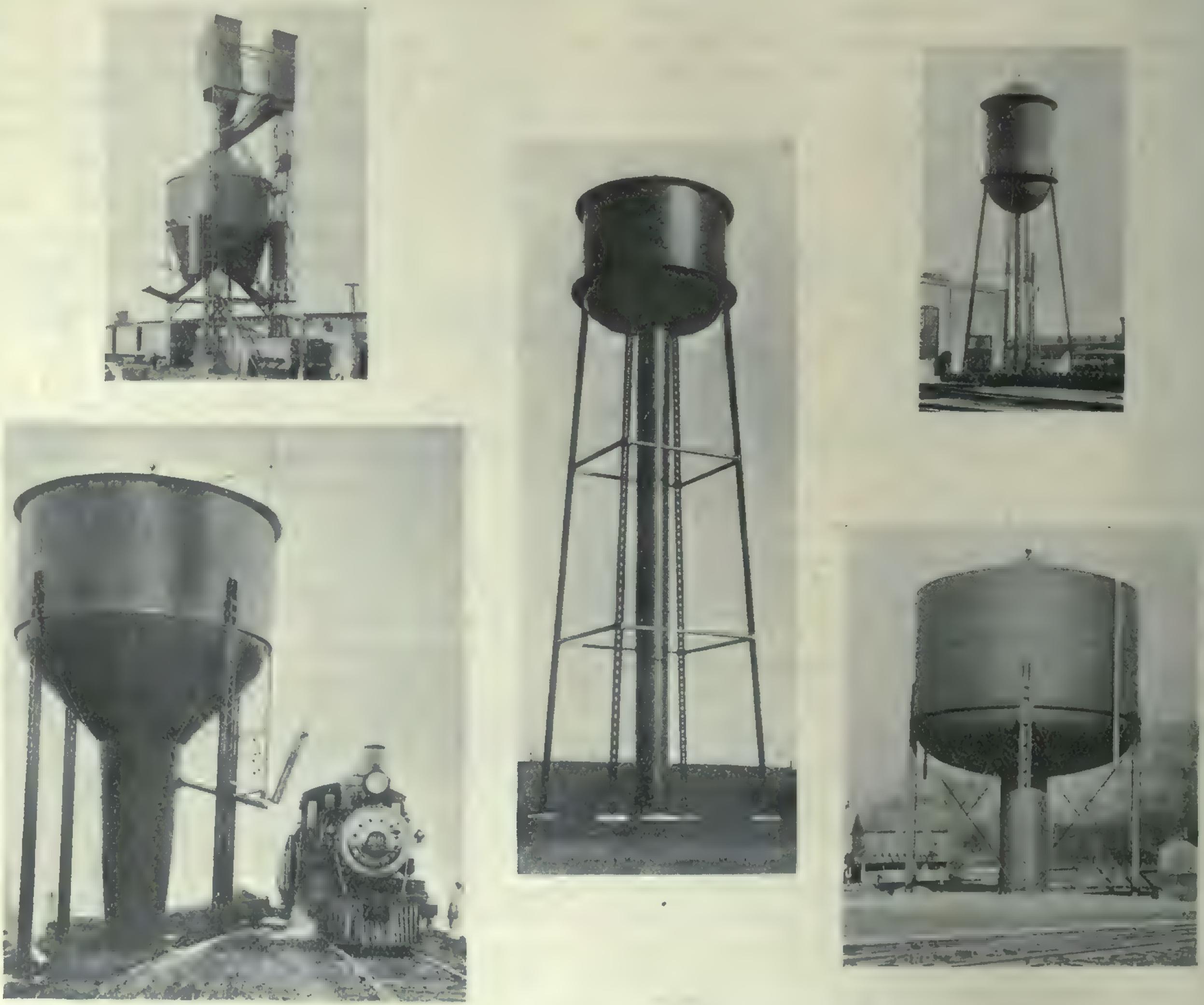
Canadian Plant of Chicago Bridge and Iron Works

The Chicago Bridge and Iron Works has built and is now operating at Bridgeburg, Ont., a new plant for the construction of steel water towers and standpipes. This company claims to be the first to make commercially possible the hemispherical bottom steel tank and since to have brought out all of the important improvements on the original design, such as the elliptical and conical bottom tanks, methods for heating the tanks and improvements in the construction of details, such as the revolving ladder for all types and the brass lined expansion joint for the hemispherical bottom type.

About 1893 Mr. Horace E. Horton, then president of the company, conceived the idea that the tower posts could be rivetted directly to the sides of the steel tank and that the tank sides themselves would act as vertical girders to transfer the weight of the water to the posts. Up to this time all steel tanks had been built with flat bottoms or with some indirect and awkward method of attaching the posts to the tank. The hemispherical type of tank once properly designed quickly replaced the old-fashioned standpipe except where a hill was available and centrally located.

About ten years ago Mr. George T. Horton, now President of the Chicago Bridge and Iron Works, brought out and patented the elliptical bottom tank, an improvement on the hemispherical bottom type. The new design, as shown herewith, is built of large diameter and shallow depth, thus approaching as nearly as possible the absolutely uniform pressure which is so desirable.

The special feature of the design is the large steel riser pipe rivetted directly to the tank bottom. This construction does away with the leaky expansion joint and wood frost casing which previously had been used with every other type of tank. The diameter of this riser pipe varies from three to six feet depending on the climate, the size being made in all cases large enough



Improved designs of elliptical and conical bottom tanks.

to prevent interruption of service from ice. Some ice will form on the side of the pipe but not enough to prevent circulation. The success of this idea is well shown by the large number of tanks of this design which have been in successful operation through the northern part of the United States and Canada.

The tank bottom is practically flat where the riser pipe is attached and therefore is flexible and in itself an ideal expansion joint. This is illustrated by a 200,000 gallon tank, 175 ft. to the bottom, which has been in successful operation for two years.

The large riser pipe, besides doing away with the wooden frost casing and expansion joint, also serves as a settling basin. The inlet and outlet pipes extend up into the large riser several feet so as to be above any possible accumulation of sediment and a washout valve operated from the outside is installed at the bottom riser so that the tank can be cleaned without emptying or interrupting its service. This feature, together with the elimination of the expansion joint and wooden frost casing has proved so popular that the elliptical bottom type of tank, designed only for locomotive service, is now widely in use for municipal plants and sprinkler systems.

It was found that where railroads are using muddy river water that the self-cleaning feature of the tank was of great importance and in order to facilitate the precipitation a new design was brought out. This tank as can be seen from the accompanying cuts, differs from the elliptical bottom tank only in that the conical bottom makes a minimum angle with the vertical of 45 degrees. This type is recommended for use where the water contains a very considerable amount of sediment. The Chicago Bridge & Iron Works tanks are in service on eighty-five railroads in the United States and Canada. Some of the large systems are the Transcontinental and Grand Trunk Pacific, Chicago Burlington & Quincy, Chicago & Northwestern, Pennsylvania and New York Central lines. The tanks have been installed in numbers from 1 to 156 per railroad.

For municipal service the large riser pipe type of tank does not require any heating except under very unusual circumstances. For sprinkler service, where the water remains constantly stationary the tank is usually heated with a brass steam coil. The same method is used for locomotive service tanks which are not frequently used when steam is available. If the locomotive tank is located at a point where the traffic is reasonably heavy, no heating is needed. For isolated locomotive tanks where no steam supply is available a heating stove is installed in the bottom of the large riser pipe which has its bottom raised about six or seven feet above the top of the foundations. The lower six or seven feet of the riser pipe is then lined on the inside with brick and forms a heater house. The stove pipe extends directly up through the centre of the tank out through the roof. This company asserts that they were the first to propose this method of heating when these tanks were adopted as a standard on the Transcontinental Railway between Superior Junction and Cochrane. This method of heating has proved very satisfactory and has since been adopted on other lines.

The company further claims that other manufacturers have brought out tanks very similar in appearance to those built by the Chicago Bridge and Iron Works, and that in order to avoid infringement of the patents held by Mr. Norton they provide an expansion joint to connect the riser pipe to the tank bottom, by investigating the construction of this connection the imitation can always be distinguished from the original design. The Chicago Bridge & Iron Works has in operation besides its original plant at Chicago and its new plant at Bridgeburg, Ontario, a shop at Greenville, Pa., near Pittsburgh. These favorable locations make it possible to avoid all excessive freight and duty charges.

The Essential and the Non-Essential in Pure Water*

SUCH standards of purity as have been tentatively advanced in the past are purely technical in character. The ordinary sanitary analysis, on which such standards are based, consists of a long list of determinations, both qualitative and quantitative, and the usefulness of many of them is supposed to lie in the information they afford with respect to whether the water has ever been polluted with animal excrement, and when and in what quantities. If it be assumed that water is free of pathogenic bacteria, and it can be shown that mere organic and mineral matter does not deleteriously affect the health of the consumer, what possible good can come from laboriously and expensively analysing water for "oxygen consumed," "nitrites," "nitrates," "chlorine," and "total solid matter"? Why would it not be much better to restrict the ordinary chemical analysis to the really important, although simple, determinations, such as taste, odor, color and turbidity, in order to establish the range in its physical characteristics, and for suspended matter, iron and hardness to furnish a line on the really essential features of its chemical makeup?

How many waterworks are supporting laboratories at no small cost for the purpose of filing file after file with the results of chemical analyses which not only are incapable of definite interpretation, but which would be of no aid to the superintendent in the operation of the works if they were? In many cases such laboratory work is continued as routine because similar work is done in so many other water works laboratories.

Therefore, why not pay more attention to the recording only of such important data as will give clear, continuous and valuable information that any waterworks superintendent can understand, and which will serve as a reliable guide in the operation of the works under him? It is astonishing how much really valueless information is available on the nitrogen content of waters, and how comparatively little on color, turbidity and hardness. The filtration man does not strive for the removal of nitrogenous matters from water, per se, but he certainly bends every effort to the removal of color and turbidity, and very often, too, of hardness and iron. Let us now consider briefly of what real value is the chemical analysis so commonly carried as routine work in the waterworks laboratory, taking up each determination in the order in which it usually appears on the record sheets.

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* Abstract of Paper by Mr. Geo. A. Johnson before the American Water Works Association.

Value of Chemical Analysis

Temperature.—Temperature observations are of some value in connection with the operation of a filtration plant, because it is well known that all filters do their poorest work during cold weather; and where coagulating and softening chemicals are employed in water treatment it is equally well known that the coagulating and softening reactions are measurably slowed up by low temperatures, and accelerated by high temperatures. Temperature observations at different depths in ponds, lakes and reservoirs often furnish valuable information with respect to stratification, etc., and readily explain the reason for the periodic unsatisfactory appearance and taste of some waters, due to spring and autumn "overturn."

Turbidity.—The ordinary citizen does not look with favor on a water which is turbid; that is, carries in suspension mud, silt and clay in quantities sufficient to impart to it a marked cloudiness or a distinct muddy appearance. It is not so much a case of whether such matter is actually injurious as that it is not agreeable to the sight, and promotes other aesthetic prejudices such as those against taking into the system so much actual mud and dirt. Therefore, in all up-to-date cities where the water supply is turbid it is the custom to treat it in some way before delivering it into the mains, in the endeavor to remove the turbidity and make it agreeable to the sight.

Color.—Many first-class water supplies are highly colored. This yellowish color originates for the most part in vegetable extractions, and where stains are usually prominent. Such color has no sanitary significance, but offends the aesthetic sense of sight, and it has become the custom in large cities to use every reasonable effort to effect its removal before the water is delivered into the mains.

Bacterial decomposition of the deposits on the bottom of some lakes deprives the lower strata of their oxygen, and such layers become highly colored. With the periodic appearance of the "overturn" in spring and autumn these colored layers are brought to the surface, distributing the color throughout the entire body of water. Furthermore, under the anaerobic conditions sometimes existing at the bottom of lakes and ponds, iron is thrown into solution. On being brought into contact with air this iron is oxidized, imparting to the water a reddish brown color.

Under ordinary circumstances sun bleaching is actively felt for a depth of about 1 ft. beneath the surface, and in a month's exposure to the sun's rays the color removal will amount to about 20 per cent.

By treating colored waters with chemicals all vegetable stains can be removed. Ozonization, and the use of oxygenated compounds of calcium, sodium or chlorine will effectively decolorize water, but their high cost is usually prohibitive were there no other objections to these forms of treatment.

Filtration of colored water through clean quartz sand will not effect measurable decolorization, and it is well known that without the aid of a coagulating chemical slow sand filters will not consistently remove more than about 20 per cent of the dissolved color in water. The most efficient and satisfactory method of water decoloration is by coagulation, followed by filtration.

Taste and Color.—Objectionable tastes and odors are sometimes naturally imparted to water through the growth of certain forms of microscopical life, and when such are recorded in the laboratory are followed by the taking of prompt measures to correct them, such as the application of copper compounds and the like to the affected water in the lakes and reservoirs on the collecting and distributing system. Such tastes and odors have no sanitary significance, but are aesthetically objectionable.

In some cases certain industrial wastes discharged into the water above the intake will impart an offensive taste and odor to it. The routine test at the laboratory should furnish reliable data in this line, and allow such odors and tastes readily to be traced to their source, and thus make their elimination possible.

Nitrogen.—All organic matter naturally passes through a cycle of changes before arriving at the final stage of nitrate or saltpetre, and free and albuminoid ammonia, as determined in the chemical analysis of water, represent the nitrogenous organic matter in its earlier transitional stages. The presence in water of nitrogen in this form furnishes circumstaitial evidence of its prior pollution, since fecal matter invariably contains such products. The word "circumstantial" is used advisedly, for the reason that vegetable matter from swampy areas, although remote from sources of animal pollution, often contributes nitrogen in these forms in considerable quantities. As such it would, of course, have no sanitary significance.

By some it is considered that the ratio between free and albuminoid ammonia serves as a fairly accurate guide in determining the character of the organic matter contributing it; and that a high free-albuminoid ammonia ratio coincident with low chloride and nitrates characterize vegetable organic matter; and, conversely, that high free ammonia with high amounts of chlorides, characterizes animal organic matter. In a very general way this is true, but since by chemical analysis one can obtain from vegetable matter precisely the same combination in free and albuminoid ammonia, nitrites and nitrates, that come from the analysis of water polluted with animal excrement, the evidence furnished is certainly but circumstantial.

And after all of what sanitary significance is mere organic matter, whether animal or vegetable, in the absence of specific germs of disease? Eliminating the aesthetic phase, and the possible effect of imagination on the human organism, it actually has very little sanitary significance, as will be shown later on.

Chlorine.—The chlorine found in water is not of particular sanitary significance, but inasmuch as sewage and domestic wastes contain large amounts of salt, its presence in water supplies indicates that it may have come from such sources. The water supplies of seaboard cities, even when unpolluted, are normally higher in chlorine than unpolluted inland supplies, due to the salt blown in from the ocean. In certain inland localities unpolluted water supplies are high in chlorine , due to mineral deposits in the soil. Therefore, like nitrogen, high amounts of chlorine in water merely furnish circumstantial evidence of dangerous pollution.

Total Solids.—When a sample of water is evaporated to dryness the dry residue represents the total solid matter which the water originally contained. This includes, not only the matter in suspension which rendered the water turbid, but matters in solution. The results have little or no sanitary significance.

Volatile Solids.—When the dish containing the "total solids" is heated the so-called "volatile" solids are burnt up. These are supposed to represent the organic matters present in the water, and some analysts attempt to characterize these by their charred appearance and odor when burning. Such determinations have little or no value in water analysis.

Hardness.—Water, in its passage over and through the soil, dissolves and picks up certain minerals, among the most common being lime and magnesium. These give to the water its hardness.

There are two kinds of hardness, namely, temporary and permanent. The carbonates of lime and magnesium, held in solution by the dissolved carbonic acid in the water, constitute the temporary hardness and may be almost completely softened by boiling. Waters which, in addition to dissolved carbonates, contain in solution calcium and magnesium sulphates, chlorides or nitrates, cannot be effectively softened by boiling. Such hardness is termed permanent.

It is difficult to set a maximum limit for the amount of hardness a water may contain and yet be considered satisfactory. In the lake cities a total hardness of 100 parts per million is considered satisfactory, yet such a hardness in Eastern Atlantic cities would be considered unsatisfactory. At Columbus, O., where the total hardness of the raw Scioto River water ranged from 41 to 372 parts per million, and averaged 222 parts during the year 1912, the water is softened, and the endeavor is always to deliver to the consumers a water having a total hardness of 100 parts per million or less. In 1912 the actual hardness of the Columbus tap water averaged 79 parts per million.

Hardness determinations are highly important, and should be carried as routine in all waterworks laboratories. By determining the total hardness and the alkalinity (the difference generally representing the permanent hardness) an excellent line is afforded on this important characteristic of water. The records are of value in settling discussions as to the advisability of softening the water; in soap consumption; on its utility for various industrial purposes, and on its suitability for steam raising. Where a coagulating chemical is used in the purification of a water supply it is indespensable, owing to the fact that a certain amount of alkalinity is required to decompose every grain of added coagulant, otherwise if the alkalinity be deficient, coagulation will be unsatisfactory and undecomposed coagulant appear in the treated water; an inadmissable condition. The sanitary aspect of hardness will be referred to later on.

Iron.—Practically all natural waters contains iron. The soil contains iron in the form of sulphide or oxide. Being dissolved out in water it may be present as an oxide, a carbonate, or as "humic acid," the original organic compound which holds ferric oxide in solution.

Ferric oxide can be removed by sedimentation and filtration; ferrous carbonate by aeration through the opportunity thus afforded for the escape of carbonic acid; and if the iron happens to be in combination with organic acids, the addition of alkalies will break up the loose combination and liberate the iron.

Generally speaking, no water can be considered entirely satisfactory which contains more than about one part of total iron per million parts of water. Even a less quantity than this is desirable, as a taste is sometimes perceptible in water containing around one part of iron.

Carbonic Acid.—The determination of free carbonic acid in water is of importance, as it is well understood that it is an active agent in the corrosion of metals, particularly iron and lead. "Red water" troubles are often to be laid at the door of free carbonic acid, in some measure at least, and where it is present in relatively large quantities steps are often taken to remove it by adding lime to the water.

Where coagulating chemicals are used, particularly where lime is not employed with the salts of iron and aluminum which are more commonly used as coagulants, the determination of free carbonic acid furnishes valuable information, as with each grain of added coagulant there is a corresponding increase in the amount of free carbonic acid.

Significance of Common Constituents

Eliminating from discussion for the time being all forms of bacterial and other microscopic life, let us consider the evidence bearing on the sanitary significance of the more common constituents of water, as determined by chemical analysis.

Physical Features.—Under this heading, of course, come taste and odor, color and turbidity. What effect on the health of the consumer have these features as applied to water?

A water heavily charged with mud will naturally possess an argillaceous or clayey taste and odor, the same being intensified on heating. This is not agreeable to many. Assume that a water contains on the average 100 parts per million of suspended matter. In a year's time an adult will consume in this way about 1/7 lb. of such matter, or some 5 lbs. in a lifetime. This quantity in itself cannot be considered as having any sanitary significance.

Water which is naturally highly colored sometimes possesses a slight astringent taste, but such coloring matters, being vegetable stains for the most part, can have no deleterious effect on the health of the consumer.

Some waters possess offensive tastes and odors due to growths in them of certain higher forms of microscopical life, and due to the liberation by them of essential oils in process of their development or decay. These are relatively small in quantity, and cannot in themselves actually cause serious disturbances in the body of the consumer.

Some waters are so heavily polluted with certain industrial wastes as to give them a highly objectionable taste and odor. Probably the most prominent in this line are waters tainted with the waste liquids resulting from the destructive distillation of wood and coal. Creosotes, phenols and similar compounds are especially offensive and far reaching. A very few drops of creosote will impart a marked taste to a gallon of water.

Now as to the sanitary significance of such substances in water. Let us assume that the 200 lbs. of creosotes and phenols were all pure creosote. The medicinal dose of creosote may safely be taken at ten drops. To get a single medicinal dose from water polluted as above it would be necessary for one to consume over 30 gallons of the water. Furthermore, creosote is not a cumulative poison, but is rapidly excreted through the pores of the body, leaving nothing behind.

Finally, then, those physical characteristics natural to many surface waters which lend to them an unsightly appearance, or an objectionable taste and smell, are of actual injury only in so far as they may affect the individual imaginatively. This feature is not to be disregarded, however, for there is no doubt that many thousands of people actually have thought themselves into the grave. One of the first lines of common sense water logic, therefore, is that drinking water shall be free from perceptible quantities of color and turbidity, and that it shall possess no disagreeable, or actually foreign, tastes or odors.

Organic Matter.—Under this heading, although it may not be precisely correct, we will include all nitrogenous matter, such as free and albuminoid ammonia, nitrites and nitrates; and carbonaceous matter, such as "oxygen consumed" and the like; in short, all organic matter found in water, both of vegetable and animal origin, whether derived from human or animal excrement or from the wash of woods and fields. It is necessary at this point only to eliminate living bacteria from the discussion. They will be considered later on.

There is nothing in the complex compounds of organic matter commonly found in water supplies which need give alarm to the water consumer. Prior bacterial decomposition of such matters, doubtless, is instrumental in producing certain ptomaines, which in sufficient quantity would exert in some degree a toxic effect on the human organism. But while such conditions might be conceived of in sewage, in water, even after it has received sewage up to the limit of its powers of digestion, the dilution of such substances is too great to warrant serious consideration being given to this feature.

Chlorine.—The effect of chlorine on the public health, in the quantities and as found in water, is nil. The average individual consumes at the table each day many times as much salt as is ever present in a drinking water supply.

Hardness.—It is the contention by some physiologists that those constituents which make water hard are deleterious to the public health. In some cases this view would seem to have considerable merit. The traveler is unpleasantly reminded of the effects of abruptly changing from a soft to a hard water, and vice versa, but there are no statistical data to prove that in general the hardness of a water has any clearly defined effect one way or the other on the public health. Although it is strongly maintained by some that various specific diseases such as urinary calculi, goitre, etc., are produced by the continued use of very hard waters, the confirmatory data to prove out this view are lacking. It is much more probable that the effect of hard waters is really restricted to simple gastric and intestinal disturbances, which are temporary only in their effect.

Iron.—The chief objections to iron in a water supply, from a sanitary standpoint, are its undesirable taste and appearance, when present in sufficiently large quantities. Where it comes from the source of supply it can readily be removed by aeration and filtration; and when it comes from the service pipes through the corrosive action of carbonic acid and other agents, corrective measures have to be taken before the water is delivered into the mains.

The sanitary significance of iron in water may be considered as nil, for when present in large amounts its undesirable taste would preclude its use.

Microscopical Examinations.—Water supplies are examined for the higher forms of microscopical life as a routine procedure in but few places. In the majority of cases such examinations are carried on only at times when the water possesses objectionable tastes and odors, the endeavor at such times being to locate and identify the organism which is causing the trouble. Knowing the kind of organism, it is relatively easy to destroy it at its source through chemical treatment.

Bacteria

It is the almost universal custom in water works laboratories to make daily analyses of the water supply for total numbers of bacteria; in some the number of bacteria developing on special media at body temperature is also determined; and in many presumptive tests for B. coli are carried as daily routine. There is no question that the results of bacterial analysis are of more value in determining the hygienic quality of a water than the entire chemical and microscopical data laboriously and expensively obtained.

Bacteriology is a comparatively new science, and by no means a precise one. It is a matter of common knowledge that with the methods of analysis of today the bacteriologist can isolate and positively identify specific disease germs only with the greatest effort and difficulty, and even then it is of primary importance that their number and virulence be also known before the water can justly be condemned. The finding in water of germs known to be associated in one way or another with disease-producing germs furnishes valuable circumstantial, but nevertheless indefinite evidence.

Sometimes the presence of comparatively large numbers of bacteria in water has no sanitary significance whatsoever. This is true even when the evidence is quite positive that among the number are forms whose best known habitat is the intestines of man and domestic animals. Waters draining uninhabited areas, and therefore far removed from opportunities of pollution, particularly where the areas drained are swamps, sometimes show high numbers of bacteria.

The test for B. coli is the usual way the present-day bacteriologist has of ascertaining the relative purity of waters, also of forming a judgment of the purity of an individual water. This organism is the normal inhabitant of the intestines of man and some domestic animals, and of course is always present coincidentally with the typhoid germ when a person is suffering from that disease. It is equally true that in the vast majority of cases where B. coli is found in water the typhoid bacillus is absent. Therefore, where B. coli is found the inference that B. typhosus is or may be present furnishes circumstantial evidence purely, yet because the typhoid bacillus may be isolated from water supply with the greatest difficulty, and because the reverse is true of the colon bacillus, the presence or absence in water of the latter organism is looked upon as the surest index of sewage pollution available to modern water bacteriology.

But the colon bacillus found, even if the number of coli be large, may have come solely from the excreta of domestic animals, or even from fish, and such animals do not suffer from typhoid fever. Again, the bulk of the coli may come from the excreta of perfectly well persons, and where a water is contaminated with city sewage this is always the case. So its presence in water merely furnishes evidence that it has been polluted with animal excrement; that typhoid fever germs may be present, but no proof that they are.

A water may contain a few stray coli and yet be perfectly safe to drink, for they all may have come from domestic animals. Furthermore, coli may have entered a water months before, even accompanied by typhoid germs; but both of these organisms, being out of their natural habitat in water, quickly become attenuated and lose their virulence.

In judging a water on the presence in it of B. coli, it is necessary to possess a knowledge of the number of these germs and of their vitality, in order that it may be known whether the pollution is recent, in what relative amount, or if it occurred a long time in the past and the germs found represent the attenuated survivors of those which entered the water originally.

The numbers of bacteria in a water and the results of the test for coli have definite, though limited, value. High numbers of bacteria and the persistent appearance of B. coli can only mean a dangerously polluted water. Not that it is actually unsafe to drink all of the time, but that at any time it may become so. Low numbers of bacteria and no coli can only mean a water of high sanitary purity.

The absolute value of bacteriological examinations is difficult to express except in this manner. B. coli may be present in a water every day for weeks and months on end and the water be perfectly safe.

Almost all of the supplies show evidence of prior contamination. The mark is there but what does it signify? Compare Kansas City with New York. We know that the water supply of the former, with either its high turbidity or hardness, would not be acceptable to the water consumers of New York City, yet the bacterial results at Kansas City make a more satisfactory showing, and the typhoid fever death rate in the two cities was virtually the same in 1912.

It is unnecessary to go farther in a discussion along comparative lines. A supply which is satisfactory in one city would be held as unsatisfactory in another, although both are safe to drink. Communities accustomed to turbid or colored waters do not instinctively rebel against them, but only after they have seen and drunk clear and colorless waters. With hard water it is the same, but in a less degree, for the householder is aware that here lies the reason for high soap consumption, and the steam raiser objects because of the cost of keeping his boilers free from incrustation and corrosion. But in a general way that is all.

We must acknowledge that it is not feasible to obtain from surface sources public water supplies which are free from all evidences of sewage contamination, but there is no reason to doubt the entire feasibility of so purifying contaminated supplies that they will be safe and wholesome. Such purified waters will still contain in reduced quantity the original sewage matters, but are made satisfactory to all the senses, and from a physical and chemical standpoint may justly be accepted as reasonably pure and entirely wholesome waters.

As to the bacteria; no matter what their significance, as shown by the usual sanitary analysis, sedimentation and filtration will reduce their original number to a relatively small residual, and sterilization effectively will remove the last vestige of potential danger which the contaminated water originally possesses. Therefore, what matters it, within the limits of reason, how contaminated the water was originally, if by purification, which is called for in connection with practically all surface waters, we can obtain at moderate cost a clear and colorless water, one which does not possess objectionable tastes and odors, and one in which bacterial life is reduced to a practical minimum? Is such water not to be classed as "pure and wholesome"? It certainly may justly be termed "wholesome," and reasonably "pure," since its consumption is conducive to health, even though the strict and generally accepted interpretation of the word will not allow us to term it absolutely "pure."

The writer lacks the temerity to set down a list of standards of purity for public water supplies; but after what has been said above he does not hesitate to say that in his humble opinion "pure and wholesome water" should mean water which is free from noticeable turbidity and color, offensive tastes and odors, and forms of bacteria known to produce disease. Waters which in their natural state or by purification cannot be made to comply with this standard are without the pale.

The writer submits that a water reasonably free from color, turbidity and objectionable tastes and odors is not impossible, or even difficult, of achievement; nor is it difficult to pass judgment on a water that does not comply with these requirements. With the bacterial requirement it is vastly different, for the reason that modern methods of bacteriological analysis are not sufficiently precise and speedy to allow of the ready detection of disease germs in water. How then is it possible to meet this most essential requirement in the light of the existing bacteriological methods? Until the typhoid bacillus and other germs which may produce disease can promptly and certainly be detected in water, it cannot be done.

Would it be heresy to say that B. coli may be found in a water day after day and month after month, even in 1 c. c. volumes, and yet that water be perfectly wholesome and innocuous? Such a condition can be imagined, even realized, for to become a producer of typhoid fever there would be required among those persons contributing the coli persistently found in the water an individual suffering from typhoid or convalescent from that disease. Indeed, the coli might all come from the harmless excrement of domestic animals, the same being used as fertilizer on the watershed and washed into the stream at time of rains and thaws.

B. coli when found in water is a danger signal. There is no doubt about that. The more that are found, and the oftener they are present, indicates increased and continuous contamination. It does not prove; it furnishes circumstantial evidence that the water may contain germs of typhoid fever. The greater the pollution the larger must be the number of people contributing to the pollution. Hence by increasing the number of people the danger is proportionately increased, because of the greater number of individual possible sources of typhoid fever. Therefore the number of coli present in a water is of significance, yet with one colon bacillus there may be a typhoid, and with a hundred, none.

In the New York water supply in 1912, B. coli was found in 10 per cent. of the 1 c. c. samples examined; in 3 per cent of the samples of the same volume at Cincinnati; at Columbus daily tests of this volume showed it to be present only on two occasions during 1912; and at Minneapolis and Pittsburgh it was never present. The typhoid fever death rates in those cities that year were 10, 7, 19, 11 and 6. What absolute proof is afforded by the above colon results with reference to the typhoid fever death rate, which, after all, is the surest index of the hygienic quality of a water supply?

Where water is filtered and made satisfactory on physical grounds, there is absolutely no excuse for the persistent presence in it of living B. coli or typhoid fever germs when hypochlorites or other effective germicides are employed as a finishing touch in the purification process. But nevertheless if they do appear at times the water cannot, without other good reasons, be condemned as unsafe to drink.

Careful filtration followed by sterilization presupposes among other desirable features a water of high bacterial purity, and by these means, provided the purification processes are carried through with skill and continued vigilance, everything within the reach of modern practice has been done to remove the impurities it may have contained; and it is plain that such purified water cannot be denied a place in the class of reasonably pure and wholesome waters

New General Hospital, Toronto

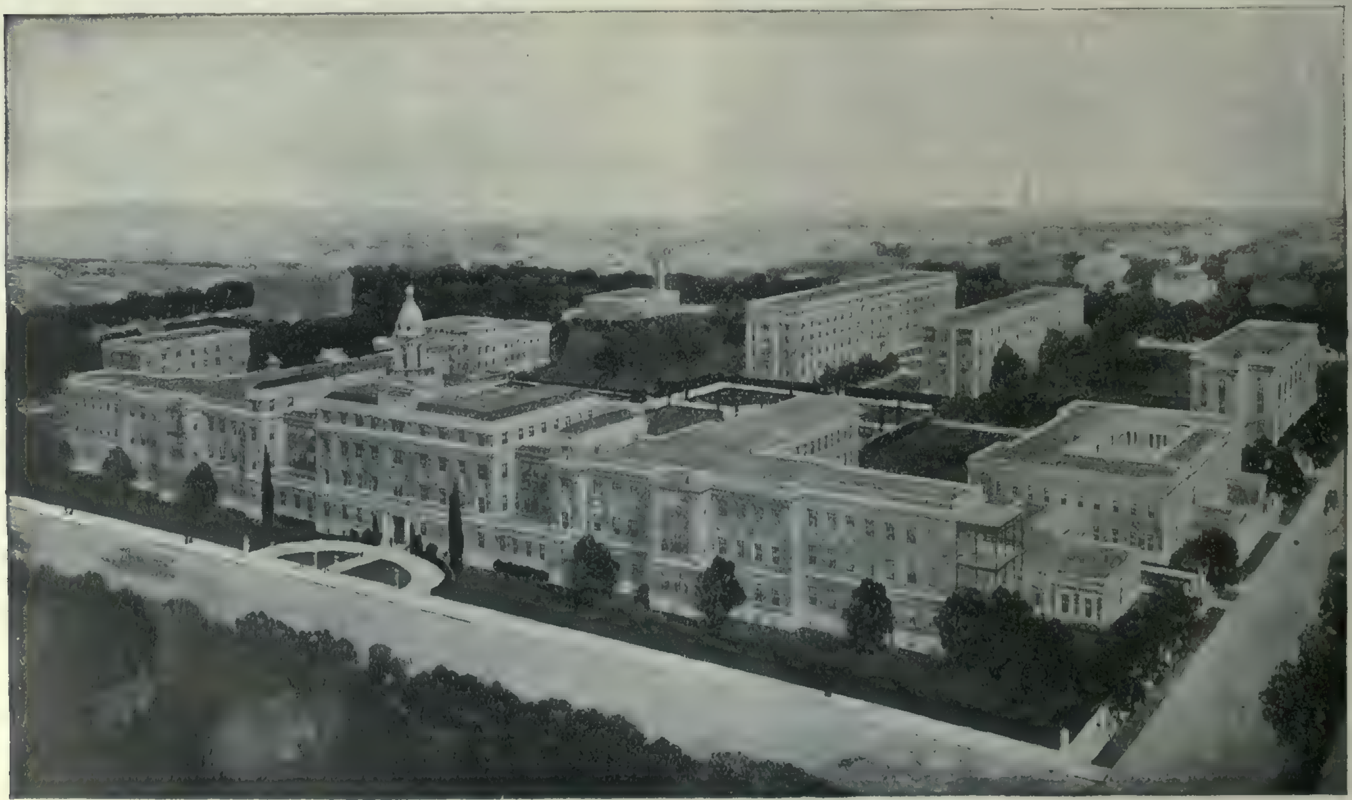
Construction Features—Brick and Iron Work—Wall Coatings—Floor Covering and Tiling—Equipment—Heating and Ventilation—Elevators

THE new General Hospital, Toronto, is acknowledged to be the best equipped institution of the kind on the continent. The corner stone was laid by Earl Grey, then Governor-General of Canada, on April 11th 1911. It was formally declared open June 19th, 1913, and during the second week of July the patients were transferred from the old hospital on Gerrard street to their new quarters. The rapidity with which this great undertaking has been completed speaks volumes for the board of directors and the staff of architects, engineers and contractors whom they engaged to carry their mandates into effect.

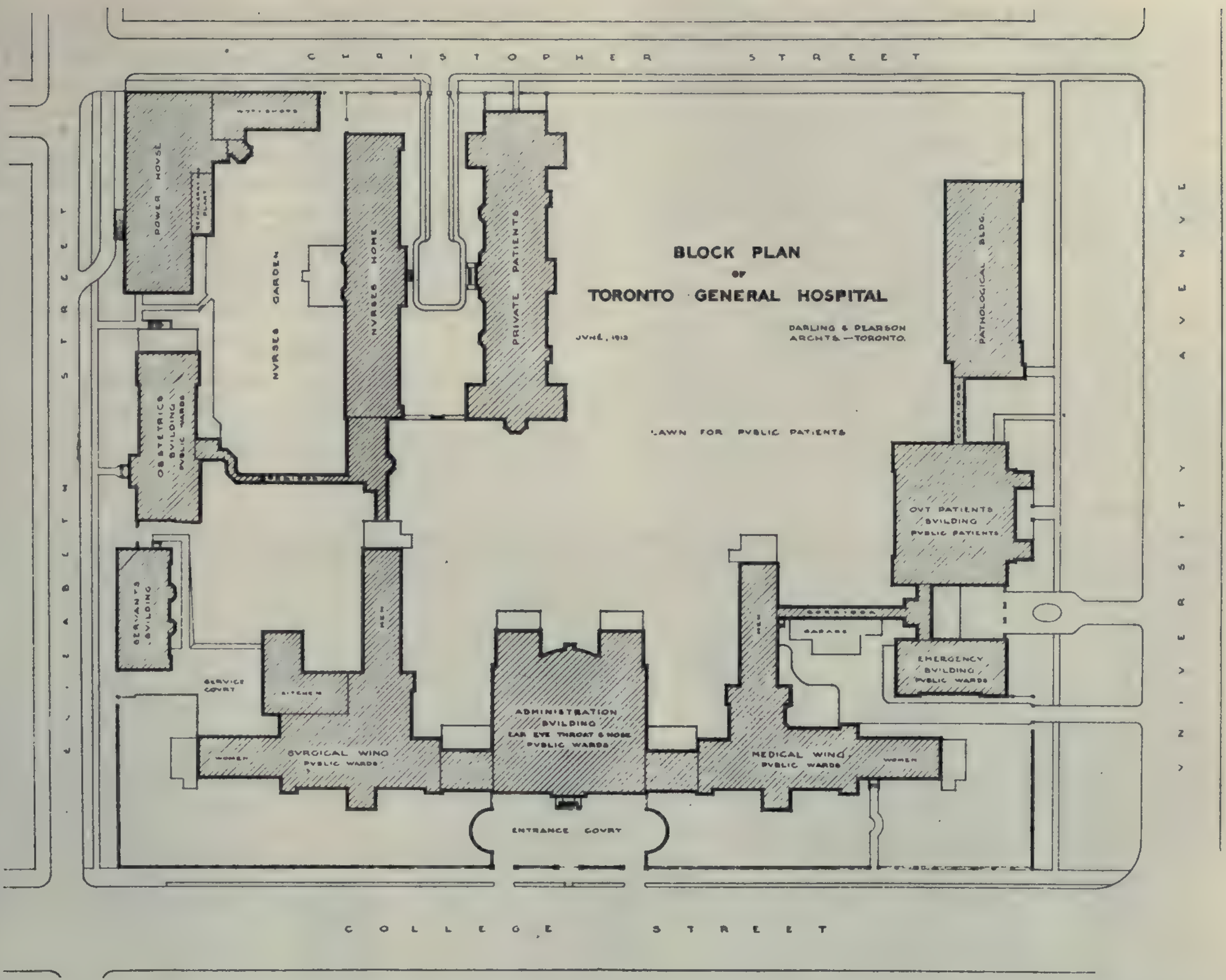
The institution, which will provide beds for about seven hundred patients, is arranged about three sides of the nine-acre square bounded by College, University, Christopher and Elizabeth streets. The main structure, comprising the administration building in the centre and the surgical building and medical departments on the east and west respectively, faces College street. This group is six hundred and twenty feet in length. The administration building, which is four storeys high, a storey higher than the adjoining surgical and medical portions, has its central situation further accentuated by an attractive main entrance and a tower executed in terra cotta surmounted by a copper dome. Extending south from the administration building are the surgical and the medical wings and south from the surgical department is the nurses' home. East of the nurses' home and facing Elizabeth street are the servants' building, obstetrics section and the power house, workshop and laundry. On the west side facing University street are the admitting department, the emergency hospital to the north, and to the south the out-patient department. This latter building, capable of affording treatment for 600 patients daily, is, because of its interior arrangement, one of the striking features of the whole group. A large central hall runs through to a skylight and the rooms on the floors are arranged cloister-like around three sides of the hall. South of the out-patient department is the large four-storied pathological building. Between the pathological building on the west and the nurses' home on the east and running north from Christopher street is the private patients' pavilion. This building, five storeys in height is practically a hospital complete in itself. Covered passageways connect all the departments except the private patients' building.

Many elements must have entered into the problem presented in determining the plan to be adopted. The relation of the group to the site, the relation of the various buildings of the group to each other, a plan that would be suggestive of the purpose, a maximum of space with reasonable expense, an internal arrangement that would centralize and facilitate internal management and produce efficiency in lighting, heating, ventilation and sanitation, and the unification of the whole, these with other factors must have been considered. The architectural plan was developed by Messrs. Darling & Pearson.

The northern facade facing College street is of free Renaissance type. Features of the general effect are the abundance of cheerful light and air and the sense of proprietorship indicated in the well-marked centre and the terminal wings, and the unity and balance of the whole. The severely plain style of the architecture has not always pleased but in



Bird's-eye view of the new General Hospital, Toronto.



an institution of this kind mere ornamentation must always give way to the utilitarian. Dr. C. K. Clarke, Medical Superintendent of the Hospital, says, "Those best qualified to speak unhesitatingly say, that 'for the purpose designed the hospital is a splendid tribute to the genius of the men who created it.' "

CONSTRUCTION DETAILS

The various buildings are fireproof throughout. The outer walls are of solid brick and the dividing walls of hollow terra cotta tile with metal lath. The floors are of concrete. The outer walls are faced with a brick especially manufactured by the Don Valley Brick Works for the purpose and trimmed with terra cotta of British make and supplied by Doulton & Company, Limited, London, Eng.

For the work of construction the Don Valley Brick Works furnished 22,000,000 bricks and 1,000,000 feet of porous terra cotta and the Dominion Bridge Company 1,350 tons of structural steel. Two kinds of brick were used, a structural wire cut and a facing brick. This latter is said to be the most expensive brick ever made in America for facing large structures. It is semi-vitreous in nature and of the dimensions of Roman brick, that is, 13½ inches by 3 inches. By the proper mixing of clays and care in firing an old gold color with deep bronze and purple flecks was produced which lends character and dignity to the whole group. The great expanse of wall if executed in stronger colors would have been trying to the eye.

In order to expedite building the masonry was divided among several contractors. Messrs. Holtby Bros., in addition to preparing the immense preliminary excavation for the main building, executed the contract for the masonry of the medical department; H. N. Dancy & Son, the administration building; Thomson Bros., the surgical wing; Witchall & Sons, the emergency and out-patients' building; R. Robertson & Sons, Limited, the pathological building; Teagle & Son, the nurses' home; Self Bros., the power house.

The roofing is felt and gravel, Messrs. Douglas Bros. furnishing, in addition to the galvanized iron work and the copper dome for the cement tower, 16,500 square feet for the administration and obstetrics buildings, and Messrs. H. Williams & Company 13,100 square feet for the private patients' pavilion, in addition to the galvanized iron and metal work of the same department. The roofing, galvanized iron, cornice work, etc., of the pathological and servants' buildings and medical wing were the work of the Forbes Roofing Company.

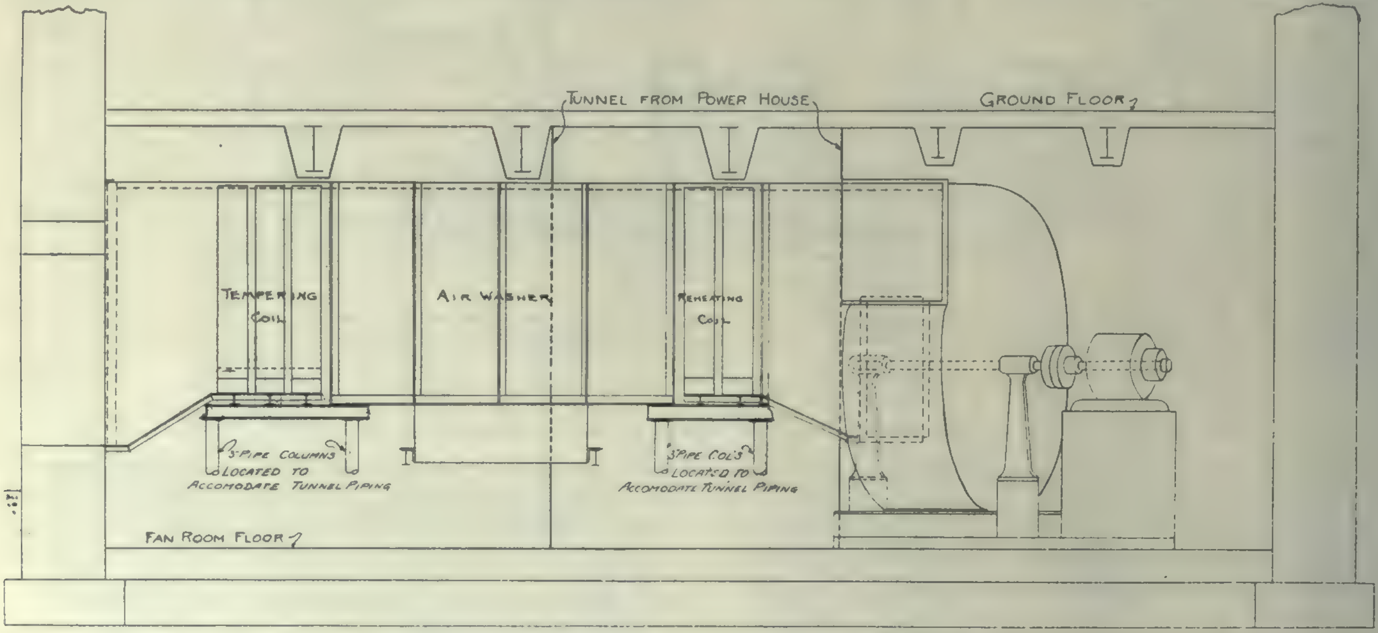
Iron Work

Ornamental and structural iron now plays an important part in the construction of all modern fireproof buildings. Much of the ornamentation, strength and safety of the new hospital depends upon the well-selected designs and the judicious use of this building material. The staircases, fire-escape stairs, frames and casements for operating windows and operating room balconies, sun porch railings and area railings, elevator cages and miscellaneous light ornamental work are all of iron work. The contract for furnishing these for the administration, private patients, obstetrics and servants' buildings, together with the surgical wing and power house, was awarded to the Dennis Wire & Iron Works Company, of London, Ont. The extent of their contract may be gathered from the fact that over a year and a half prior to the opening they had a large force of men engaged in putting in their work and that three or four months must yet elapse before their contract is completed.

The attractive and dignified fence which surrounds the new institution consists of large iron panels supported by brick pillars. The main entrance is particularly imposing the supporting pillars being of large dimensions and surmounted by lighting standards. This work was fabricated and installed by the Architectural Bronze and Iron Department of the Canada Foundry Company.

Flooring

The efficiency of a hospital depends to a very great extent on perfect sanitation and on the use of dust-resisting materials in construction. The Building Committee, intent on making this one of the best equipped hospitals, has been careful in its choice of interior finishing. All the tiling in the emergency, out-patients', medical and surgical buildings was supplied and erected by the T. Eaton Company. The entrance, receiving lobby, passages, stair landings and the many verandas are paved with Edwards red Welsh quarry tiles, which are easily cleaned and cool and restful to the eye. The floors of the operating rooms are paved with a special German white flint tile, so closely cemented that dust cannot lodge, while the walls are lined with an English white tile which does not crack even when near the intense heat which must be employed at times in the sterilizers. The whole supplies that hygienic condition which modern surgery demands. MacMullin grey Tennessee marble covers the partitions and walls of all lavatories and beautifully marked light grey Canadian marble is used for a six-foot dado in the out-patients' building. An excellent feature found throughout the structure is the sanitary junction of walls and floors. This is accomplished by means of a 6-inch cove base composed of terrazzo polished to a smooth surface. This feature is a specialty of the T. Eaton Company. The same company also furnished the "battleship" linoleum which covers the floors of the passages and corridors, 14,550 yards being used. The color is sealing wax red and was obtained after numerous experiments by the manufacturers, and very nearly approaches the shade of the Welsh tile used in other parts of the building. The linoleum is cemented to concrete floors with waterproof cement.


Tunnel from Power House
Ground Floor
Tempering Coil
Air Washer
Reheating Coil
3" Pipe Columns Located to Accomodate Tunnel Piping
3" Pipe Col's Located to Accomodate Tunnel Piping
Fan Room Floor

Section through south fan room, Surgical Building.

Wall Coatings

To increase the possibilities of cleanliness the walls have been covered with the lacquer enamel Paripan. This material has been used in some of the English hospitals, notably Guys and London. It has three qualities which make it adaptable for this kind of work. It affords lasting surfaces, is impervious to water and is easily cleaned, and is an excellent light reflector. In the corridors, wash rooms, operating rooms, etc. a glossy finish is used, while in the wards and large rooms a broken white ceiling with a light flat green frieze and glossy dado of deeper green has been employed. The woodwork specifications called for one coat of paripan filler, one of flat and two of glossy paripan. This part of the work was in the hands of Sturgeon's Limited. The plastering of the medical wing was done by W. J. Hynes, Limited.

Lighting

Indirect and semi-indirect systems of lighting are generally employed. Each ward is supplied in the centre with one or more indirect lighting fixtures of hard white enamel with silver plate reflectors and glass covers which make them dust proof. On each fixture are two or more intensities which can be manipulated with a general switch. The main entrance, dining room and the sitting room are provided with special bronze colored semi-indirect lights in classic design hanging from rods instead of chains. In the corridors are massive fixtures of spun glass with 10 and 14 inch hemispheres. The lighting fixtures were furnished by the T. Eaton Company.

Hardware

The extent and importance of the hardware contract in an undertaking of this magnitude may be readily understood when it is told that the building has 2,000 doors, 2,500 windows, 700 door transoms and 700 window transoms. The inner doors on the brick walls are hung on special 6 by 6 inch butts and the doors of the inner portions are hung on three special 5 by 5 inch butts. A master key, four tumble Yale locks with cast bronze faces, knobs, roses and key plates are used throughout the interior. All outer doors, except the main entrance, are equipped with Yale cylinder locks with outside knob solid and inside knob always free. These may be locked with the dead bolt from the inside only. The outside main entrance doors are provided with four pairs of 6 by 6 inch extra heavy cast bronze butts with cast fibre washers and Yale cylinder thumb latch and double cylinder locks.

The master key system has been carefully worked out so that the smallest possible number of keys need be carried.

The superintendent has his grand master key with which access may be had to any of the buildings. The assistant superintendent, lady superintendent, housekeeper, etc., have east a sub-master key which operates only the locks under their control. A careful record of the entire system is kept by the Yale & Towns Manufacturing Company so that any time duplicates may be made of any key from its number.

The window bolts and lifts and window transom butts and catches are of cast bronze, while the door transoms have solid bronze transom chains and catches. The 250 lavatory doors are equipped with cast bronze box flange hinges made to spring open when the doors are released by the lifting of the latch. The hardware contract was executed by the Aikenhead Hardware Company.

EQUIPMENT PROVIDED

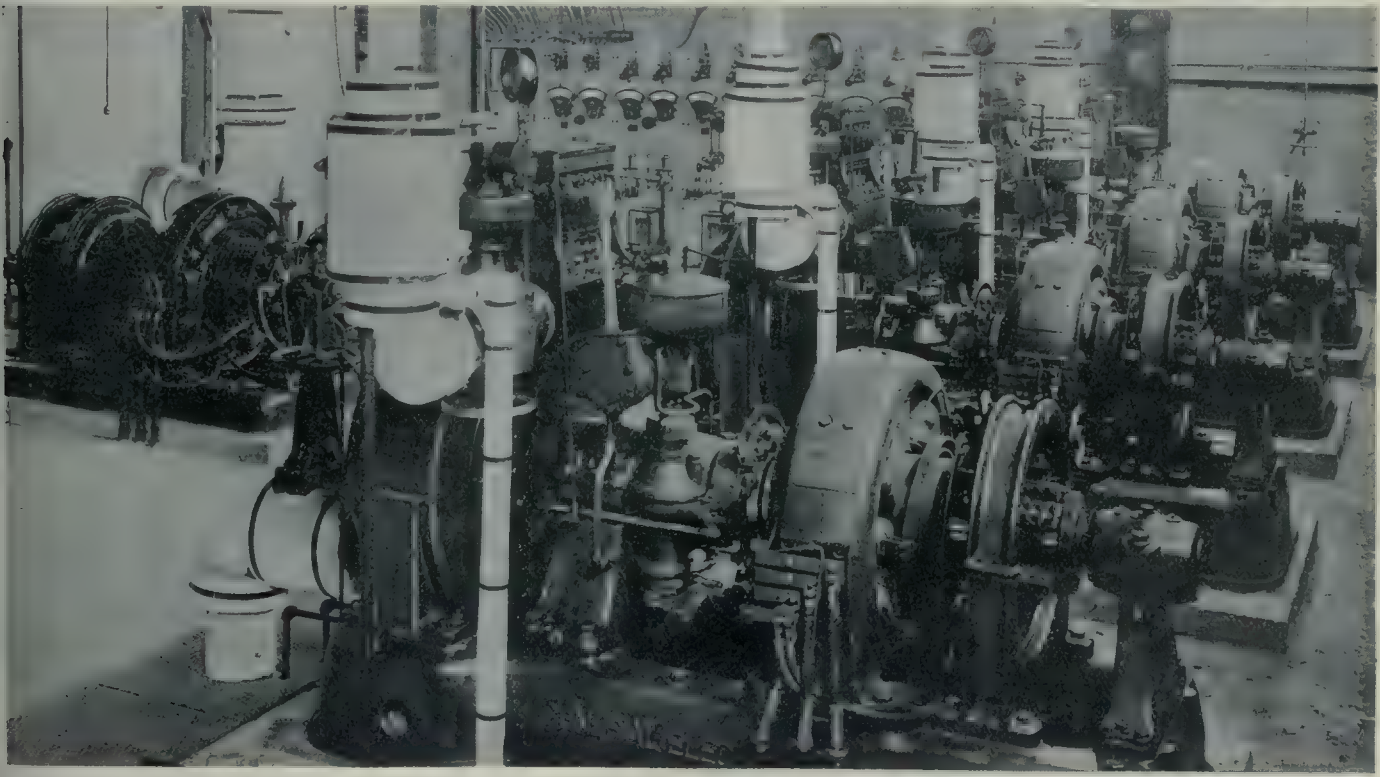
Every possible care has been taken to equip the new institution with the most recent and effective machinery and appliances in order to secure proper ventilation, a well-regulated heating system and to facilitate as much as possible the vast amount of labor involved in the management of a large hospital. This important part of the work was designed by Messrs. Williams & Cole consulting engineers, Toronto, and installed under their supervision. The efficiency of this feature will make it a model for the new hospitals built for some time to come.

Power House

The power house building is a brick and fire-proof structure 40 ft. x 136 ft. A brick wall divides the engine and boiler room. The boiler room is 68 ft. x 40 ft. with the floor set 16 ft. below the street level. The ceiling and floor of the engine room and boiler rooms are of reinforced concrete. The plant is now operating very efficiently under the management of Mr. Allan Gibson.

The boiler room contains four Babcock & Wilcox water tube boilers set in two pairs with means of access between them from front to rear. Each boiler has a capacity of 500 h.p. at a pressure of 150 lbs. The boilers are fitted with Murphy automatic stokers and Dutch oven settings. Eight tons of coal can be stored on the top of each furnace. The coal is fed mechanically to the fires by means of two 8 h.p. vertical engines, one being fixed at the extreme end of each pair of furnaces. Both natural and forced draft are used, the latter obtained by means of two steam driven, 90 in. Sturtevant fans. These are automatically regulated by a Bushnell damper regulator.

The coal is carried from the bunkers to the bins on the top of each furnace by means of an electric crane supplied **by J. T. Hepburn & Company.** This crane is capable of carrying a load of one ton. This crane and the bucket it carries is electrically operated. The same equipment removes the ashes to one end of the boiler room, from which point they are raised by a Turnbull hydraulic lift to the street level and dumped into wagons for removal. The boiler room also contains an incinerator for the disposal of refuse. This was supplied by Heenan & Froude. In this incinerator, provision is made for feeding the refuse which, in general, will be collected in special closed receptacles, through a charging door opening placed on the roof of the furnace immediately over the drying hearth. In this way the refuse will be discharged instantaneously into the furnace without the risk of its coming in contact with the operators.



Four turbo-generators in Toronto General Hospital power house—To the left a motor generator—Switchboard in background.

Generator Room

The generating equipment consists of four units of 125 kw. capacity installed by the Canadian General Electric Company. The generators are driven by Corliss non-condensing steam turbines 2,400 r.p.m. at 140 lbs. pressure. The generators are d.c. multi-pole, interpole, three-wire, 250 volt type. The generator armatures are air cooled by fans. There are two air gap commutators on each machine and the two a.c. collector rings are tapped in four places to the coils on that armature. Leads pass from the collector rings to a compensator below the switchboard and the end of each lead connects to a coil immersed in oil. From the centre of this coil a connection leads to the neutral bus, which will care for 25 per cent. out-of-balance load.

There is also installed a motor generator set of 125 kw.

capacity, the motor being three-phase, 550 volt, 25 cycles, C.G.E. type. The generator is similar to the other four, a three-wire, 250 volt machine. This will be operated by outside current in emergency.

Switchboard

The switchboard is made up of eight panels, being 5 generator panels and 3 distributing panels, which supply light and power to the various buildings. The board complete, is 20 ft. long by 7 ft. 6 in. high. Each generator panel carries two ammeters and one watt meter as well as two circuit breakers on the outside leads. The three distributing panels carry one graphic recording wattmeter. At the right of the board is the usual pair of swing voltmeters. Everything in connection with the board was supplied by the Canadian General Electric Company.

The generated power is utilized for lighting the various buildings and also for operating a large number of small motors. When the motor installation is complete, there will probably be close to 60 units, varying in size from 1 to 10 h.p., distributed at various points throughout the building. At the present time there are about 51 motors installed.

Ventilation

Ventilation is provided for by means of a system of supply fans and ducts with air washers, tempering coils and exhaust ducts and fans. A separate system is provided for the service rooms and lavatories. It is arranged to make a complete change of air throughout the building every ten minutes and in addition to this in certain of the departments the air is washed before it is allowed to enter the rooms. For example, in the surgical building there are three sets of air washing equipments and in the administration building three sets; also there is one in the operating room, two in the private patients' department, etc. The air washing sets consist of a motor-driven spraying outfit which keeps water continually sprayed over the air which a second motor, operating a fan, draws in from the outside of the building. This air, having been washed, passes up through the different rooms and is finally exhausted through roof outlets by means of fans installed in small enclosures on the roof. In all, 36 fans are used for this purpose, the sizes varying from 3 to 10 h.p.

Heating

The heating is done by both the direct and indirect method. The direct method is a system of the forced circulation of hot water piped to and from two large heating tanks in the power house. These tanks, which were manufactured by the Polson Iron Works, Limited, are 60 inches in diameter and 13 feet 2 inches and 8 feet 10 inches long respectively and are provided with steel shells and copper tubes. In the indirect method the air is warmed by passing over heated coils. Radiators of special hospital type, manufactured by the Dominion Radiator Company have been used. They have extra width between the sections and are of a plain pattern. These systems were installed in the surgical wing, administration building, out-patients' building, and emergency hospital and nurses' home by the Bennett & Wright Company, and in the medical wing, pathological building, private patients' pavilion and obstetrics' building by Messrs. Purdy, Mansell, Limited.

During the past winter the water was admitted at 182 deg. Fahr. and was returned after a circuit through the entire system within the pathological building at 181 deg. Fahr., showing that a very even heat is maintained.

In addition to the arrangements for heating the building, high pressure steam piping is carried to the diet kitchens and to the hydrotherapeutic room. This latter contains the electric light cabinet, vapor cabinet, continuous baths, showers, needle sprays, bidets and pack sinks and is located in the medical wing. These were installed by Messrs. Purdy, Mansell, Limited.

The Johnson Temperature Regulating Company have furnished the ear, nose and throat department in both the outpatients' building and the administration building with a compressed air system made up of compressors and ducts for supplying air to these rooms.

The Laundry

The laundry throughout is electrically operated. A battery of washers which operate almost continuously are belted to a shaft driven by a 10 h.p. C.G.E. motor. Two centrifugal dryers are operated respectively by 2 h.p. and 5 h.p. Crocker-Wheeler motors. The clothes are next put into a dry room tumbler operated by a 5 h.p. Crocker-Wheeler motor. The final drying is accomplished in a larger dry house through which air is circulated by means of a ¾ h.p. motor. The largest mangle is operated by a 3 h.p. variable speed Crocker-Wheeler motor. On this machine a Cutler-Hammer control is installed, and an emergency switch which stops and reverses the machine instantaneously. Three smaller mangles are each driven by ½ h.p. motors. The bodies of all these mangles are electrically heated. There is also a collar and cuff ironing machine driven by a 2/5 h.p. motor. In addition the laundry is equipped with ten large electric irons operating on 125 volts. All the motors in the building operate on 250 volts.

One of the wards coated with paripan.

Refrigeration

The cooling plant is based on the principle of refrigeration by indirect expansion. Its capacity is 17 tons of refrigeration every twenty-four hours. A brine solution is cooled by the expansion of ammonia, then by means of two Burnham pumps this solution is forced into the various refrigerators in connection with the kitchens. By the same system ice sufficient for the requirements of the hospital is manufactured daily. Large galvanized iron cans filled with water which has been distilled in a Tripure still are placed in a large tank containing ammonia coils and brine pipes and thus ice from pure water is provided for patients. This tank, which was also manufactured by the Polson Iron Company, Limited, serves as a brine reserve in the system of refrigeration.

All the main piping passes through a tunnel 9 feet by 8 feet and over a third of a mile in length. This tunnel is situated under the centre of the various buildings and at convenient points the piping for each department passes off in the direction required.

Call System

An interesting feature is the silent nurse call system. This comprises a series of annunciator cases, lamps and bull's-eyes, by means of which a patient is able to call the nurse. By pushing a button at the head of the bed a light is shown where the nurse is supposed to be at the time and also a red light is shown in the transom window of the ward. These cannot be extinguished until shut off by nurse.

Kitchen

The equipment of this large hospital kitchen, ward serving rooms, serving pantries, ice-cream and vegetable rooms was furnished by the Gurney Foundry Company, Limited, Toronto.

The apparatus was in many cases specially designed by this firm to meet the requirements of an institution of this size and character. The range for this equipment was constructed in such a manner that there are no over-head pipes, the smoke flue being specially designed beneath the floor and running to a large flue some distance away from the range.

The soup kettles, steam roasters and "upright" vegetable cookers are installed so as to do away with all escaping odors and steam, and are ventilated with a special wrought iron ventilating pipe running to the top of the main building. In this way no odors can escape to mingle with the air in any part of the building. The large ventilating hood over the entire apparatus in the main kitchen is constructed to carry off the excess heat and all odors when covers are obliged to be opened in the stock kettles, steamers, etc. This hood is connected with a large ventilating pipe which is connected to a specially designed brick ventilating flue to which is attached an electric ventilating fan of the latest type.

The Elevators

The Turnbull Elevator Company have installed eleven elevators in the hospital, all of the direct-connected electric type, the usual worm gear construction of winding machine being adopted. The principal feature of interest in connection with these elevators is the control system adopted on those operating in the medical and surgical wings. These elevators are provided with the usual car switch so that they may be operated by an attendant in the day time, and the usual signal system of annunciator connected to push buttons on the various floors is also provided. Since it was desired, however, to be able to use these elevators at night without the use of an attendant, the control system is provided with a transfer switch so arranged that when this transfer switch is moved from one position to the other, the car switch is disconnected and an automatic control comes into action.

The pressing of the button at any one of the landings which previously registered a call on the annunciator, now acts to operate the elevator itself and the car automatically travels to the floor on which the button was pressed, and stops there, unlocking the door automatically to allow the waiting passenger to enter.

A gang push button is provided in the car connected in parallel with the buttons on the various floors, and the pressing of any particular button will send the car to the corresponding floor.

An interesting feature of this control system is the means taken to protect against accident through mis-use or ignorance on the part of the person using the elevator, and to protect against interference by other parties when one person has secured the use of the elevator. Safety switches are provided on each door so that the elevator cannot operate unless all doors leading to the hatchway are closed. In addition to this a safety door lock system is provided. This system consists of a solenoid actuated cam on the car, normally extended, which unlocks the door at which the elevator car hapens to be so that a passenger may enter, but as soon as the passenger presses the button in the car or at one of the landings, this solenoid draws back and the door automatically locks itself. The solenoid remains energized whenever the car is moving, even when passing the different floors, with the result that all the doors remain locked until the car arrives at the desired floor and then only the door at that floor is unlocked. The collapsible gates on the car itself are also connected to safety switches so that a passenger cannot operate the car until these gates have been closed, thus protecting occupants from danger due to reaching out of the car in passing a floor, or kicking against the passing floors.

The person using the car is protected from interference by other parties, by the fact that all other push buttons are automatically cut off by the pressing of any one of them and the circuit established by the pressing of any button is maintained by a corresponding relay on the controller. This relay is connected to a selector, the function of which is to send the car down when the car is above the floor for which the button was pressed, and to send it up when the car is below that floor. This selector also stops the car at its arrival at the floor by opening the circuit to the reversing magnet switch.

General safety has been provided by using a potential switch, which opens the supply line to the elevator in case of drop in voltage, or if any of the ordinary safety devices operate, such as the slack cable switch which opens in case of any slackening up of the cable or crossing of cables on the winding drum, or the over travel limit switch, which would operate if the car were to run beyond the ordinary limits of travel due to failure of the ordinary operating limit switches.

City Control of Water Front

Among the interesting papers presented at the convention of the Union of Canadian Municipalities, held at Saskatoon, July 15-17, was that presented by His Worship, Mayor Oliver, of Port Arthur. In introducing his subject Mayor Oliver pointed out the difficulties involved in obtaining control in this important feature of municipal equipment. His Worship thought that there could be no difference of opinion as to who ought to control the water front, and said:

"I think that we can assume that one and all agree that from every standpoint it is beneficial to every City to have complete untrammeled control of its water front. From a scenic or landscape standpoint, from a sanitary standpoint, from a commercial and industrial standpoint there can be no opposition to civic control. Instead of this however, we find the waterfront of almost every city and town littered with the flotsam and jetsam of stream or lake; the derelicts of commerce stranded on the beach; sewers drained into the water, impurities of every imaginable character poured or dumped into the same. Docks, elevators, warehouses and boathouses are placed in positions beneficial only to the owners, while railways own the whole or the greater portion of the waterfront, which becomes a net-work of tracks and spurs. To aggravate the trouble, many streets are closed, the traffic is thus thrown on a few and conditions become dangerous. This all goes to show that in the strenuous rush for individual and corporation gain, natural beauty, scenic grandeur, landscape planning, sanitation, pure air and breathing spots have all been ruthlessly swept aside. At the same time, opportunities for civic commerce are restricted and municipal authority ignored."

After discussing somewhat fully the inconvenience caused to private individuals and the hindrance to manufacturers and shippers arising from the alienation of the water front, Mr. Oliver advanced the argument, that legislation should be obtained to allow towns and cities to expropriate and hold water lots, and when new city sites are selected there should be legislation preventing the water lots from becoming the property of individuals. We quote as follows:

"To me it seems a wrong principle that as soon as a town site is laid out and plans adopted, that the owner of land facing the shore can apply to government and receive deeds for the water lots in front thereof. I would suggest therefore, that legislation be enacted to govern all new town sites, villages, etc., hereafter established making it imperative that the government grant the municipality the said water lots under a condition that the title can never be transferred by the city to any individual or corporation. The said Legislation should also allow cities to expropriate and hold water lots already deeded subject to similar conditions. By doing so, the city can advance trade and assist industries leasing sites carefully selected so as not to interfere with any civic plan, at a good rental with a reasonable increase from time to time."

"I would further suggest that a stated case should be taken to the Dominion Railway Board and a ruling obtained to the effect that no individual or corporation can prevent any person from gaining access to the waterfront or withhold trackage or spurs where asked for when the petitioners are willing to pay for any land necessary; because a persistent refusal is a restraint on trade and injurious to the general welfare of Canada."

In closing emphasis was placed upon the value of such a body as the Montreal Harbor Commission and the assistance it lends in promoting trade and commerce, securing sanitary cleanliness and retaining the natural scenic and landscape beauty.

Canadian Railroad Development

Work will be started shortly on the construction of the new Grand Trunk station at Stratford, Ont.

Engineer Kellatt, of the Lake Erie and Northern Railway, states that it is his intention to have the line in operation between Galt and Brantford by October 1st.

It is understood that a new railway station to cost $60,000 will soon be erected at Fredericton, N.B. It will be used by the Valley Railway and Intercolonial. It is possible that it may be used by the C. P. R. also.

The following officers have been appointed to the Intercolonial Railway; Mr. F. P. Gutelius, general manager; Mr. F. B. Bady, chief engineer; Mr. C. A. Hayes, traffic manager; Mr. W. A. Duff, chief engineer of bridges.

The final accounts of the Intercolonial Railway of Canada for the fiscal year, show a net surplus of $800,000. This is about $100,000 less than the estimate of the Minister of Railways, when he made his annual statement in the House.

Mr. Charles Murphy, general superintendent of eastern lines for the Canadian Pacific Railway, has accepted the position of general superintendent of the Manitoba division, with headquarters in Winnipeg. He succeeds Mr. D. C. Coleman, who has been appointed to the Alberta division.

Clearing of right-of-way along the route of the Pacific Great Eastern Railway in West Vancouver is in progress and grading will soon be started. Grading outfits are now being conveyed to the various camp locations. Within a few weeks four hundred men will be at work along the grade.

A gap of only 38 miles now separates construction gangs along the route of the Canadian Northern Railway, working south from Alberta summit and north from Kamloops. Alberta Summit is about forty miles from Tete Jaune Cache, and construction gangs now at work there have the work well advanced along the Fraser River.

Mr. J. G. Sullivan, chief engineer for the western lines of the C. P. R. is considering the question of substituting oil as fuel instead of coal as at present used on locomotives on the Cascade division of the C. P. R. main line, between Vancouver and North Bend, and is discussing the matter with local traffic officials at Vancouver.

Officials of the Pacific Great Eastern Railway have decided to locate the North Vancouver station right at the entrance to the North Vancouver ferry landing. The building will not be a permanent structure, but will be a substantial affair nevertheless, and big enough to accommodate the local traffic passing into and out of North Vancouver when the line is completed.

The announcement was made by the Canadian Pacific Railway recently that the following new stations would be established in the western provinces: Vegreville-Calgary line, from Calgary—Rise Deer, Benyon, Redland, Rockyford, Baintree, Hawick, Lyall, Norfolk, Chestermere Lake, Barlow. Saskatoon-Calgary line, from Saskatoon—Excel, Cereal, Chinook, Dobson, Youngstown, Stanmore, Richdale and Modena.

Acting under instructions from the Transcontinental Railway Commission, the contractors in charge of the work of building the Quebec railway terminals are using every effort to complete the work by September. At present there are 350 workmen employed in the completion of the Cap Rouge railway yard, with the intention of having it ready to stretch its miles of tracks and sidings by fall, when the Transcontinental Railway is expected to be in operation to Quebec.

A new Grand Trunk route from Ottawa to Toronto is proposed in negotiations which, it is understood, have been opened up between that company and the Ottawa and New York Railway. Running rights over the latter are sought, if an arrangement can be made for standardizing the line. The Ottawa and New York Railway is owned by the New York Central, but its roadbed and rails are not in standard condition, and carrying out the proposed scheme would be contingent on improvements.

Many improvements are promised for the Intercolonial Railway. One of the first steps planned is the creation of a six-tenth grade from the city of Montreal to Halifax and Sydney and this change, it is expected, will be brought about at the rate of about one hundred miles each year. Another big improvement which is under construction is the question of double-tracking. The piece from Levis to Chaudiere, about thirteen miles, will be done this season as the money has been voted for this section.

Tenders have now been closed for the construction of portions of the Canadian Northern Pacific Railway on Vancouver Island. These include that portion from the city of Victoria to a point near Deadman's River, in the District of Esquimalt, a distance of approximately five miles; a line leaving the above at Regina avenue, Victoria, and extending to Union Bay, Saanich Peninsula, a distance of approximately 15¼ miles. Tenders to include clearing, grubbing, grading, bridges, trestles, culverts, masonry and fencing.

The plans for the St. John Valley Railway from Centreville to Andover were submitted to the provincial government of New Brunswick at a recent session. Before construction work can be commenced the approval of both the provincial and federal governments of the location plans is necessary. The contractors are now devoting themselves to the three sections between Gagetown and Centreville now under construction. These three sections, amounting to about 120 miles in all, make up more than one-half of the line, and it is believed that they will be completed this season.

The support of the provincial government in favor of a project for building a railway from Bella Coola, a port in northern British Columbia, to Red Deer, Alta., is being asked for by Mr. Edward Bath, a promoter of London, England. Mr. Bath stated that he had secured strong financial backing in England, and that survey parties have already been dispatched from Revelstoke and Ashcroft to make preliminary explorations of the route. The general direction of the proposed line will be east and west across the central portion of the province, tapping the Chilcoten, Lillooet and Big Bend districts. A charter will be asked for at the next session of the Dominion Government.

The plans of the T. & N. O. Commission provide for the reduction of the grade between North Bay and New Liskeard, and the rebuilding of nearly fifty miles of the main line and the filling of many more. The engineers who have been at work have now practically completed surveys of fills and diversion that will reduce the grade nearly by half. This will be done by diverting the line for some 35 miles north of North Bay, the most costly section of the whole plan, some $1,482,500 being required for this section. Another diversion of 6½ miles comes at Mileage 90, where the road will take a new route for four miles. Train filling will be necessary on a section totalling about ten miles running the total cost of grade reduction up to $2,263,000.

There is a possibility that the work of diverting the main line to the new G. T. P.-T. & N. O. R. Union Station at Cochrane will be completed this fall, according to a statement made by Chairman Englehart of the Temiskaming & Northern Ontario Railway Commission. Two large gangs are now at work on the laying of sidings along the main line between Cochrane and North Bay in readiness for the operation of the G. T. P. grain trains over the line. The total distance to be covered is more than 200 miles. A report on the survey for the new Nipissing Central line is nearly finished and will be in readiness by the end of the month. The Gowganda line survey is also making good progress and should see compeltion some time this fall.

Toronto's long-delayed new Union Station will be an imposing structure, one that will rank with any on the continent, according to statements made by Mr. J. W. Leonard, assistant vice-president of the C. P. R. Mr. Leonard states that Architects Ross and Jones, of Montreal, and Architect Lyle, of Toronto, are now making an inspection of the most modern railroad terminals in the United States in order to secure ideas for Toronto's proposed structure. They will return to Montreal about the end of the month, when a start on the new plans will be made. Questioned as to when a start would be made with the new C. P. R.-C. N. R. station at North Toronto, the official said that the insistence of the city of an eighteen-foot subway at Yonge street had necessitated the drafting of entirely new plans. They were, however, well on the road to completion and should be ready for publication in about two weeks' time.

Tenders for the construction of the sea wall, breakwater, ship canal and retaining wall in connection with the $25,000,000 Toronto harbor improvement scheme have been asked for by the Dominion Government. The breakwater will extend from the eastern gap to Woodbine avenue and from the western gap to the Humber River. The ship canal is to give access to the industrial district planned by the harbor board in Ashbridge's Bay. The cost of this portion of the work will be in the neighborhood of $5,000,000. It is not expected that much progress can be made with the actual work this year, but early in the spring it will be well under way.

Mainly Constructional

The News in Brief—From Coast to Coast

The town of Welland, Ont., will shortly call for tenders for sewers.

Mr. George Smith, formerly town engineer for Lindsay, Ont., has been appointed town engineer for Midland, Ont.

The city of Toronto has decided to enlarge its civic plant for street paving sufficiently to take care of all the paving work of the city.

Building permits for the first six months of 1913 at Sydney, N.S., total $186,793, as against $254,616 for the corresponding period of last year.

A $6,250,000 hotel is to be built on the site of St. George's Hospital, London, Eng. The area purchased is an acre and three-quarters and cost $1,300,000 an acre.

The United Typewriter Company, Toronto, will erect a ten-storey building on their property on Lombard street. The cost will be between $125,000 and $150,000.

The formal signing of the contract for the new Parliament Buildings at Winnipeg took place recently and as soon as the contractors can organize their forces work will be begun.

The permit for the erection of the 10-storey million-dollar building of the Dominion Bank at King and Yonge streets, Toronto, was issued by the City Architect's office.

Work started recently on the construction of the plant of the Imperial Iron and Steel Company at Prince Albert. This company will employ four hundred men within fourteen months and will mill 3,000 tons of iron per month.

The contract for the building of the Longue Pointe School at Montreal was awarded to Mr. F. Henri Demers at a recent meeting of the Catholic School Commissioners, the Board deciding to accept the lowest tender, $196,000.

Building permits for the first six months of 1913 at St. John, N,B., amounted to $1,184,194, an increase of no less than 283 per cent over the same period of 1912, which is a far larger percentage than can be shown by any other city in the Dominion.

The Canadian Municipalities convention will be held in Sherbrooke, Que., in 1914. Officers elected for the year ensuing are: President, F. P. Bligh, Mayor of Halifax; first vice-president, C. M. R. Graham, Mayor of London, Ont; second vice-president, F. H. Herbert, Sherbrooke; third vice-president, F. E. Harrison, Mayor of Saskatoon; hon secretary-treasurer, W. D. Lighthall, K.C., ex-Mayor of Westmount, Que. (re-elected).

The contract for the new Government drydock at Levis was awarded by the Cabinet Council to Messrs. M. P. Davis & Son. The cost is approximately $2,600,000. The drydock will be one of the largest in the world, and will provide accommodation for the repair of the largest ocean liners, thus meeting a long-felt want in connection with the St. Lawrence route. Construction will begin at once, and it is hoped to have the dock in operation for the season of 1915.

The committee of works of the city of Toronto recently adopted the following recommendations of Works Commissioner Harris. One is the extension of Wilton avenue, from Bolton avenue to Coxwell avenue. This will necessitate a subway at the G. T. R. tracks at Logan avenue. The cost will be $570,000, of which 18 45-1000 per cent. will be paid by the property owners. The other work is the grading of Bathurst street, between the C. P. R. and Nina street. This will cost $225,000, of which property owners will pay 28 85-100 per cent.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N.S.
Waterworks extension, Agnew St., for Town Council. Clerk, W. F. Donkin. Engineer-in-charge, J. H. Hamilton.

Blenheim, Ont.
Cement walks for Town Council. Mayor, Edmonds. Clerk, P. S. Shillington. New walks on Marlboro, Victoria, Jane, Little and Catharine streets.

Downie Twp., Ont.
Cement culverts for Twp. Council. Tenders will be received by Clerk, Peter Smith, 25 Elizabeth St., Stratford, after July 20th, for culverts on Concessions 3, 10, 11, 6, 7, 8, 9, and gore. Specifications at office of Clerk.

Dover Twp., Ont.
Drainage for Twp. Council. Clerk, John Welsh, Chatham, Ont. Tenders received by Clerk until July 31st, for dredging about 9 miles drainage work in above Township.

Montreal, Que.
Concrete pipes, Notre Dame, for Board of Commissioners, c/o L. N. Senecal, Secretary, City Hall. Required, 2 x 3 pipe, 500 lin. ft.; 24 x 30 x 60 ft. lin; manhole shafting, 36-in. diam. sewer 1,300 lin. ft.; 42-in. diam., 1,200 lin. ft. Engineer, Major Howard, Sewer Dept., City Hall. Plans and specifications at office of Purchasing & Sales Agent. Tenders received by Secretary until July 24th.

Sewers, pavements, etc., for Board of Commissioners. Secretary, L. N. Senecal. At meeting of Council the following amounts were voted on new sewer construction, $56,350; preliminary work for Cartier Monument, on Mount Royal Park $2,000; fitting up playgrounds on Gallery and St. Patrick's Square $2,635. Installation of water pipes on certain streets, $75,000; construction of sewer on Bois de Boulogne ave., $2,000; construction of pavements and sidewalks on Cote St. Paul Rd., $53,000; continue work of covering in St. Pierre River, $94,250; fireproofing low level stations, $12,500; leveling of Bouce street, $7,000.

Paving for Board of Commissioners. Secretary, L. N. Senecal. Engineer, Geo. Janin, City Hall. Tenders will shortly be called for.

Sewers for Board of Commissioners. Secretary, L. N. Senecal. Engineer, Geo. Janin, City Hall. Tenders will be called for shortly.

Road work, Lachine, for Town Council. Sec.-Treas., H. Charette. Alphonse Laplante's tender for sand at 80 cents per cu. yd. was accepted but contract will not be awarded until money market improves.

Ottawa, Ont.
Pavements for City Council. Mayor, J. A. Ellis. City Engineer, Archibald Currie. Asphalt pavements on McLaren, Bank to Elgin; Lister, Bank to Bronson; Arlington, Bronson to Bell.

Paving. Council is contemplating placing all streets in city in good condition. Material, asphalt, wood block, tar macadam, tarvia, macadam. By-law will be submitted to ratepayers. Mayor, J. A. Ellis. Engineer, Archibald Currie.

Point Grey, B.C.
Sewer. The Council will receive tenders till 5 p.m., July 28th, for an 8-in. diameter sewer from the existing sewer near Laurel street along 18th ave. to the lane in Block 536 D.L. 472, approximately 400 lin. feet. Clerk, G. G. Heighway, Municipal Hall, Kerrisdale, B.C.

Port Arthur, Ont.
Additions to sewer system for City Council. Commissioner of Utilities, J. J. Hackney. By-law has been passed by ratepayers.

Park improvements for City Council. Commissioner of Utilities, J. J. Hackney. By-law has been passed by ratepayers.

Sidewalks for City Council. Commissioner of Utilities, J. J. Hackney. By-law has been passed by ratepayers.

Toronto, Ont.
Paving, etc., cost $25,000, Humber Blvd., for R. Home Smith and Board of Control. Parks Committee approved $16,000 widening and paving from Lake Shore North; $7,000 widening and paving section of Bloor St.; $2,000 planting trees, etc.

Street extension for Board of Control. Mayor, H. C. Hocken, City Hall. Extensions, Earl St., $40,000; Wilton Ave. from Bolton to Coxwell, $570,000, will include subway at Logan Ave. Grading Bathurst St. from C. P. R. to Nina St., $225,000. Passed by Works Committee July 14th.

Twp. Tilbury West, Ont.
Drainage, cost $3,248, for Twp. Council. Clerk, S. T. Anderson, Comber, Ont. Engineer-in-charge, J. J. Newman, C.E., Windsor. By-law will be voted on July 26th.

Victoria, B.C.
Water main for City Council. Water Commissioner, C. H. Rust. Consulting Engineer, Wynn Meredith. Tenders received by Water Commissioner until July 31st, for the fabrication and laying of 10½ miles of 36 in. rivetted steel pipe and appurtenances on the line of the Sooke Water Supply pressure conduit. Specifications prepared by Consulting Engineer. Plans, etc., at the Sooke Water Supply Office, 1414 Douglas street.

Winnipeg, Man.
Sewers for Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. Tenders received by Board of Control until July 14th for sewer in Cathedral ave. from Parr street to W. line Lot 31, Bl. 1.

Water mains for Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contract awarded to Engineer of Construction for water mains in: Cathedral ave., McKenzie street, Anderson, Bannerman, Main, Prince, Artillery, Battery, Mortimer Pl., St. John's ave., Athole ave., $2,488.80.

Sewers for Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractor, Dominion Construction Co., 290 Selkirk ave., for sewer to Ethelbert street, at $366.50; William Warrack for sewers in Canora street and Ida ave., at $804.

Watford, Ont.
Waterworks for Town Council. Clerk, W. S. Fuller. By-law has been voted on.

CONTRACTS AWARDED

Ft. William, Ont.
Sewer, Stanley St., for City Council. Mayor, Geo. Graham. Engineer, John Wilson. General contractors, Flanagan & Murphy.

Montreal, Que.
Roadway, to Quebec, for Prov. Govt. Dept. of Public Works. Minister, Hon. L. A. Taschereau, Quebec. Sec., Alphonse Gagnon. General contractor, H. Beauregard, 70 St. James St. General contractor is calling tenders for part of the work. 150 miles macadam roadway, crushed stone required.

Sewers for Board of Commissioners. Sec., L. N. Senecal. Engineer, Geo. Janin, City Hall. The following contracts have been recommended, Harris Cons. Co., 120 Sanguinet St., main sewer, $140,000; Henault & Heffernan, 692 Church Ave., Verdun, 2nd section, $156,437; main sewer, Notre Dame de Grace, F. O. Sullivan, c/o Sec. Sewer Dept., City Hall. 4th sec., $78,940; Zenon Corbeau, 2502 Ave. de Chateaubriand, 5th sec., $109,857; F. Dillon, Alice St. to 29th Ave., $32,350; F. Dillon, Rosemount Blvd., $22,434; Henault & Heffernan, 692 Church Ave., Verdun, Mountain St., $9,571; Salvator Ricci & Co., 1753 Ave de Chateaubriand, Contrecoeur, $15,247; Berri St., $16,875; Gilbert Paye & Co., c/o Sec. Sewer Dept., City Hall, Rosemount and Delorimier, $61,545; Bordeaux and Descarrieres, $4,493; Henri Bertrand, 2727 St. Hubert St., several tenders ranging from $740-3,324.

Pumping station, cost $30,000, Commissioner, for City of Montreal. Engineer, Geo. Janin. Builders, Gilbert, Paye & Co., 2065 Ave de Chateaubriand. One storey (50 ft.), 30 x 65, cement foundation, reinforced concrete and brick construction.

Simcoe, Ont.
Sewerage pumping machinery, cost $1,410, for Town Council. Clerk, W. C. McCall. General contractors, Canadian Fairbanks-Morse Co., Ltd., 26 Front St. W., Toronto.

Granolithic sidewalks for Town Council. Clerk, W. C. McCall. General contractor, J. B. Osborne, at 10c. per foot.

Railroads, Bridges and Wharves

Greensville, Ont.
Concrete dam, cost $5,000, Dundas Creek, for Dundas Water Commission, Dundas. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg., Hamilton. Work is held up for better arrangements.

Grantham Twp., Ont.
G. T. Rly. Co. has been authorized to construct siding for Canadian Canners, Ltd., on Lot 20, Con. 2.

London, Ont.
Bridge, cost $25,000, Wharncliffe Road, for City Council. Mayor, C. M. R. Graham. Chairman Board of Works, B. W. Bennett. Engineer, W. N. Ashplant. Tenders addressed to Chairman No. 2 Committee, received until July 31st, for substructure of highway bridge over Thames River, 2 plain concrete piers, 2 reinforced concrete winged abutments containing about 620 cu. yds. concrete and 17,000 of steel reinforcements.

Montreal, Que.
Pier extension for Harbour Commissioners, c/o Mr. Cowie, Chief Engineer, 57 Common street. Extension to King Edward Pier, 250 x 300, concrete. Queen Alexandra, 250 x 300, concrete; Jacques Cartier, 250 x 300, concrete. To be built by Commissioners next spring.

Ottawa, Ont.
Bridge for Can. Northern Ontario Rly. Chief Engineer, A. F. Stewart, Toronto St., Toronto. Permission granted to construct bridge across Little Sturgeon River, Twp. Beaucage, Ont., mileage 243.5 from Ottawa.

St. John, N.B.
Rebuilding wharf, North Wharf, for City Council. Commissioner, H. B. Schofield, City Hall. Engineer, Geo. N. Hatfield, City Hall. Wooden wharf to be replaced by concrete or granite structure.

Toronto, Ont.
Painting bridges for Board of Control. Mayor, H. C. Hocken, City Hall. Specifications at office of Railway and Bridges Dept. Tenders received by Mayor until Aug. 5th, for painting bridges, North Glen Road, St. Clair Ave., over Vale of Avoca, Wallace Avel footbridge over R. R. Tracks.

Harbor Improvement for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. Tenders received by Sec., until Aug. 25th, for construction of sea wall, breakwater, ship channel and retaining wall. Plans at offices of J. G. Sing, Toronto, Harbor Commissioner's office., 76 Adelaide W., Toronto; H. J. Lamb, Dist. Engineer, Windsor, and J. L. Michaud, Dist. Engineer, Post Office, Montreal, Que.

Winnipeg, Man.
C. P. Rly. Co. has been authorized to construct bridge across Red River on its Kildonan Branch.

CONTRACTS AWARDED

Bay Fortune, P. E. I.
Bridge, cost $7,000, for Prov. Govt. Dept. of Public Works. Sec., L. B. McMillan, Charlottetown. Engineer-in-charge, H. H. Shaw, Charlottetown. General contractors, W. P. McNeill & Co., New Glasgow, N.S. Two span, 120 x 15, steel construction.

Breadalbane, P. E. I.
Bridge, cost $1,400, for Prov. Govt. Dept. of Public Works. Sec., L. B. McMillan, Charlottetown. Engineer-in-charge, H. H. Shaw, Charlottetown. General contractors, W. P. McNeill & Co., New Glasgow, N.S. One span, 60 x 15, steel construction, contracts for 6 smaller steel bridges in various parts of the country have been awarded to Messrs. McNeill & Co.

Emerald, P. E. I.
Bridge, cost $1,200, for Prov. Govt. Dept. of Public Works. Sec., L. B. McMillan, Charlottetown. Engineer-in-charge, H. H. Shaw, Charlottetown. General contractors, W. P. McNeill & Co., New Glasgow, N.S. One span, 50 x 15, steel construction.

Gravenhurst, Ont.
Concrete dam, cost $5,000, South Falls, for Elec. Light & Water Commission. Chairman, W. J. Stubbs. Engineers, Bowman & Connor, 36 Toronto St., Toronto. General contractor, W. G. Gibson, Port Hope.

Moorefield, Ont.
Bridge (Booth Bridge) for Twp. of Maryboro. Clerk, R. McArthur. Steel, Ontario Bridge Co., Crown Office Bldg., Toronto. Abutments, Pipe & Clemens, Berlin, 69 x 16, 1 span, concrete abutments.

Mink River, P.E.I.
Bridge, cost $3,000, for Prov. Govt. Dept. of Public Works. Sec., L. B. McMillan, Charlottetown. Engineer-in-charge, H. H. Shaw, Charlottetown. General contractors, W. P. McNeill & Co., New Glasgow, N.S. One span, 100 x 15, steel construction.

Prov. of Quebec
Bridge, cost $3,500, over Mill Hill Brook, for Council of Valcartier. Sec.-Treas., Thos. Lavallee. Engineer, L. A. Vallee, Que. General contractors, Donohue Construction Co., Quebec.

Peterboro Co., Ont.
Three bridges for County Council. Clerk, E. M. Elliott, Peterboro. Engineer-in-charge, J. G. Belcher, C.E., Peterboro. General contractors, Dickson Bridge Co., Campbellford, Ont.

Wilmot, P.E. I.
Bridge, cost $2,000, for Prov. Govt. Dept. of Public Works. Sec., L. B. McMillan, Charlottetown. Engineer-in-charge, H. H. Shaw, Charlottetown. General contractors, W. P. McNeill & Co., New Glasgow, N.S. One span, 70 x 15, steel construction.

Public Buildings, Churches Schools, etc.

Battleford, Sask.
Public building, for Dom. Govt. Dept of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until 4 p.m. July 31st. Plans, specifications, etc., may be obtained at the offices of J. E. Cyr, Supt. of Public Bldgs. for Manitoba, Winnipeg, Man.; W. T. Mollard, Clerk of Works, Regina, Sask., and at office of Sec. and at Dom. Govt. Telegraph Office, Battleford.

Baie Des Febvres, Que.
School, cost $125,000, Yamaska County, for R. C. School Commissioners, Baie des Febvres. Architect, A. Trudel, 15 St. Philippe St., Montreal. Four stys., 64 x 82, cement foundation, brick construction. Architect will soon call for tenders.

Cartierville, Que.
Rest home, cost $60,000, for Rest Home Committee, c/o R. P. Recteur, Rachel E. and Papineau Ave., Montreal. Architect, L. R. Montbriand, 230 St. Andre St., Montreal. Mason, M. Prousse. Brick, Jos. Monette, 351 Sanguinet. Painting Cesaire Despatie, 2719 St. Hubert. Architect not yet sure whether to use stone or brick. Three storeys and basement, 65 x 150, stone foundation, stone and brick construction. Tenders called shortly for roofing, carpenter and electrical work.

Edmonton, Alta.
Laundry and power house, cost $45,000, for Misericordia Hospital, 12th street & Victoria ave. Architect, H. Percy Banie. General contractors, Cannell & Spencer Construction Co., 427 Jasper ave. W. General contractors are doing practically all the work themselves. To be finished by Sept. 1st, 1913. Two storeys, 40 x 98.

Montreal, Que.
Catholic Y. M. C. A., cost $10,000, St. Dominique near Mile End Station, for Rev. Emile Piche, Bernard and Waverly. Architects, Gauthier & Daoust, 180 St. James street. General contractor, painting and concrete, T. Lessard, 210 Park. Carpentry, Lebel & Forgues, St. Urbain and Van Horne. Iron and steel, Dom. Bridge Co., Lachine. Roofing, heating, plumbing and electrical work, Blanchard & Son, 2168 St. Lawrence. 3-storeys and basement.

Church, cost $200,000, 401 Centre St., for St. Charles R. C. Church Parish, c/o Rev. A. Lacosse, 401 Centre St. Architects, Macduff & Lemieux, Merchants Bank, St. Catherine W. 65 ft., 100 x 100, stone foundation, Montreal stone, structural steel and brick construction. Plans prepared.

Church, cost $30,000, Pius IX., for Hochelaga Methodist Church. Pastor, Rev. Isaac Nelson, 80 Chambly. Architect, A. G. Nosworthy, 814 New Birks Bldg. 30 x 60, cement foundation, brick construction. Plans in progress.

Royal George school, Notre Dame De Grace (Church and Girouard), for Protestant School Commissioners of N. D. G. West, c/o Mr. S. Duncan, 737 St. Catherine W. Architect not chosen. Two stys. and basement, 100 x 60, cement foundation, concrete and brick construction.

Church, for St. Colomba's Congregation, c/o Rev. J. A. Osborne. Architect not chosen. Architect to be chosen before Xmas, plans drawn and work started in Spring of 1914.

Alterations to City Hall, cost $10.000, Longueuil (St. Charles), for Town of Longueuil. Architect, Alf. Prefontaine Mason, Telesphore Narboune. Carpenter, Emery Verronneau. Iron and steel, American Locomotive, Maisonneuve. Painting, roofing, heating, plumbing, electrical and interior fittings not let yet. Three storeys, cement foundation, brick construction.

Medicine Hat, Alta.
Hospital for R. C. Church, Father Cadoux. Mr. E. D. Bennett, Toronto St., will donate site for hospital on Block 16, Crescent Heights sub-div. providing

building is commenced within the present year.

Nelson, B.C.
Hospital, cost $78,000, for Kootenay Lake General Hospital. Sec., Geo. Johnstone. Directors, J. A. Irving, Edward Kerr, Geo. F. Motion, all of Nelson. Architect, Alex. Carrie. Accommodation for 55 patients, ice-making plant to be installed to produce 192 lbs. of ice every 14 hours.

Port Arthur, Ont.
Stores and offices, cost $425,000, for Jas. Whalen & Co. Architects, Brown & Vallance, 32 Canada Life Bldg., Montreal. General contractors, Canadian Stewart Co., head office, Montreal. Terra cotta, Atlantic Terra Cotta Co., New York. Granite, John Swenson Granite Co., c/o General contractors. Seven storeys, 100 x 90.

Regina, Sask.
Jewish synagogue, Ottawa St., Blk. 361, for House of Jacob. President, S. Pearlman, Broad and 10th Ave. Plans, specifications, etc., obtained from President who will receive tenders for the erection and supply of material. Brick and frame construction.

Addition to hospital for City Council (Hospital Board). Architect, N. R. Darrach. City Commissioner, L. A. Thornton has been asked to call for tenders for addition of new wing to present building.

Church, cost $50,000, for Methodist Church, 14th Ave. and Rae St. Architects, Clemesha & Portnall, Scarth St. Brick, stone and artificial stone construction. Plans ready.

St. Anne de Bellevue, Que.
Church, cost $25,000, for Union Church Congregation. Architects, Peden & McLaren, 20 St. Alexis street, Montreal. General contractor, masonry, carpentry, roofing, painting, S. W. Hamilton, 402 Bleury street. Heating, plumbing and electrical work, Westmount Plumbing & Heating Co., 4278 St. Catherine West.

Sudbury, Ont.
Public building for Dominion Govt., Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, Ont., until Aug. 6th. Plans at Post Office and Station "F," Yonge St., Toronto.

Whitby, Ont.
Addition to House of Refuge for County Council. Supt., Dr. Lavery, Whitby. Tenders for work and materials received by Clerk, C. E. Farewell, Whitby, until August 2nd. Further particulars from Supt. or Clerk.

West Lorne, Ont.
Post office, cost $25,000, for Dom. Govt. Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. Plans being prepared.

CONTRACTS AWARDED

Amherst, N.S.
School addition, cost $30,000, Acadia St., for Town Council. Architect, W. M. Mitchell. General contractor, J. E. Lusby. Two storeys, extension 4 rooms to present building also an assembly hall, stone foundation, red limestone and brick construction.

Burquitlam, B.C.
Church for Burquitlam Anglican Church, Cameron St., off North Road. General contractors, Bowden Cons. Co., Burnaby, B.C.

Blackfoot Indian Reserve, Alta.
Boarding school for Dom. Govt. Dept. of Indian Affairs. Sec., J. D. McLean, Ottawa. General contractor, F. L. Davis, Calgary.

Burnaby, B.C.
Manual training school, cost $3,675, for Public School Board. Architect, J. H. Bowman, Crown Bldg., Vancouver. General contractors, F. P. Rogers, Vancouver. Frame construction.

Collingwood, Ont.
Post office, cost $108,000, Hurontario, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. General contractors, Healy, Herrington & Bryan, Collingwood.

Charlottetown, P. E. I.
Rebuilding church, cost $200,000, for St. Dunstan's R. C. Cathedral. Rector, Rev. G. J. McLellan. Builders, John S. Metcalf Co., Ltd., 34 St. Francois Xavier St., Montreal. Foreman of Co., Mr. Hodge.

Calgary, Alta.
Police station, cost $16,000, for City Council. Architects, Lang & Mayor, Board of Trade Bldg. General contractors, Thomas McKenzie & Jamieson. Trussed Concrete Steel Co. have secured the contract for the Kahn System of reinforcing. Four storeys, 75 x 100.

School, cost $185,000, for School Board. Building Supt., H. McClelland. General contractor, R. A. Brocklebank, 9 Bell Block. Concrete, Foster Cartage Co., 14th Ave. W. Brick, reinforced concrete and sandstone construction.

Edmonton, Alta.
Public school, cost $4,000, Richard, for Public School Board. Sec., M. Brady. Architect, G. E. Turner, Mortlake Block. General contractor, N. Cuthburtson, 113 8th St. Edmonton S. Two storeys, 26 x 37, frame construction, brick foundation.

South Edmonton, Alta.
Church, cost $32,000, 2nd Ave. N. and 3rd St. E., for the Anglican Church Congregation. Pastor, Rev. C. Carruthers, 15 3rd St. E. Architect, Mr. Gibb, Imperial Bank Bldg. General contractors, Read, MacDonald & Brewster, 619 4th St. One storey, 120 x 60, structural steel construction.

School, cost $150,000, King Edward Park, for Public School Board. Sec., M. Brady. Architect, G. E. Turner, Mortlake Block. General contractors, Read, MacDonald & Brewster, Teglar Block. Two storeys, 115 x 164, 17 rooms.

Hamilton, Ont.
School, cost $136,000, Cannon St. E., for Board of Education. Secretary, R. H. Foster. Architect, A. W. Peene, Clyde Block. General contractor, W. H. Yeates, 24 Leeming street.

Addition to school, cost $5,000, Dundas Road, for Twp. School Board. Architects Eastrick & Son, 30 King St. E. Mason, Wm. Aldridge, 28 Hunt St. Carpenter, John Mills, 167 Herkimer St. Roofing, M. V. McLean, 314 Hess St. S. Painting, C. King, 32 Caroline N. One storey addition, 67 x 40, brick construction.

London, Ont.
Alterations to civic offices, cost $6,000, Dundas, for City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Roofing, Philip Carey Co., $255. Vault doors, Ford & Featherstone, $55.

Medicine Hat, Alta.
Church, cost $90,000, for R. C. Church, Priest, Father Cadoux. Architect, M. N. Cutter, c/o Father Cadoux. General contractors, Purdy Anderson & Co., Montreal. One storey, 152 x 54, reinforced concrete construction.

Montreal, Que.
School, cost $196,000, Longue Pointe (Lavaltre), for R. C. School Commissioners. U. Lafontaine Com. Academy, 85 St. Catherine W. Architect, Z. Trudel, 238 St. Andre, Montreal. General contractor, H. Demers, 47 Labelle. 4 storeys, 70 x 130, cement foundation, Indiana limestone, terra cotta and structural steel construction.

Alterations to City Hall, cost $10,000, Longueuil (St. Charles), for Town of Longueuil. Architect, Alf. Prefontaine. Mason, Telesphore Narboune. Carpenter, Emery Verronneau. Iron and steel, American Locomotive, Maisonneuve. Painting, roofing, heating, plumbing, electric and interior fittings not let yet. Three storeys, cement foundation, brick construction.

Portage la Prairie, Man.
Boarding School and Hospital for Dominion Government, Dept. Indian Affairs. Secretary, J. D. McLean, Ottawa. General contractors, Sydney Bros.

Regina, Sask.
Fair building, cost $120,345, for City Council. City Clerk, A. W. Pool. Architects, Storey & Van Egmond, Credit Foncier Bldg. General contractors, Parsons Construction & Engineering Company, Limited, Scott street, at $102,000. Heating and plumbing, Potts & Smith, Cornwall street, at $18,345.

Two grand stands, cost $30,000, for City Council. Manager of Grounds, D. T. Elderkin, 201 Donahue Block. General contractor, H. Traub. Frame construction, seating, offices, dining room, etc.

Twp. North Grimsby, Ont.
Public school, cost $8,500, for Trustees S. S. No. 3. Secretary, W. E. Smith, Grimsby. Architect, Joseph Daw, 165 St. Paul street, St. Catharines. Masonry and plastering, G. Nigh, Grimsby. Carpentry and roofing, D. Marsh & Son, Grimsby. Steel, Hamilton Steel Construction Co., Hamilton. Painting, G. Haist, Grimsby. Heating and plumbing, W. Walker, Grimsby. Electrical, Martin Elec. Co., St. Catharines.

Toronto, Ont.
Addition to school, cost $33,087, Pape ave., for Board of Education. Secretary, W. C. Wilkinson. Masonry, Steel and fireproofing, G. T. Gayton, 2 Wayland ave., $12,445. Carpentry, A. Williamson, 44 Badgerow, $12,850. Plastering, John Jackson, 583 Concord, $2,000. Painting and roofing, J. T. Flowers, 5 Denison ave., $2,500. Iron stairs, Shipway Iron B. & W. Co., 773 King W., $3,292.

Addition to school, cost $29,227, McMurrich, for Board of Education. Secretary, W. C. Wilkinson. Masonry, steel and fireproofing, G. T. Gayton, 2 Wayland ave., $11,400. Carpentry, Crocker & Ledrew, 185 Ossington, $11,753. Plastering, Geo. White, 688 Kingston Rd., $2,100. Painting, J. Phinnemore, 455 Yonge street, $1,032. Roofing, J. T. Flowers, 5 Denison ave., $1,559. Iron stairs, Can. Ornamental Iron Co., 88 River, $1,383.

Addition to school, cost $43,780, Deer Park, for Board of Education. Secretary, W. C. Wilkinson. Masonry and steel, J. A. Wickett, 28 Toronto street, $19,449. Carpentry, F. Armstrong, 89 Oak street, $19,264. Plastering, John Jackson, 583 Concord, $1,850. Painting, Taylor & Co., 9 Bloor E., $1,730. Roofing, J. T. Flowers, 5 Denison ave., $1,487.

Sanitarium, Weston, for National Sanitarium Assn. Sec.-treas., R. Dunbar, 247 King W., Toronto. Architects, Dennison & Stephenson, 20 King West. Masonry, Davidge & Lunn, 684 Bathurst. Carpentry, Geo. Henry, 153 Rusholme Rd. Steel, McGregor & McIntyre, Pearl street. Roofing, Forbes Roofing Co., 91 Spadina ave. Plastering, W. J. Hynes, 718 Dupont street. Painting, J. J. Brennan, 260 Shaw street. Three stys. addition to main wing, steel and brick construction.

Victoria, B.C.

Observatory Bldg., Gonzales Heights, for Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, G. C. Hurrell, Victoria.

Winnipeg, Man.

Parliament Bldgs. for Prov. Govt., Dept. Public Works. Acting Minister, G. R. Coldwell. Architect, F. W. Simon, 260 Fort street. General contractors, Thos. Kelly & Sons, 200 Nanton Bldg., for $2,859,750.

College for Manitoba Medical College, Winnipeg. Architect, E. W. Crayston, 572 Ross ave. General contractors, masonry and carpentry, Blow Bros. Iron and steel, Vulcan Iron Works, Point Douglas ave. Roofing, A. B. Ormsby Co., 677 Notre Dame. Painting, R. Crawford, 118 Sherbrooke street. Heating, G. L. Stephenson, 842 Sherbrooke street. Electrical, Wm. McDonald & Wilson, 309 Fort street.

Law courts for Prov. Govt., Dept. of Public Works. Acting Minister, G. H. Coldwell. Prov. Architect, V. W. Horwood, 261 Fort street. General contractors, The National Construction Company, Donalda Bldg. Structural Engineer, C. A. Turner, Canada Bldg. Plumbing, Crane & Ordway Co., 93 Lombard, at $119,000.

Business Buildings and Industial Plants

Brighton, Ont.

Factory. Tenders received by Architect, W. A. Mahoney, O. A. A., Guelph, Ont., until July 28th. Plans, etc., at office of architect and Geo. Drewery, B.A., Brighton. Owner's name withheld.

Fort William, Ont.

Warehouse, for A. MacDonald Co., 116 Market St. E., Winnipeg, Man. Plans are being revised by M. H. Braden, Ft. William. Three storeys, 101 x 66.

Hamilton, Ont.

Alterations to store, cost $5,000, York street, for Duff Stores, Ltd. Architects, Watt & Blackwell, Lister Chambers. Plans ready.

Store, cost $5,000, King, for B. H. Webster, Wentworth & King streets. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. Marquee will be built. One storey, 24 x 80, pressed brick construction.

Ladysmith, B.C.

New Western Hotel Co. contemplate addition to hotel to cost $12,000.

Montreal, Que.

Theatre, cost $45,000, St. Lawrence and Duluth, for Solomon Vineberg, 316 Notre Dame St. W. Architect, C. Dufort, 632 St. Hubert street. Three stys., 30 x 96, cement foundation, stone, terra cotta, structural steel and brick construction. Tenders received by architect and owner after July 21st.

Hotel, cost $60,000, Lachine, for Hudon & Orsali, 259 St. Paul street, Montreal. Architect, J. O. Turgeon, 55 St. Francois Xavier. Four storeys, 50 x 100, cement foundation, structural steel and brick construction. Plans ready.

Shoe factory, cost $11,000, Carriere, for British Construction Co., 238 St. James St. Architect and builders, owners. Owners will receive tenders for foundation, brick work and other trades.

Candy and biscuit factory, cost $40,000, 245 Delorimier, for Aetna Biscuit Co., Ltd., 245 Delorimier ave. Architect, Jos. Sawyer, 407 Guy street. Require all kinds of candy and biscuitmaking machinery. Three storeys and basement, 57 x 100, cement foundation, reinforced concrete construction. Plans ready.

New Hamburg, Ont.

Office for Standard Reliance Mortgage Corporation, 84 King St. E., Toronto. Manager, W. S. Dinnick, c/o company. Plans under way.

Orillia, Ont.

Factory for C. N. W. Shoe Co., London, Ont. Town Clerk, C. E. Grant. Ratepayers will vote on July 21st, giving $25,000 and exemptions.

Ottawa, Ont.

Alterations to bank and office building, Metcalfe and Sparks streets, for Royal Bank of Canada, Sparks street. Have purchased buildings and will remodel.

Port Arthur, Ont.

Flour mill and elevator for Davidson & Smith, Hardisty street. Architects, Barnett & McQueen Co., Ltd., Fort William. Eight storeys. To have a capacity of 2,500 bbls. Plans ready.

Red Deer, Alta.

Hotel Alberta, cost $40,000, for Calgary Brewing Co., Calgary. Architects, Lang & Major, 231 8th ave. west, Calgary. Three storeys, 100 x 80, stone construction. Old buildings to be razed, new structure must be started so as to secure license for 1914.

St. Mary's, Ont.

Flour mill equipment for G. Carter & Son. Company contemplates installing additional equipment.

St. Catharines, Ont.

Rebuilding canning factory, Lake St., for Dominion Canning Co. Tenders received by architect, A. E. Nicholson, from August 1st until September 1st. 4 storeys, 50 x 150, reinforced concrete construction.

Toronto, Ont.

Addition to packing house, cost $25,000, Paton Rd., for Puddy Bros., 45 Paton Rd. Tenders received by architects, Chadwick & Beckett, 18 Toronto street. Four storeys.

Hotel and restaurant, 46 Richmond St., for J. J. O'Neill, 53 Wellesley street. Site purchased, 100 x 150, Buildings to be remodelled. Renewal of old St. Charles license applied for.

Addition to warehouse, cost $16,000, 74 Front St. E., for Bowes Co., Ltd., 74 Front E. Tenders called by architect, L. Foulds, 21 Leader Lane, about July 22nd. One storey addition, felt and gravel roofing, present building to be reinforced with steel.

Alterations to store and offices, cost $6,000, 780 Yonge street, for W. Tyrell, 95 King E. Tenders received by architect, R. A. Abraham, 23 Jordan street. Three storeys, 24 x 48, structural steel and brick construction, brick foundation.

Stores and apartments, Carlton & Church, for Robt. Davies, 244 Todmorden Rd. Architect, H. Simpson, 85 King E. Three storeys, 60 x 50, brick construction. Plans prepared.

Bank, Royce and Symington, for Bank of British North America. Architects, Mitchell & White, 55 Isabella street. Plans ready July 14th. Tenders received by architect. Two storeys, brick construction.

Winnipeg, Man.

Publishing plant, Transcona, for Transcona Times Co., Transcona. Architect, E. D. Tuttle, 701 McArthur Bldg. Plans prepared.

CONTRACTS AWARDED

Bracebridge, Ont.

Addition to tannery, cost $6,000, River Rd., for Beardmore & Co., 39 Front E., Toronto. Manager, P. A. Smith. Work done by day labor, under supervision of manager. One storey, 300 x 150, structural steel and hollow brick construction.

Calgary, Alta.

Stores and offices, cost $20,000, 8th ave. E., for E. H. Hume, Victoria, B.C. Builder, A. A. Ross, 201 David Block. 37 ft. 6 in. x 100 ft., cement foundation, brick construction.

Edmonton, Alta.

Store and apartments, cost $35,000, Fraser and Picard, for Jno. Hagmann, 789 Fraser ave. Architect and builder, T. C. Pennie, P. O. Box 431. General contractor, J. Warren, c/o owner. 3-storeys, 93 x 40.

Warehouse, cost $110,000, 3rd St. Architects and owners, Purcell & Kelly, 4th St. General contractors, Purcell & Foote, 4th street. Four storeys, 100 x 130.

Alterations to hotel, cost $25,000, Jasper W., for Robt. McDonald, Yale Hotel, Jasper ave. Architects, Magoon & MacDonald, Tegler Block. General contractors, Read, MacDonald & Brewster, Tegler Block. Three storeys, 100 x 50, brick and mill construction.

Store, cost $40,000, Namayo, for G. S. Armstrong, 433 Namayo ave. Architects, Magoon & MacDonald, Credit Foncier Bldg. General contractor, Cameron Anderson, 118 McCauley street. Five stys., brick construction.

Store and office, cost $15,000, Spruce, for E. S. McQuaid, Cariepy Block. Architect, P. Marvin, Jackson Block. General contractors, Bishop & Webster, 699 Namayo ave. Three storeys, 50 x 50 frame construction.

Fort William, Ont.

Elevator, cost $50,000, Island No. 2, for W. H. Dwyer, Ottawa and Fort William. Builder, D. A. Gordon, Luci Court, Fort William.

Hamilton, Ont.

Addition to factory, cost $5,000, Barton E., for Malcolm, Souter Furniture

Co., Barton E. Architects, Stewart & Witton, H. P. & L. Bldg. General contractors, Mitchell & Riddell, 91 Peter Street.

Foundry and Storage Warehouse, Clark street, for Otis-Fensom Elevator Co., Victoria ave., north. Architects, Stewart & Witton, H. P. & L. Bldg. Masonry, W. H. Cooper, 67 York St. Two storeys and basement, 200 x 45, 100 x 70.

Storage building, cost $30,000, for Canadian Colored Cotton Mills Ltd., 352 McNab St. N. Architect, Stewart McPhie, Bank of Hamilton Bldg. Masonry, Geo. E. Mills, 614 King E.

Montreal, Que.

Stables, stand, etc., cost $37,000, Dorval, for J. T. R. Laurendeau, 30 St. James St. Designer, Raouil Gariepy, 25 St. James street. General contractor, Damien Lalonde, cor. Colonial and Rachel streets. Frame construction.

Bank, cost $25,000, St. Catherine E. & Darling, for City & District Savings Bank, 176 St. James, Montreal. Architect, A. H. Lapierre, 51 Trust & Loan Bldgs. Masonry, Estate of M. Huberdeau, c/o Mr. Corbeil, cor. St. Catherine E. and Darling. Carpentry, P. Brouillet, 79½ St. Elizabeth. Roofing, heating, plumbing and electrical work, Roch Ouimet, 128 Bleury street. Painting, C. O'Brien, 25 Lorne ave. Plastering, F. Beaudoin & Fils, 536 Drolet. Marble, Robt. Reid, 125 St. Alexander. Three storeys, 25 x 50.

Offices, cost $10,000, St. Urbain, for James M. Aird, 165 St. Urbain. Architects, A. Gordon & Aird, 115 Stanley. Builder, J. W. Gordon, 2211 Clarke. Two storeys, 33 x 66, concrete foundation, reinforced concrete construction.

Store, cost $12,000, St. Catherine E., for Mrs. H. E. Vautelet, 69 Victoria ave. Architect, Chas. Bernier, 70 St. James. General contractor, Alf. Pion, 338 Marquette. Two storeys, 22 x 100, lime or sandstone and brick construction.

Moving picture theatre, cost $13,000 Monk Blvd., for A. Bourdeau and W. Pepin, 167 Hadley and 70 St. James, Ville Emard. General contractor, Renaud Legault, c/o owner. Private designer. 25 ft., 50 x 50, cement foundation, brick and concrete blocks construction.

Store, cost $18,000, Laurier, for A. Dalbec, 99 St. James. Architect, A. H. Lapierre, 30 St. James. Mason, A. Filion & Frere, 865 de St. Valier. Carpentry, Lamien Lalonde, cor. Rachel & Colonial. Three storeys and basement, 25 x 65, stone foundation, brick construction.

McAdam Jct., N.B.

Machine shop for Can. Pacific Ry. District Engineer, Geo. Wetmore, King St., St. John. General contractor, Henry Post, Woodstock, N.B. Bolts and rivets for steel work, Wm. Lewis & Son, Brittain street, St. John.

North Edmonton, Alta.

Addition to packing plant, cost $15,000, for The Swift Canadian Co. Architect and general contractor, J. McDermot, Winnipeg. Two storeys, 60 x 60.

Ottawa, Ont.

Office, warehouse, etc., cost $12,500, Frank, for J. T. Blythe, 394 Bank St. General contractors, masonry, carpentry, roofing and painting, Alexander & Campbell, 587 Lisgar. Plastering not let yet. Heating and plumbing, J. T. Blythe. 394 Bank street. Electrical work, Wm. R. McCallum & Co., 263 Laurier West. Solid brick construction.

Stores and offices, cost $150,000, Rideau, for Blackburn Bros., Creighton St. Architect, W. E. Noffke, Central Chambers, Queen street. Elevators, Otis-Fensom Co., Queen St. Masonry and electrical work done by day labor. Carpentry, Smith Bros., 310 Flora. Iron and and steel, Dominion Bridge Co., Sparks St. Copper, McFarlane & Douglas, 250 Slater. Painting, heating and plumbing not let yet. Plastering, Chas. Hunt.

Ottawa, Ont.

Stores, cost $15,000, Sparks St., for N. D. Porter, Bank St. General contractor, R. Holmes, 80 Arlington. General contractor is doing work by day labor.

Coal sheds and storage, cost $27,000 to $30,000, for J. G. Butterworth & Co., 86 Sparks street. Architect and general contractors, owners. Work being done by day labor, under supervision of Mr. Butterworth. Frame and brick constr.

Factory, cost $27,000, Nelson St., for Crown Lithographing Co. General contractors, A. Toms & Copeland, Arlington ave. Steel and iron, A. Marshall, 3 O'Connor St.

Port Arthur, Ont.

Flour mill and elevator, cost $358,000, for Davidson & Smith, Hardisty Street. Architect and general contractors, Barnett & McQueen Co., Ltd., Fort William. Eight storeys, reinforced concrete and brick construction, concrete dock to be built, machinery to be installed.

Garage, cost $20,000, for W. Foote, 234 Park street. General contractor George Otto, 206 Arthur St. Two storeys, brick construction.

Prince Rupert, B.C.

Hotel, cost $50,000, for Premier Hotel Co. Architect, J. N. Randall, Hutchinson Bldg. General contractor, C. L. Williams. Five storeys, 100 x 50, concrete and stone foundation, brick and reinforced concrete construction. Architect buys all material.

Regina, Sask.

Implement factory, cost $40,000, Rothwell Place, for Tenn Mfg. Co., Ltd., 210 Westmann Chambers. Architects, Storey & Van Egmond, Credit Foncier Bldg. General contractors, Smith Bros. & Wilson, Rose street. Two storeys, 113 x 80.

Departmental store, cost $500,000, Victoria ave., for C. W. Sherwood Co., Ltd. Architects, Brown & Vallance, Montreal, Que. Contractors, R. J. Lecky & Co., Ltd., Northern Crown Block Bldg. Four storeys and basement.

St. John, N.B. (West)

Grain elevator for Canadian Pacific Railway Company. General manager, F. R. Hodge, Montreal. General contractors, John S. Metcalf Co., Montreal, c/o J. K. Wyman, St. John West, N.B. Brick power house being roofed.

St. John, N.B. (Dock)

Repairs to warehouse, cost $5,000, for E. R. Owens, London Eng. c/o G. O. D. Otty, Richey Bldg., Princess St. General contractor, Ed. Bates, 73 Duke St.

Toronto, Ont.

Bank, Church and Wilton, for Sterling Bank of Canada. Architect, J. M. Lyle, 14 Leader Lane. Masonry, Smallwood Bros., 97 Clinton street. Carpetry, Jos. Dougherty, 106 Shuter St. Plastering and painting, F. G. Roberts, & Co., 106 Wells street. Heating and plumbing, J. R. Seager, 799 College St. Three storeys, 25 x 35, stone and brick construction.

Stores and offices, Yonge and Shuter, for Ryrie Bros., 134 Yonge St. Architects, Burke, Horwood & White, 28 Toronto street. Masonry, Elgie & Page, 18 Toronto street. Carpentry, J. C. Scott Lumber Co., River street. Steel, Toronto Structural Steel Co., Atlantic avenue. Roofing, A. Matthews, Ltd., 256 Adelaide W. Painting, Roberts & Co., 256 George street. Heating, plumbing and electrical work, Bennett & Wright, 72 Queen E. Stone carving, Watson & Cree, 836 Yonge street.

Theatre, cost $35,000, 502 Bloor West, for J. C. Brady, 413 Palmerston Blvd. Architect, J. A. MacKenzie, 203 Lumsden Bldg. Mason, H. N. Dancy & Son, 220 Howland ave. Carpentry, Jas. Sim, 372 Markham St. Plumbing, Mashinter & Co., 119 Simcoe street.

Victoria, B.C.

Addition to newspaper building, cost $20,000, for Victoria Daily Colonist. General contractors, Westholme Lumber Co., Government and Pandora. Four storeys, steel, frame and brick construction.

Winnipeg, Man.

Office building and restaurant, Smith St., for Olympia Cafe, 277 Portage ave. Architect, Jas. Chisholm, 310 Enderton Bldg. General contractors, Carter-Halls-Aldinger, 1010 Union Bank Bldg. Iron & steel, Minneapolis Steel & Macey Co., Minneapolis, Minn. Painting, general contractors. Cut stone, Winnipeg Stone Co. Steel casement, J. H. Ashdowne Co. Six storeys, 110 x 120, concrete foundation, structural steel and tile construction.

Residences

Calgary, Alta.

Residence, cost $6,000, Elbow Park, for Alberta Home Builders, 201 Grain Exchange. Two storeys, 29 x 33, frame, Plans ready.

Two residences, cost $5,000, Beaumont. Architects and owners, Topley Davidson & Co., 22nd St. E. Frame.

East London, Ont.

Twelve cottages, cost $20,000, for Argyle Land Co. (R. Metcalfe & Wood), 173 Dundas street. Architect, W. G. Murray, Dom. Savings Bldg., London. One storey, frame construction.

Edmonton, Alta.

Residence, cost $7,000, Syndicate. General contractor and owner, Vincent Barton. Architect, E. W. Morehouse. Two storeys, frame construction. Plans ready.

Fort William, Ont.

Residence, cost $5,000, Marks street, for R. Sproule. Tenders received by architects, Hood & Scott. 2½ storeys, 32 x 40, brick veneer construction.

Hamilton, Ont.

Residence, cost $10,000, Main St. E., for Walter Stewart, c/o architect. Tenders received by architects, Stewart & Witton, H. P. & L. Bldg. Two stys. and basement, 43 x 40, cement foundation, pressed brick construction.

Residence, cost $12,000, Wentworth, for Adam Inch, Mount Hamilton. Tenders received by architect, F. W. Warren, 808a Bank of Hamilton Bldg. Two storeys, basement and attic, 34 x 44, stone foundation, pressed brick construction.

London, Ont.
Alterations to bachelor apartments, for Argyle Land Co. (R. Metcalfe & Wood), 173 Dundas street. Architect, W. G. Murray, Dominion Savings Bldg. Plans ready.

Ottawa, Ont.
Residence, cost $7,000, Wendover, for Sam S. Lucy, 1147 Bank street. Brick construction, stone foundation. Plans being prepared.

Residence, cost $5,000, Concord street, for C. Nelson, 111 Lees ave. Brick construction, stone foundation. Plans in progress.

Medicine Hat, Alta.
Residence, cost $5,500, for I. Inwood, Manager Quebec Bank. Lots 7-8, Block 4, Herald Sub. Architect, M. N. Purdy. Two storeys, 35 x 83, steel lath and cement construction.

Montreal, Que.
Apartment house, cost $30,000, Cote St. Luke, for J. P. Stephen, Star and Nosworthy, 814 New Birks Bldg. Plans being changed and tenders to be called again.

Residence, cost $17,500, Outremont (St. Catherine Rd.), for T. Viau, 481 St. Denis St. Architect, A. H. Lapierre, 30 St. James street. Two storeys, 42 x 44, stone foundation, stone and brick construction. Plans prepared.

Residence, cost $15,000, Outremont, for E. Ducharme, 714 Ontario, Maisonneuve. Architect, J. A. Ouellette, 250 Amherst. Three storeys, 30 x 80, stone foundation, stone trim and brick construction. Plans ready.

Residence, cost $10,000, for Alex. Mackay, St. Martin and Dorchester streets. Architect and builder, owner. Owner open to receive tenders for plastering. 2½ storeys and basement, 23 x 60, brick construction.

Notre Dame des Victoires, Que.
Residence, cost $24,000, for Parish of N. D. Des Victoires. Architects, Viau & Venne, 76 St. Gabriel, Montreal. General contractor, masonry, carpentry, iron and steel, J. B. Legare, 1235 Delorimier, Montreal. General contractor calling tenders for roofing, painting and electrical work. Heating and plumbing, Mr. Otis, Parish of Notre Dame des Victoires.

Regina, Sask.
Apartment block, cost $60,000, Victoria ave. and Argyle St., for David D. Bennett, 2108 Albert St. Architect, S. G. Tripp, Suite 5, Princess Theatre, Scarth St. Three storeys and basement, fireproof, reinforced concrete, stucco finish over brick, 24 suites. Tenders received by architect.

South Calgary, Alta.
Residence, cost $5,000. Architect and owner, H. B. McDonald, 707a First St. E. 22 x 33, frame. Plans prepared.

St. Catharines, Ont.
Residence, cost $5,000, Bellevue ave., for G. L. Sherk, Midland St. Architect, Joseph Daw, 165 St. Paul St. Tenders received by owner until July 31st. Two storeys, 40 x 26, frame construction.

St. John, N.B.
Apartment house, Bermain and Princess. Interested, Hon. Wm. P. Pugsley, Pugsley Bldg. Architect and builder, J. J. Laferme, c/o Hon. Wm. P. Pugsley, Pugsley Bldg. Eight storeys, fifty suites, cement foundation, concrete, stone structural steel and brick construction. Plans ready.

Toronto, Ont.
Alterations to residence, cost $5,000, Deer Park Cres., for A. J. Jackson, 6 Deer Park Cres. Architect, F. H. Herbert, 45 Adelaide E. Work will probably be done by day labor. 2½ storeys, brick construction.

One pair residences, cost $7,000, for Mr. Miller, 123 Bay street. Tenders received by architect, A. J. Rattray, 123 Bay street. Two storeys, 26 x 48, brick construction and foundation.

Residence, cost $5,000, Wells Hill ave., for J. W. Redfern, 63 Kendall. Architects, Craig & Madill, 304 Manning Chambers. Two storeys, 24 x 36, brick construction and foundation.

Residence, 3 Oriole Rd., Parkway, for P. W. Ellis, et al, Wellington E. Architects, Curry & Spalding, 105 Bond St., will call for tenders about July 22nd. Three storeys, steel and brick construction, stone foundation.

Three attached residences, cost $8,000, Crawford St., for Algate & Peacock, 1026 Queen St. W. Owners now open for tenders. 2½ storeys, brick construction and foundation.

Victoria, B.C.
Four residences, for Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor. Government engineer, J. E. Griffith. Tenders received by Minister until noon July 28th, for the erection and completion of the following residences at the Mental Hospital, Essondale, B.C.; Residence for Head Gardener, Engineer, Bursar, Assistant Medical Superintendent. Plans, specifications, etc., at offices of J. Mahoney, Govt. Agent, Vancouver, S. A. Fletcher, Govt. Agent, New Westminster, and at Dept. of Public Works, Victoria.

Westmount, Que.
Residence, cost $32,000, Mt. Crescent Heights. Architect, R. E. Bostrom, New McGill Bldg. Three storeys and basement, 30 x 65, cement foundation, solid brick construction. Tenders called by architect about July 25th.

Winnipeg, Man.
Apartment block, cost $15,000, Maryland, for J. F. Parker, 194 Young street. Architect, E. W. Crayston, Ross avenue. Three storeys and basement, 30 x 90, pressed and common brick construction.

CONTRACTS AWARDED

Calgary, Alta.
Residence, cost $5,000, Houndsfield Heights for F. McNally, c/o builder, C. A. Maus, 1316 15th St. N.W. Two stys., 28 x 30 ft. 6 in., frame construction.

Residence, cost $8,000, Elbaya, for E. F. Adams, 501 18th ave. west. Builder, H. Templeton, 2314 4th street west. 2-storeys, 36 x 35, frame construction.

Edmonton, Alta.
Residence, cost $15,000, Athabasca. General contractor and owner, T. W. McKerman, Royal George Hotel. Architect, Jas. Henderson. 2½ storeys, 34 x 34, brick veneer construction.

Six residences, cost $15,000, Wilton. General contractor and owner, W. E. Ostrander, 603 Tegler Block. One sty., 24 x 34, frame construction.

Residence, cost $7,000, Syndicate. General contractor and owner, Vincent Barton. Architect, E. W. Morehouse. Two storeys, frame construction.

Residence, cost $5,000, 25th street. General contractor and owner, A. H. Monesly, 10 Alberta Loan Block. 2 storeys, 30 x 30, frame construction.

Hamilton, Ont.
Twelve residences, cost $24,000, Cumberland ave., for Hamilton Dwellings Ltd., c/o General contractor, R. G. Wilson, Rutherford ave. Concrete foundation, brick construction.

Five residences, cost $7,500, Morris ave. General contractors and owners, Wooley & Farewell, King St. E. Frame construction.

Four residences, cost $8,000, Sherman ave. General contractors and owners, McKay Bros. Brick construction.

Lake Mantou, Que.
Summer bungalow, cost $6,500, for S. B. Townshend, 18 St. Sacrament, Montreal. Builder, R. Ryan, rear 697 Atwater ave., Montreal. Two storeys, frame construction.

Medicine Hat, Alta.
Residence, cost $8,000, Lockwood St., for R. A. Sewell, c/o Perry, Sewell & Perry, Toronto St. Architect, W. T. Williams, Porter Block. General contractors, Worthy & Fulton. 2½ storeys, 30 x 40.

Montreal, Que.
Six flats, cost $8,000, for W. Dalphy, 121 Addington. Builder and architect, owner. Masonry, carpentry, roofing, painting, interior fittings, builder. Heating and plumbing, E. & H. Madore, 2550 Notre Dame W. Electrical work, Valee & Hamlin, 1867 St. James St. Owner contemplates more flats as soon as these are finished.

Residence, cost $25,000, Westmount (Aberdeen ave.), for R. C. Patton, Quebec Bank Bldg., or 421 Mackay. Architects, Cox & Amos, 6 E. T. Bank, St. Catherine St. W. General contractor and carpenter, D. M. Long, 39 Windsor. Tenders called by general contractor for masonry, roofing, painting, heating, plumbing, electrical work, interior fittings, plastering. 2½ storeys and basement, 33 x 64, stone foundation, Indiana cut stone and pressed brick construction.

Three flats, cost $9,000, Addington, for Cheri Gagne, 325 Old Orchard. Architect and builder, owner, Two storeys and basement, 23 x 50, cement foundation, stone trimmings, brick construction.

Two flats, cost $11,000, Grey ave. Builder and owner, John H. Hand, 609 Belmont ave. Architects, Wright & Son, St. James St., Two storeys, 50 x 50.

Twelve flats, cost $15,000, Christopher Columbus, Builder and owner, F. Frank, 619 De Flemimont. Three storeys, 75 x 65, concrete foundation, brick construction.

Parsonage, cost $10,000, Sherbrooke and Cartier, for Congregation L'Eglise du Redempteur, c/o Rev. H. E. Benoit, 1105 Sherbrooke E. Architects and builders, members of congregation. Three stys., 25 x 65, cement foundation, stone and brick construction.

Three flats, cost $4,500, Chabot. Build-

(Continued on page 78)

Tenders and For Sale Department

Brantford Hydro-Electric System

Tenders Wanted

Sealed tenders, addressed to the Brantford Hydro-Electric System, 8 Commercial Chambers, Brantford, Ont., and endorsed "Tender for Sub-station Building," will be received until 12 o'clock noon on **Wednesday, the 30th day of July, 1913**, for the construction of a concrete and brick sub-station building.

Drawings, specifications and form of tender may be obtained on application to the above address.

The lowest or any tender will not necessarily be accepted.

Brantford Hydro-Electric System.
Brantford, Ont., July 16, 1913. 30

Tenders for Dredging

Sealed tenders will be received at the Clerk's office, Chatham, Ont. (where plans and specifications can be seen) up to 12 o'clock noon, on **Thursday, July 31st, 1913**, for dredging about 9 miles of drainage work in the Township of Dover, County of Kent. The work to be let subject to the final passing of the By-law.

The lowest or any tender not necessarily accepted. Tenders must be marked "Tenders for Dredging," and each accompanied with a marked guarantee cheque for $2,000.

Dated, June 17th, 1913.

H. M. BEEHARD, Reeve.
JOHN WELSH, Clerk,
26-30 Chatham P. O.

Sealed tenders addressed to the undersigned and endorsed "Tender for Toronto Harbour Works," will be received at this office until 4 p.m. on **Monday, August 25, 1913**, for the construction of a Sea Wall, Breakwater, Ship Channel and Retaining Walls at the City of Toronto, in the County of York, Province of Ontario.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, Ont.; Harbour Commissioner's Office, 76 Adelaide St. West, Toronto; H. J. Lamb, Esq., District Engineer, Windsor, Ont., and J. L. Michaud, Esq., District Engineer, Post Office, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 12, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44297. 29-30

Tenders for Debentures

Municipality of McIrvine

Sealed tenders addressed to the undersigned will be received for the sale of thirteen $1,000 twenty-year Sinking Fund School Debentures bearing interest at 6 per cent.

FRANK J. STRAIN, Clerk.
29-30 Fort Frances, Ont.

Notice to Contractors

Sealed proposals will be received at the offices of the Water Commissioner, City Hall, until 12 noon, **July 31st, 1913**, for the fabrication and laying of about 10¼ miles of 36-in. rivetted steel pipe and appurtenances on the line of the Sooke Water Supply pressure conduit, and in accordance with the requirements of the general specifications prepared by Wynn Meredith, Consulting Engineer for such construction, pursuant to the provisions of By-law No. 814.

Plans and specifications can be seen, and forms of tender obtained at the Sooke Water Supply Office, 1414 Douglas Street, Victoria, B.C.

The lowest or any tender not necessarily accepted.

C. H. RUST,
Water Commissioner.
Victoria, B.C.,
June 27th, 1913. 28-29-30

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Wharf at Vancouver, B.C.," will be received at this office until 4 p.m., on **Thursday, August 21, 1913**, for the construction of a Wharf at Vancouver, B.C.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C., The District Engineer's Office, Confederation Life Building, Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office Building, Montreal, Que., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and places of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 8, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44661.

29-30

TENDERS

Will be received by the undersigned up to **Friday, August 15th, 1913**, for the erection of a three storey concrete and brick Municipal building for the Town of Cobalt, approximately 43 ft. x 100 ft., according to plans and specifications prepared by Messrs. Angus & Angus, Architects, North Bay.

Contractors are required to enclose a marked cheque along with each tender for five per cent. of the amount of same, the lowest or any tender not being necessarily accepted.

Work to commence immediately on award of contract.

Plans and specifications may be seen at the office of the architect or at the office of the undersigned.

R. L. O'GORMAN,
Town Clerk,
30-31 Cobalt, Ont.

PRICEVILLE, ONT.

Tenders for Steel Bridge and Abutments

Sealed tenders marked "Tender," addressed to the Reeve, Township of Glenelg, Priceville, will be received up to **August 1st** for the construction of a bridge at Traverston, near Markdale.

Tenders will be received as follows:—

1. Two concrete abutments.
2. Reinforced concrete floor, 110 x 14 ft.
3. Steel bridge, 110 ft. span, 14 ft. wide.

An accepted bank cheque for 5 per cent. of contract, payable to the Treasurer of Twp. of Glenelg, shall accompany each tender and will be returned on non-acceptance.

Plans and specifications may be seen at the offices of the Reeve or Engineer.

The lowest or any tender not necessarily accepted.

THOS. NICHOL, Reeve.
Priceville, P.O.
R. McDOWELL, Engineer,
29-30 Owen Sound, Ont.
Priceville, July 14, 1913.

TOWN OF BASSANO, ALBERTA

Sewage Disposal Works

Sealed tenders, addressed to the undersigned, will be received up till 18 o'clock on **Friday, 15th August, 1913**, for all labor and materials (except filter distributors) necessary for the construction of sewage disposal works, consisting of tank and filter and relative works near the Town of Bassano.

Tenders must be accompanied by an accepted cheque for five per cent. of the amount of the tender, or alternatively by the bond of an approved guarantee company.

Plans and specifications and other information may be obtained at the offices of the Consulting Engineers at Winnipeg and Calgary, on deposit of $25, which will be returned to bona fide tenderers on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

GEO. B. R. BOND, Sec.-Treasurer,
July, 1913. Bassano, Alta.

The John Galt Engineering Co., Ltd.,
Consulting Engineers. 29-30

Tenders For Bridge Construction

Sealed tenders plainly marked as to contents, will be received by the undersigned up to noon of **Wednesday, August 6th, 1913**, for the construction of a reinforced concrete beam bridge on Yonge Street, just north of Aurora, in the County of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto. The lowest or any tender not necessarily accepted.

FRANK BARBER, County Engineer.
Toronto, July 22, 1913. 30

Tenders for Bridge

Tenders will be received up to noon, **August 11th, 1913**, at Lamlash, for the erection of a steel bridge, 90 ft. c. to c., on Lat. 20 x 21 in Con. 3 S. D. R. Bentinck. Also for two abutments for the same. Plans and specifications may be seen with Henry Metcalf, Hanover, or James Warren, Engineer, Walkerton. A certified cheque for $200 to accompany each tender, payable to the Treasurer of the Township of Bentinck.

(Signed) ALEX. WILSON,
Emwood, Ont.
Bentinck, July 7, 1913. 30

PETROLIA, ONT.

Tenders for Concrete Trunk Sewer

Tenders will be received by the undersigned up to 5 p.m. on **Monday, the 28th day of July, 1913**, for the re-construction with cement concrete work of about 1,000 lineal feet of outlet to Trunk Sewer in the Town of Petrolia.

Plans and specifications may be seen at the Town Clerk's office.

The lowest or any tender not necessarily accepted.

29-30 J. McHATTIE, Town Clerk.

Tenders for Painting

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, August 5th, 1913, for painting North Glen Road Bridge over Rosedale Ravine, St. Clair avenue (Moore Park), over Vale of Avoca, and Wallace Avenue Bridge—foot bridge over C. P. R. and G. T. R. tracks.

Specifications and tender form may be obtained upon application at the office of the Railway & Bridge Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relative to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
July 15th, 1913. 30

DERRICKS FOR SALE

One 25-ton Terry & Tench travelling stiff leg derrick.

One 20-ton stiff leg derrick.

One 15-ton stiff leg derrick.

No reasonable offer refused.

National Sand & Material Company, Ltd.
30-31-32 Welland, Ont.

Tenders Wanted

Sealed tenders will be received by the undersigned until **Wednesday, July 30th**, for the construction of the following works for the Counties of Halton and Wellington, or tenders may be handed in at the Court House, Guelph, up till 3 p.m., Thursday, July 31st.

A. 51 ft by 18 ft. Steel Highway Bridge at Eden Mills between the townships of Eramosa and Nassagaweya.

B. Concrete abutments for same.

C. Alternative design for concrete arch with suspended floor.

D. Retaining walls at Rockwood 145 ft. long.

For plans, specifications and other information apply to

JOHN S. FORD, Esq., Milton, Ont.
D. ANDERSON, Fergus, Ont.
BOWMAN & CONNOR, Engineers,
30 Toronto, Ont.

TENDERS
FOR
Equipment of Municipal Abattoir and Rendering Building now being erected at the foot of Tecumseh Street, Toronto

Separate tenders for the several trades mentioned below in connection with the above buildings will be received by registered post only addressed to the undersigned up till noon on **Tuesday, August 5th, 1913.**

1. Machinery for Killing Departments, Pens, Iron Fencing, etc. Tanks, and Rendering Machinery.
2. Ice Machine and Motor, with all Piping, Condenser, and Foundations.
3. Insulation of Chill Room—floors and walls.
4. Electric Wiring, Fixtures, etc.
5. Steam Heating for Offices and Men's Rooms.
6. Cattle Chute, Connecting Bridge, Conduct Catch Basin, Chimney, Elevators, Chill Room, Drip Pans.
7. Boiler Room Equipment, including Boilers, Heater, all Piping, Fittings, and Pumps.
8. General Painting of Buildings, Iron Work, Machinery, Pens, Fences, etc.

Plans and specifications may be seen and forms of tender and all information obtained at the office of Messrs. William R. Perrin & Co., 530 King street east, Toronto, and No. 200 Old Colony Building, corner Dearborn and Van Buren Streets, Chicago, Ill.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or tenders will not be entertained, and all tenders are to be subject to the condition that the work will be finished by April 1st, 1914.

Parties tendering shall submit with their tender the names of two personal sureties or the bond of a guarantee company.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
30

Tenders for Bridge Covering

Tenders will be received up to **6 o'clock P.M. August 4th, 1913**, for the recovering of the East End bridge, Walkerton. Tenders may be for the whole or separately for the steel and cedar flooring. Specifications may be seen with the undersigned.

A. E. McNAB,
Walkerton, Ont.
Chairman of Committee.
Walkerton July 21st, 1913. 30

Tenders for Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Wednesday, August 6th, 1913**, for the construction of a reinforced concrete culvert on Yonge street at Langstaff opposite Lot 36, Markham, in the County of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto. The lowest or any tender not necessarily accepted.

FRANK BARBER, County Engineer.
Toronto, July 22, 1913. 30

BRIGHTON, ONTARIO

NOTICE

Whole or separate tenders will be received up to noon of **Monday, July 28th**, for the erection of a factory building. Plans and specifications for which may be seen at the office of the architect, W. A. Mahoney, O. A. A., Guelph, or at the office of Geo. Drewery, B.A., Barrister.

Lowest or any tender not necessarily accepted.

(Signed) GEO. DREWERY, B.A.,
Barrister,
30-31 Brighton, Ontario.

For Sale

FOR SALE.—Three Second-Hand Contractor's Dinky Vulcan Locomotives in first-rate condition. One 9-in. x 14-in. and two 10-in. x 16-in. Also a 50-ton Steam Shovel, and some contractors' Dump Cars. Apply to The Canadian Fairbanks-Morse Co., Ltd., 444 St. James Street, Montreal. 30-31

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

BARGAINS!

1	Thew Steam Shovel, used less than 90 days, shop number 690; like new	$3,300
30	1½-yd. dump cars, 36-in. gauge; practically new. Each	30
1	American Well Air Compressor, 12 x 12 x 14, 340 ft. capacity, new	440
1	Rand Belted Air Compressor, 10 x 14; A.1.	240
1	Buckeye Trenching Machine, steam driven; cuts trench 27-in .wide to 8 ft. deep. Overhauled and A.1.	2,500
2	American, 6¼ x 10, D.C., D.D. Hoisting Engines with boilers and boom swingers, A.1. Each	725
1	Three-drum Stronsburg 7 x 10 Hoisting Engine with boiler; practically new.	725
1	Gates No. 5 Crusher, 2 arm Spider, rear drive (Rebuilt B.) Exceptionally low price.	

For anything else second-hand, write

WILLIS SHAW MACHINERY CO.

New York Life Building, Chicago, Ill.

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont. 29-t.f.

Residences

(Continued from page 75)

er and owner, A. Robert, 1432 Chabot. Three storeys, 27 x 58, cement foundation, brick construction.

Flats, cost $5,000, Maisonneuve (Bennett), for E. Bisson, 106 Bennett. Builder and general contractor, owner. Three storeys, 25 x 42, brick construction.

Four flats, cost $7,000, Addington, for Jos. St. Andre, 17 Strathmore. Architect and builder, owner. Two storeys, 50 x 40, stone foundation.

Residence, cost $12,000, Roslyn ave., for Geo. Rabinovitch, Room 35, 30 St. James street. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Mason, J. H. Hutchison, 64 St. Ambroise. Other contracts not yet awarded. 2½ storeys, 23 x 55, stone foundation, stone trimmings, brick construction.

Ottawa, Ont.

Residence, cost $7,000, Echo Drive, for Miss M. Munsie, 43 Aylmer ave. General contractor, J. R. Howe, 324 Mutchmore. Heating and plumbing, J. P. Band, 344 Bank. All other contracts are being done by general contractor.

Addition to apartments, cost $7,000, Besserer, for Mrs. H. Lyons, 316 Besserer street. Architect, W. E. Noffke, Central Chambers, Queen street. General contractor and carpenter, F. F. Slack, 95 Flora street. Mason, Mr. Bouchea, Clarence street. Painting not let yet. Heating and plumbing, Holloway & Son, 373 Somerset. Electrical, P. S. Ackroyd, 184 Bank street.

Toronto, Ont.

Detached residence, cost $10,000, Rosedale Rd., for Jno. Clouson, c/o architect, J. M. Lyle, 14 Leader Lane. Cut stone, Oakley & Son, 278 Booth ave. Masonry, Wm. Hughes, 216 Simcoe St. Carpentry, Weller & Co., 54 Tecumseth street. Roofing, Duthie & Son, 30 Widmer street. Plastering, W. J. Hynes, 718 Dupont street. Painting, J. R. Robinson, 425 Sumach street. Plumbing, R. C. Mansell, 85 Quebec ave. Electrical, H. Alexander. Bank of Toronto, King and Bay streets.

Residence, cost $13,000, St. Clair and Spadina Road, for L. J. Applegath, 155 Yonge street. Architect, C. J. Gibson, Janes Bldg. Carpenter, P. J. Corcoran, 306 St. Clarens ave. Plastering, Hanna & Nelson, 273 Rusholme Road. Plumbing and heating, F. Armstrong, Queen St. W. 2½ storeys.

Nine pair and one detached residences, cost $50,000, Boom ave. Builder and owner, J. W. & J. S. Rankin, 243 St. Clarens ave. Owners employ regular staff for all trades. 2½ storeys, 42 x 44, pair, brick construction and foundation.

Residence, cost $18,000, Walmer and Davenport, for E. J. Lennox, 164 Bay street. architect and general contractor, owner. Masonry and stone, Page & Co., Queen's Park. 2½ storeys, 60 x 100, stone, structural steel and brick construction.

Winnipeg, Man.

Two residences, cost $11,000 each, Wellington Cres. Architect, Frank Peters, Phoenix Bldg. General contractors, Simmons Bros., 1200 Garfield ave. 2½ storeys and basement, 32 x 47, pressed brick construction.

Power Plants, Electricity and Telephones

Aurora, Ont.

Electrical appliances, cost $21,000, for Town Council. Clerk, S. H. Lundy. Bylaw will be voted on August 4th. $16,000 for electrical equipment for light and power. $5,000 for electrical pumps for waterworks.

Brantford, Ont.

Elec. substation for Brantford Hydro-electric System. Tenders called until 12 o'clock noon, July 30th. Specifications, etc., at 8 Commercial Chambers, Brantford.

Medicine Hat, Alta.

Telephone exchange building, cost $85,000, for Provincial Govt., Dept. of Railways and Telephones. Deputy Minister, W. J. Harmer, Edmonton. Three stys., stone and brick construction. Automatic telephone system to be installed. Plans prepared.

New Toronto, Ont.

Electric plant for Village Council. Bylaw carried for $7,000, cost of erecting poles and extensions from sub-station. Contract will be made with Ontario Hydro-electric Commission for supply of power.

Sault Ste. Marie, Ont.

Electric elevator for Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractors, D. Jamieson & Son. Electric passenger elevator for public bldg.

Toronto, Ont.

Lightning arresters, cost $7,000, Davenport, for Toronto Power Co., Davenport Rd. Architect, H. G. Salisbury, 12 Adelaide E. One storey, 24 x 48, structural steel and brick construction.

Victoria, B.C.

Steel conduit for City Council. Tenders received by Water Commissioner C. H. Rust until July 31st, for the fabrication and laying of about 10½ miles of 16-in. rivetted steel pipe, etc. Plans, etc., at Sooke Water Supply Office, 1414 Douglas street.

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

Pioneer Manufacturer of

Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.

The benefit of 20 years experience as successful contractors.

Yours for the Asking

Hotchkiss Lock Metal Form Co.

BINGHAMPTON, N.Y.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record

and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The **KERR**

"Keystone"

Iron Body

GATE VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

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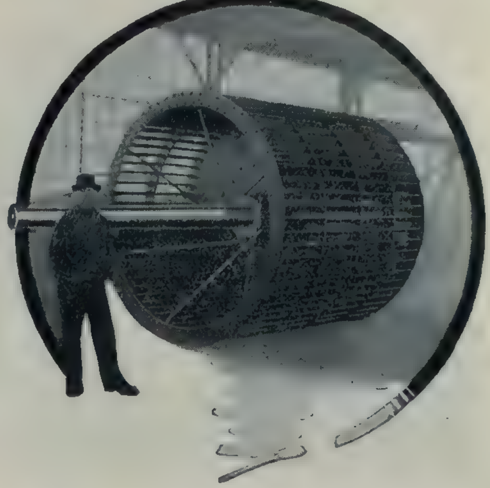

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Current Prices of Building Material.

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	26 00	30 00
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	24 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 10 per cent.; lead waste, $9.00, less 10 per cent.; caulking lead, 6¾ cents per lb.; traps and bends, 35 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, $9.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil, in bbls., 63c. per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 60c. per gal. of 9 lbs.

Turpentine, in barrels, 60c. per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

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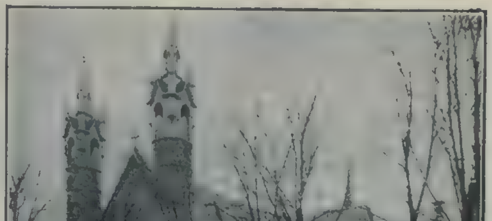

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Alphabetical Index of Advertisers
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Vol. 27 **July 30, 1913** **No. 31**

Heat Treatment of Iron and Steel

At the recent meeting of the American Society for Testing Materials the committee on the heating treatment of iron and steel recommended the following practice for the treatment of case-hardened carbon-steel objects. In work where hardness of case only is desirable and lack of toughness or even brittleness is not very important, the carburized articles may be quenched from the carburizing temperature. Quenching may be done by emptying the contents of the boxes into cold water or into oil. Under these circumstances both the core and the case are coarsely crystalized. The hardening stresses may be reduced and the danger of distortion and cracking in the quenching bath avoided by removing the articles from the box and allowing them to cool before quenching to a temperature slightly higher than the critical range of the case, namely, 800 to 825 deg. C. Under these circumstances both the core and the case still remain coarsely crystalized.

If it is desirable to refine the case and increase its toughness, the carburized articles should be allowed to cool slightly in the carburizing boxes to 650 deg. C. or below. The articles should then be reheated to a temperature slightly higher than the critical point of the case. A temperature varying between 775 deg. and 825 deg. C., according to the carbon content of the metal and the thickness of the case will be suitable. Greater toughness but less hardness may be obtained by quenching in oil. The object should be removed from the quenching bath before the temperature has fallen below 100 deg. C. This treatment is recommended particularly where the carburizing temperature has not exceeded 900 deg. C. and refines the case but not the core.

In order to refine both the core and the case and to increase their toughness the articles should be allowed to cool slightly from the carburizing temperature to 650 deg. C. or lower. They should then be reheated to a temperature exceeding the critical point of a core which varies from 900 to 950 deg. C.

This temperature is followed by a quenching in water or oil. Before the objects have cooled below 100 deg. C. they should be again reheated to a temperature a little higher than the lower critical point of the case and again quenched in water or oil.

In order to reduce the hardening stresses created by quenching, the objects, as a final treatment, may be tempered by reheating them to a temperature not exceeding 200 deg. C.

Greater Safety for the Worker

There is a well-marked movement embracing the continents of North America and Europe and organized for the purpose of providing adequate protection for factory workers. The movement is both philanthropic and economic. No one will question that the spirit of benevolence lies at its very foundation, but that it is business-like and based on economic principles is not so readily admitted.

In the province of Ontario alone last year the number of accidental deaths among factory workers was 62 and the number of accidents reported was 1,502. According to the insurance tables the loss for each man killed is $7,265 and for each injured man $660. Based upon these tables the loss to Ontario for the past year is approximately one and a-half million dollars. But this is not a fair estimate. Indeed it is impossible to express in figures the extent of the loss occasioned to the family and to the state by the cutting short of a man's possibilities.

From the employer's standpoint the loss is of a fourfold nature. Stoppages, however short, through accident occasion loss and the larger the institution the greater the loss. The withdrawal of trained employee from his labor necessitates the training of a new hand and this again involves loss of time, the expense incurred in training and not infrequently a waste of material. Where a series of machines depend upon the output of one, the employment of an untrained operator may very materially decrease the possible output of the shop and the efficiency of the staff is seriously diminished. Perhaps a more tangible but not more real loss is the sums actually paid in damages by the employer because of injury to the employee.

One of the pioneers of the movement to provide safety for the worker is the United States Steel Corporation. Organizations of this kind are not generally classed among the charitable institutions. In 1906 a committee of safety was organized consisting of the heads of the various departments of the Steel Corporation. They made an investigation into the causes of accidents and methods of prevention. Since that date the firm has spent five million dollars in providing safety for its workers. The number of accidents has been reduced by 43 per cent. per annum and the number of deaths for 1911 was over 27 per cent. lower than for 1910. So soundly economic does the company deem the movement, that on one building alone they have spent $32,500 to provide protection for lamp trimmers and window cleaners, and $750,000 is set apart annually to further investigations and to provide safety devices.

The effectiveness of organized effort depends to a large extent upon the co-operation of the workers with the official staff. Two definite lines of conduct are followed. The first consists in educating the men to habits of care and consideration for their fellow workmen; the second consists in the purchase and installing of safety devices wherever possible. In order to teach the men carefulness and to beget in them a sense of responsibility, signs of warning are displaved conspicuously throughout the shops. Illuminated signs bearing warnings are placed at the gates and entrances. Pay envelopes have printed on them terse admonitions in regard to carelessness and such articles as watch fobs, knives, etc., are occasionally distributed, also bearing warnings. The wording of these is changed frequently so as to keep the workers in a state of expectancy.

So far as the equipment is concerned, when purchasing, machinery with safety devices is always specified and the operators are always encouraged and rewarded for suggestions along this line. Ladders are replaced by steps with hand rails where possible. All walks near or over machinery and in dangerous places are also provided with hand rails. Railway tracks running through the yards are depressed and carried through subways. By these means and numerous other devices the Steel Corporation has very materially reduced the death and accident rate of their shops. Other firms are taking the movement up. Some are working with the Steel Corporation, some are working along lines of their own, others are merely taking the results obtained by those who are actively investigating and adopting them to their own needs. The movement has gone so far that the question of international danger warning signs is being seriously discussed and their adoption is quite probable. The reports of the recent calamity at Binghampton carry with them in a most marked manner, the constant need for adequate safety in every department on the part of the employers and ever present alertness and strict conformity to regulations on the part of the employees.

Prevention of Boiler Scale

OPERATING engineers assert that they have been able to prevent boiler scale by the addition of certain substances to the water. The list of materials used in this connection covers an exceedingly wide range and includes such things as spoiled bacon, cheese, graphite, kerosene, Portland cement, potatoes, sugar, tannin and a host of others. Chemists frequently ridicule the use of these substances on the ground that they can have no chemical action upon scale forming salts. Nevertheless those actually operating the boilers have obtained more or less satisfactory results by their use.

An attempt has been made to explain their efficiency by stating that the tannic acid of these substances forms with the mineral matter held in solution by the water, a very soft salt which remains suspended in the water throughout the process of evaporation. However, one fireman asserted that he found a small piece of plank thrown into the boiler effective. The tannic acid contained in this would be exhausted in a day or less and it looks as if the tannic acid theory were not tenable.

Messrs. Edgar T. Wherry and Geo. S. Chiles, in the Engineering Magazine, advance the theory that the effectiveness of the substances named depends upon the operations of the laws of colloid chemistry. A colloid is a substance which when placed in water seems to dissolve but really remains suspended in the water in a finely divided condition. The theory is advanced that the colloid substances in the water tend to come together in large masses and then to pass into a crystaloid form and by the process of evaporation are deposited in scale form upon the boiler. In order then to prevent this massing of the colloids substances should be used which will retard or prevent that action and that this may be done by the addition of other colloids such as glue, gelatine, tannic acid or by the addition of such salts as sodium phosphate. In this case the chemical reaction forms compounds possessing less tendency to unite. The acceptance of this theory should give scope for investigation and place the prevention of scaling on a scientific basis.

Editorial Comment

THE New York Connecting Railroad is constructing a viaduct, part of which is of earth fill. The fill is retained between longitudinal walls, vertical on the inner face but battered on the outer face. The walls are placed about 60 feet apart and their heights vary from 35 to 60 feet. They are 3 feet 9 inches thick at the top and the footings generally go 4 feet 6 inches below the surface of the ground to a hard stratum of sand and gravel. At intervals of 60 or 70 feet the walls are connected by vertical transverse walls reinforced by rods. This portion of the viaduct is substantially a row of large thin concrete boxes filled with earth upon which the tracks are laid. The fill is to be of selected material and thoroughly compacted in shallow crowned layers. It is believed that the shape and compactness of these layers will reduce or almost eliminate the horizontal thrusts on the side walls, so that the function of the latter will approach that of mere facing.

* * *

THE Kansas City municipal authorities have been experimenting with concrete roads provided with one-half inch transverse expansion joints filled with asphalt and placed at 50-foot intervals. The results have been carefully compared with those streets upon which no expansion joints were provided. The pavement in the latter case appears to be freer from longitudinal cracks and secondary transverse cracks than those furnished with the expansion joints. There appears to have been very little movement at the joints as a result of the extremes in temperature. To those making the observations it seems logical to suppose that expansion strains may be disregarded so far as their effect on the disruption of the work is concerned; that expansion joints do not satisfactorily perform their function and that contraction was the only serious temperature effect to be considered. Specifications were changed and paper transverse joints were placed at distances of 30 feet. In the pavements that have passed through the winter of 1912 no cracks have appeared except over the paper joints and these are not noticeable nor nearly so unsightly as the old form of expansion joints.

It is proposed to build an electrically operated subway connecting the Isle of Wight with the main land. The length of the line will be some four miles, and the route will be in a direct line between Stokes Bay on the mainland and Ryde on the Island, the crossing lying a little to the east of the point where passengers for London disembark from the German steamers. The total estimated cost is $3,750,000.

1913 27(31)

Important Elements in Town Planning[*]

Aim in Planning—Various Systems—Points to be Considered—Provision for Streets, Civic Centres and Factories—Building Restrictions

By Christopher J. Yorath, A.M. Inst. C.E. Eng., City Commissioner, Saskatoon

ARISTOTLE is said to have defined a City as, "a place where men live a common life for a noble end," which implies an end or aim.

There can be no question that although the end is not a single one, there has been in the building of every city some object in view, some aim towards which those who have been responsible for its foundation and growth have consciously or unconsciously been aiming.

Unfortunately in the majority of cases the aim has been an unconscious one, with the result, that cities have grown up in a haphazard manner, and many a beautiful spot turned into an ugly accumulation of bricks and mortar.

Great Britain by the passing of the Town Planning Act of 1909 took the first step towards the undoing of mistakes of centuries and hopes by planning the future growth of existing and new cities to avoid the enormous expense occasioned through the lack of planning.

Until recent years it was thought that the checkboard system of planning was all that could be desired but anyone who has studied the subject of town planning will realize at once that it is a failure and has necessitated even in what are known as the New World cities large expenditure to rectify some of its many defects. How can a system be called a plan which does not take into consideration local characteristics such as the undulation of the ground; a winding river; and thickly wooded spots.

If Great Britain realizes the necessity of passing a Town Planning Act, surely such an Act would be of infinitely more use to Canada which at present has only a population of about eight millions or slightly more than that of London while its area is three and one-half million square miles compared with one hundred and twelve thousand square miles comprising Great Britain.

A careful study of what wise town planning, the liberal provision of attractive amenities can do, and has done for some of the cities of Europe will convince the greatest anti-town planner of the wisdom of looking well ahead.

It invariably happens that town planning is not thought of or put into operation until a certain amount of development has taken place. In Great Britain this does not interfere to any great extent with the planning for the future as the undeveloped land is not staked out into lots and held by numerous land holders, but is usually in possession of a few; whereas in Canada, owing to the checkerboard system and the selling of outlying plots far in advance of the time when the land is ripe for development the proper planning of the future is rendered far more difficult, and probably in many cases the difficulties will be so great as to make a scheme impracticable without special legislation.

A city attractive by its beauty, by its artistic symmetry and design and by the convenience which it offers will gain a reputation and an individuality of which not only its council and its landowners, but also its citizens, may be proud.

What then should be the aim of every city? To answer that question we are at once thrown back upon the question of what should be the individuality by which the city should be marked and known. Bacon says in his "Essay of Gardens" "God Almighty first planted a garden. And indeed it is the purest of human pleasures, it is the greatest refreshment to the spirits of men without which buildings and palaces are but gross handiwork." Surely then the aim should be the one implied by the term "Garden City," beautiful, well planted, and finely laid out, known and characterised by the charm which it can offer to those who seek a residence or dwelling removed from the turmoil, stress and discomforts of a manufacturing district.

The various systems of planning which have been adopted in the past are rectangular, radial and circumferential, and curvilineal; but the latest schemes for town planning are generally a combination of all three, which allows for the best fulfilment of town planning ideals.

The problem then for the town planner is to consider his scheme in respect to:—

(a) The configuration and undulations of the site.

(b) Direction of main radial and circumferential avenues and boulevards.

(c) The layout and construction of avenues and boulevards.

(d) Open spaces, parks and recreation grounds.

(e) Tramways.

(f) Civic Centre.

(g) Buildings and the space about them; the limitation of the number of houses per acre, and their height and character.

(h) Restrictions of factories and works to special areas.

Configuration and Undulations of Town Site

The beautiful sites which the Great Architect of the Universe has provided for many of our cities have been wantonly spoiled by the worst form of vandalism and the lack of a proper system of planning instead of providing a setting and vista by which the beauty of monumental and public buildings may be shown.

The first essential preparatory to the drawing up of a town planning scheme is to make a contour map of the site with contours showing the rise or fall of the ground every five to ten feet. In addition the map should show existing trees, places of historic or local interest, railways, existing public and industrial buildings, waterways, etc.

This map will enable the town planner to lay down the main avenues with the easiest possible grades, to preserve places of beauty; to establish the sites of the most important buildings so as to be in commanding positions; to design his storm and sanitary sewers so as to obtain the maximum amount of gravity flow, and to arrange his water supply in the most suitable zones so that the whole system of public utilities can be built up of units which will ultimately become parts of a completed whole.

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[*] Mr. Yorath has had experience in London, Eng., under the Town Planning Act, 1909 and also in connection with the planning scheme for the Federal Capital, Australia.

Main Radial and Circumferential Avenues and Boulevards

In London and New York, and many other large cities, great inconvenience and expense is occasioned through not having the most direct means of transit between business, factory and residential districts, and proper connections between these centres and the different railway depots. Again, through the lack of circumferential avenues the traffic in the centre of the city becomes greatly congested. It is imperative therefore in the planning of a city to exercise the greatest care and judgment in fixing the position and direction of main avenues. If possible they should radiate from the centre towards the principal outlying districts north, south, east and west of the city, and be connected and linked up with inner and outer circumferential avenues. By this means traffic desirous of crossing from one side of the city to the other can avoid the centre and more heavily trafficked streets, and in so doing prevent the congestion which so often occurs in the centre of old cities.

London is at present contemplating the construction of circumferential avenues in order to relieve the congestion which occurs in the centre.

In Vienna the Girdle Linie or Outer Boulevard is about eight miles in length; the total width between buildings is 248 feet. A separate strip of the road is set apart for the tramways and fast traffic; a continuous recreation ground or playing space is included in the scheme, well planted with trees to provide shade during the hot season.

Another circumferential avenue in Vienna is the Ring Street or Hub 178 feet wide. It has a central carriageway 41½ feet wide which is principally used by fast and through traffic vehicles. On either side are the tramways on the electric conduit system. A riding track and a promenade for foot passengers occupy the spaces between the trees, and slow and stopping vehicles find accommodation on the two outer roads.

These circumferential routes which connect up the various parks and open spaces are largely used by residents, motorists and cyclists as circular drives.

Layout and Construction of Avenues and Boulevards

It must be borne in mind that all objects in the street, utilitarian or otherwise are things to be seen, part of an organic whole, each having their respective part and place.

Athens and Rome were each crowded with such objects arranged for the most part in picturesque association. Although it will be impossible for young cities to spend much money, if any, upon beautification, beyond the planting of trees, a town planning scheme should allow for such improvements at some future date at a minimum of expense. Long straight avenues, with buildings of approximately the same height and no object to break the horizon should be avoided. If natural scenic effect cannot be obtained, then provision should be made for some architectural feature to break the skyline. By careful planning it can generally be arranged to place a church, a public building, or artistically designed residence to break the monotony of long streets.

In Germany this branch of town planning is given careful consideration, and long avenues are usually broken by means of "Squares" so that the line of sight will be met by a building, the architecture of which, has been previously approved by the local authority.

In planning out the widths of main roads it is difficult to estimate what the future will demand, but in any case it will be better to err on the wide side rather than the narrow.

The various types of streets usually required in a city are:—

(a) Main business avenues with provision for tramways and boulevards.	width, from 100 feet to 200 feet.
(b) Secondary business avenues without provision for tramways.	width, from 80 feet to 150 feet.
(c) Semi-residential avenues with provision for tramways, side and centre boulevards.	width, from 80 feet to 120 feet.
(d) Semi-residential avenues without provision for tramways, but with side and centre boulevards.	width, from 80 feet to 100 feet.
(e) Residential avenues without provision for tramways, but with side and centre boulevards.	width, from 60 feet to 80 feet.
(f) Secondary residential avenues with carriageways to take local traffic only, with side boulevards and an established building line of 30 feet.	width, from 40 feet to 60 feet.

The main avenues should be laid out with 12-foot sidewalks, slow traffic carriageways next sidewalks, and boulevards on either side of a centre carriageway for fast traffic and tramways. The secondary business avenues should have sidewalks of a minimum width of ten feet with a centre boulevard with wide grass margins, so that the actual paved carriageway can be widened as the business of the city extends.

In main and secondary business thoroughfares provision should be made for laying all sewer, water, electricity and other mains in underground conduits of sufficient size to allow proper inspection at all times. The advantages of this method are:—

1. The pipes being open to inspection at all times, leaks can be more easily located and repaired.
2. The traffic is not inconvenienced by frequent openings for repairs.
3. The enormous annual expense of opening trenches is saved.
4. The surface of the carriageway, which soon becomes uneven if many trenches are made, retains an even contour.

The residential avenues can be so formed that the sidewalks have a boulevard on either side, which will provide space for pedestrians in the hot weather.

Railways, usually an ugly feature of every city, should be made less objectionable by boulevarding.

Open Spaces, Parks and Recreation Grounds

In locating open spaces and parks, special consideration should be given to the preservation of places of natural beauty, such as woods, waterways, etc.

With the checkerboard system of planning, a large amount of valuable ground is often wasted in the unnecessary provision of paved streets and passages. By carefully planning the main and secondary avenues, through traffic can be avoided and residential districts can be laid out in a far less costly manner, and part of the space occupied by paved streets being utilized for open spaces, tennis courts and children's playgrounds. Where individual gardens are not wanted, part of the land between the houses might be laid out as allotment gardens, or as gravel playgrounds, or as paved playgrounds, to prevent a lot of derelict gardens being attached to the houses.

People's parks are universally provided in Europe within or close to the city's gates, namely a large woodland garden or forest intersected by drives and walks and interspersed with spinnies and glades typical as far as possible of rural country.

It is the duty of every city to provide as early as possible, and before development makes the price of land prohibitive, suitable parks within easy access of the public.

Country life is acknowledged to be more healthful, more restful, more natural and less wearing than that of town, it should therefore be the aim of town planners to introduce into the home life of the worker conditions as far as possible which are common to the country, viz.:—quiet, the absence of distracting sights, sounds and influences and the introduction of works of nature.

It has become a very general rule in making arrangements for the development of land on modern lines in Great Britain to stipulate that one acre in ten shall be set aside as public, or semi-public open spaces, this in addition to limiting the number of houses per acre.

Tramways

The tramway system should follow the main avenues and as far as possible each route should be linked up one with the other to form easy and suitable means of transit for the public to and from every part of the city. It should be arranged so that new lines could be constructed as the development of the town in a particular district required yet be part of what would ultimately become a completed scheme.

The tramway system of Vienna is an admirable one. It has been described as follows:—"The trams circle round the Ringstrasse and the outgoing routes branch off like the spokes of a wheel, it soon becomes an easy matter to know where to leave the hub and take the necessary spoke."

Civic Centre

The creation of a fitting civic centre is one of the most important matters which should be considered. It should be dignified and impressive, whilst at the same time in harmony with the characteristics of the town itself and in keeping with the resources of the public. Its situation should be as near the centre of the city as is possible, so planned that its architectural features and beauty can be seen from many points of vantage.

The buildings usually comprised in such a centre are the town and public halls, offices, session courts, museum, and art galleries, which suitably designed and arranged in relation to each other, can and should form a civic centre worthy of the community.

Buildings, Their Limitation and Character

The regulations with respect to buildings will be one of the most important parts of a town planning scheme and will need very careful thought on the part of local authorities. In order to obviate overcrowding it is essential that a maximum number of houses per acre should be adopted for different grades of property.

In limiting the number per acre it should be sufficient, in the case of land that is not planned out in detail, if it be stated that the rule should be so many houses to the acre, but that the requirements of the local authority would be satisfied if the average number was obtained over a certain area with due safeguards for the space about each house not being too small. There should also be a maximum number of houses stated more than which should not be erected on any one acre. Thus, if the number limited was twelve to the acre, the local authority might be satisfied if on any ten acres no more than one hundred and twenty houses were built.

In residential areas the height should also be limited. Houses should not be built more than three storeys, or more than a maximum height to be defined.

It would seem desirable in planning an area that certain centres should be fixed where shops, schools, churches, institutes, and such like buildings should be grouped together.

The grading of districts and the planning out of the constituent parts which build up a city is an important consideration. The higher buildings should be fronting on the main arteries gradually grading back to the residential property. Stores and offices will, of course, be placed along the main thoroughfares, and workmen's dwellings as close as possible to the factories in which the workpeople are employed.

Restrictions of Factories to Special Areas

It is very desirable in a town plan that the position of these should be fixed and the people should not be allowed to place them where they like. There will nearly always be natural places in a district which will be suitable for factories and workshops. Contiguity to the railway, easy gradients to the same, and the position of the rivers, canals and streams should govern this in most cases.

It is usually accepted as an established fact that factories are unsightly, with untidy and dirty surroundings, but in many places, particularly in Bourneville in England, the headquarters of Cadbury's factory, the reverse is the case. The whole of the surroundings of the factory, and the workers' houses adjoining are laid out on garden city lines and is a model of what can be done to make a factory district more ameniable than is generally the case.

EUROPEAN scientists, taking the sterilizing effect of sunlight as a premises, have experimented and indeed gone beyond the stage of experimentation, upon the sterilizing action of ultra-violet light upon water. In Rouen, France, an installation has been operating for two years and furnishing water sterilized by ultra-violet light. In that time not one single case of typhoid has been reported. During the French-Morroco campaign a similar outfit was supplied to the field hospital and the surgeon reports no typhoid during the two years it was in use. The obstacle in the way of a more general application is the expense of the equipment but with time this will be remedied and we may expect before long to find this method of treatment in quite common use.

Mud removal from Ohio River water by the water purification plant at Louisville, Ky., during 1912 amounted to 2,100 lb. per 1,000,000 gal. of water filtered, or 26 tons daily. In the removal of this mud 49 per cent. was taken out in the sedimentation reservoirs, 45 per cent. in the coagulating basin, and 6 per cent. by the filters. In the removal of bacteria 58 per cent. was obtained through plain sedimentation, 34 per cent. through coagulation, and 7 per cent. by the final process of filtration. The whole system showed a total efficiency in the removal of bacteria of over 99 per cent.

Construction Features in Double-Deck* Bascule Bridge

A DOUBLE-DECK bascule bridge over the Chicago River is the principal feature of a project for improving the connection between the business district and the north-side residence district of the city of Chicago, and providing a connecting link in the boulevard system. The only bridge at present is an old and narrow swing bridge at Rush street, and this has to carry the extremely heavy and congested traffic. This traffic includes heavy teaming traffic to the docks and warehouses and an almost incessant stream of automobiles between the city and the residence district.

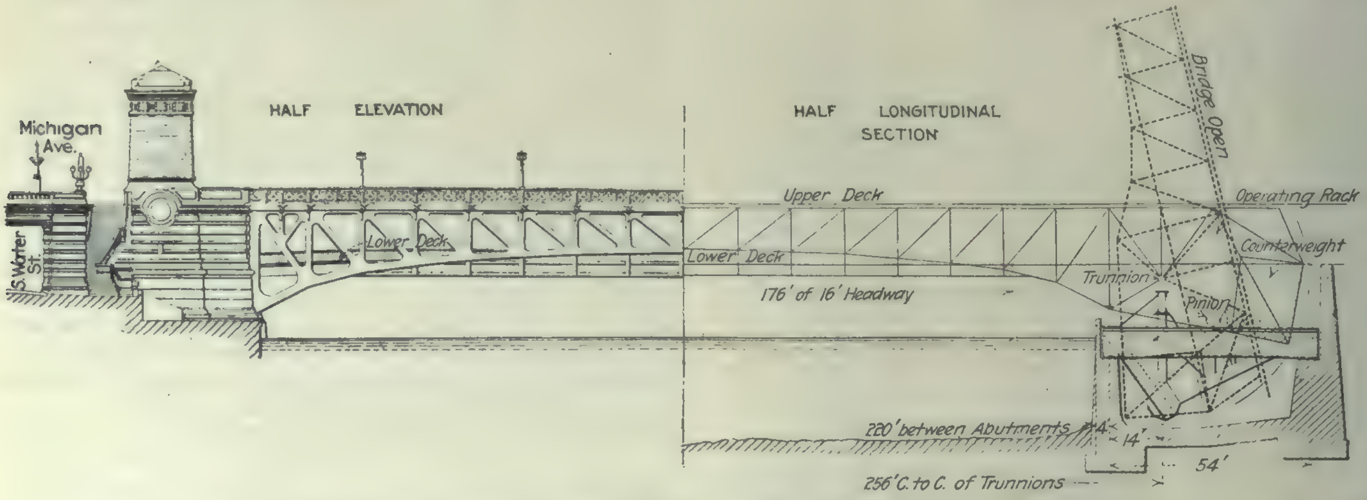

Fig. 1—Double-Deck Bascule Bridge to be built over the Chicago River at Michigan Ave.

The present plan of improvement is to widen Michigan avenue north to the river and Pine street south to the river, and to span the river by a bridge of ample capacity for the traffic. To provide this capacity it is proposed to build a double-deck structure. The lower deck (60 ft. wide) will be at the level of the river-front streets and will accommodate the local and teaming traffic. The upper deck (90 ft. wide) will be for the fast vehicles and pleasure driving, and will have inclined viaduct approaches of steel and concrete construction. This improvement is estimated to cost about $2,300,000, exclusive of land to be acquired.

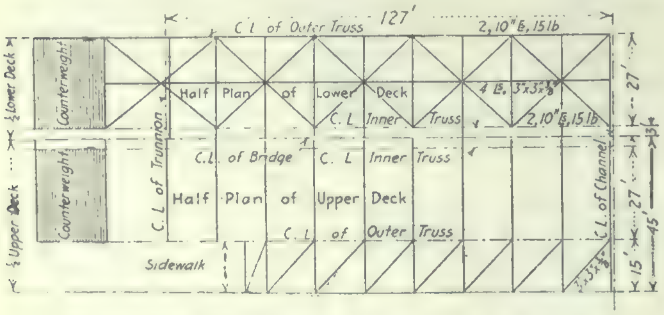

Fig. 2—Arrangement of trusses, floor-beams, and lateral bracing.

The bascule bridge will be of the fixed-trunnion type, as shown in Fig. 1, the trunnions being carried by a steel framing on concrete piers, between which will be the counterweight pits or tail pits. It will be of the double-leaf type, and each leaf will consist of two parallel adjacent portions which will be operated normally as one structure, but which can be operated separately and independently if necessary, as in the event of any accident or failure affecting only one portion. The distance between the trunnions will be 256 ft., and the clear span between abutments will be 220 ft. When the bridge is closed it must give a clear headway of 16½ ft. above the water for a distance of 176 ft., and when open it must give a clear width of opening of 220 ft. to a height of 120 ft. The trunnions will be 15 ft. above datum (or normal water level).

Each leaf of the bridge will have four trusses, forming two separate but adjacent and connected structures, as noted above. The two trusses of each part will be 27 ft. c. to c., and the two adjacent inner trusses will be 6 ft. c. to c., giving a total width of 60 ft. between the outer trusses. Each side of the lower deck will carry between the trusses an 18-ft. roadway and a 5-ft. sidewalk. In each roadway will be a single street-car track, having its center line 7 ft. 3 in. from the center of the inner truss. Each side of the upper deck will have a roadway 27 ft. wide between wheel guards and a 15-ft. sidewalk carried outside of the outer truss by cantilever floor beams. Between the two roadways will be a refuge or walk 5½ ft. wide. The clear headway above the lower deck will be 13½ ft. Fig. 2 shows the arrangement of the trusses, and the floor beams and lateral bracing of the two decks.

The roadways of the lower deck will be paved with 4-in. creosoted wood blocks fastened to a layer of 2-in. plank on 4 x 6-in. sub-planking. The latter planking is to be laid upon the roadway stringers, which will be I-beams framed between the floor beams, except that the stringers under the car tracks will be plate girders. The roadways of the upper deck will be paved with asphalt on a buckle-plate floor, the asphalt being reinforced by a continuous sheet of wire netting fastened to the stringer flanges by hook bolts. All sidewalks, and the center walks, will have 2 x 6-in. pine planking on pine stringers. All timber used in the bridge will be creosoted. Fig. 3 shows a cross-section of each deck, with its paving.

The live load for the upper deck is taken as follows:

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*Engineering News.

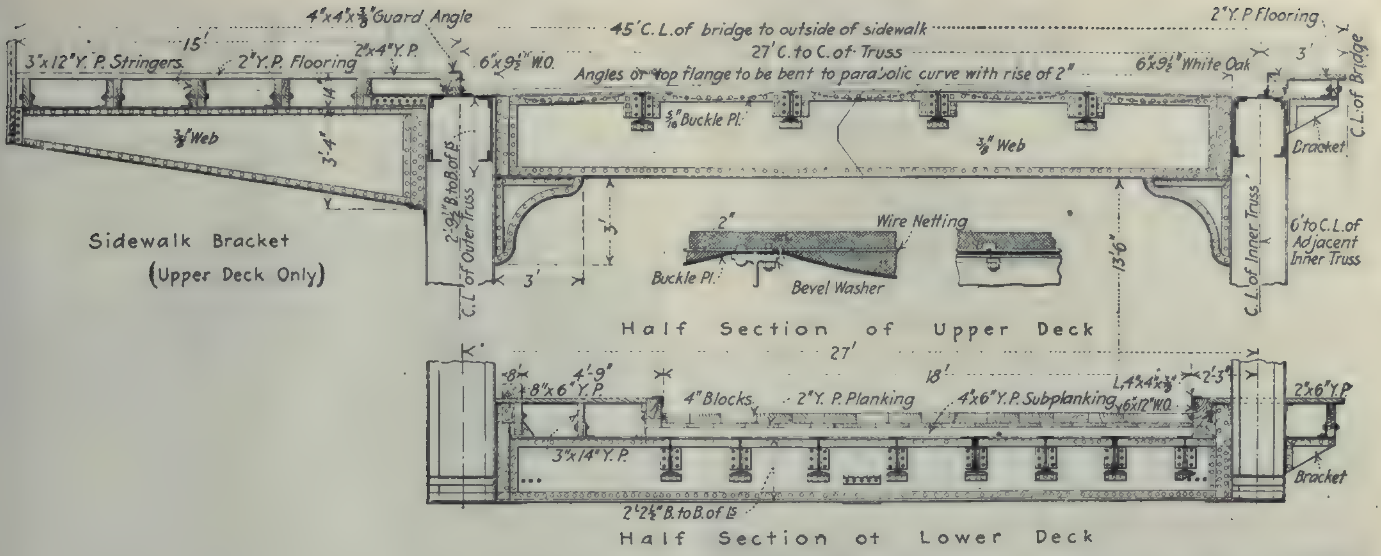

Fig. 3—Floor beams and paving.

(1) two 20-ton vehicles close together on each roadway, each with four wheels, carrying 5 tons load, spaced 5 ft. and 10 ft.; (2) allowing 10 x 20 ft. for each vehicle, the remaining area (including sidewalks) will have a uniformly distributed load of 100 lb. per sq. ft. The live load for the lower deck is taken as follows: (1) on each roadway a continuous line of 50-ton 50-ft. street cars and a 20-ton moving vehicle (as above); (2) a distributed load of 100 lb. per sq. ft. on all the unoccupied area of the roadway and sidewalks. To allow for dynamic effect of live loads, the maximum computed live-load stress is to be increased by an amount determined by the following impact formula, in which I is the increment to be added, S is the computed maximum live-load stress, L is the length (feet) of load on bridge producing maximum stress, and N is 10 per cent. of the total width of roadway and sidewalks loaded to produce maximum stress.

$$I = S \frac{100}{N\,L + 300}$$

In addition to the above loads, a moving lateral load is assumed of 300 lb. per lin. ft. of each chord or deck. When the bridge is moving, or is open to any extent, the loads causing stress in structural parts of the moving or supporting structure shall consist of the dead weight, with 20 per cent. added for effects of vibration and a wind force of 20 lb. per sq. ft. over the entire exposed area.

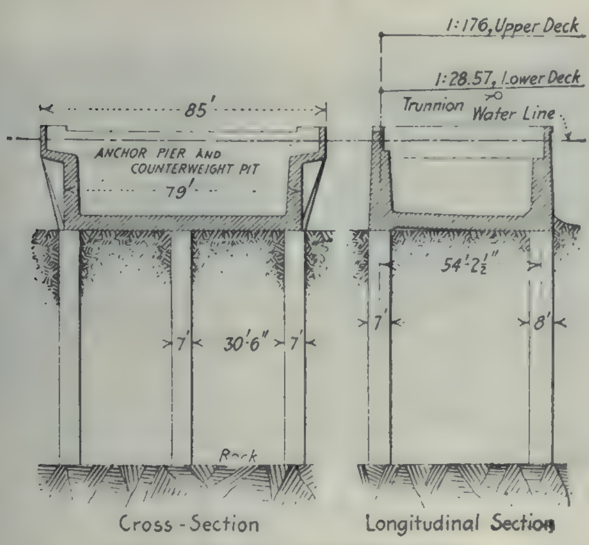

Fig. 4—Box pier on cylinder piers.

On each side of the river, behind the anchor piers, will be a machinery room with four 100 h.p. electric motors so connected that any two can be used to operate the four-truss single-leaf. Gear trains will transmit the power from the motor shaft to main pinions engaging with segmental racks on the two outer trusses. In addition there will be at each side of the river, a 7½ h.p. motor to operate the heel locks supporting the tail ends of the trusses, and on the south leaf of the bridge there will be two 5 h.p. motors to operate the center locks. For each leaf there will be hand and compressed-air brakes.

The substructure on each side will be a box-shaped pier, forming the abutment and tail pit, with the front and back walls each supported by three 8-ft. concrete-cylinder piers extending down to solid rock. This is shown in Fig. 4. At each end of the bridge will be two houses for the use of the bridge tenders, and these will be of ornamental character, harmonizing with the architectural treatment of the approaches. In view of the character and importance of this structure it is intended to give particular attention to the attractive design of the bridge itself and its approaches and surroundings, for which purpose there will be a broad open space or plaza on the upper level over each of the abutment piers.

The Orange Commercial Club, Orange, Texas, will offer one hundred dollars in prizes for the best mile of road using the split log drag. No compensation will be given the farmers for dragging the road other than the advantages of an improved public highway and an opportunity of winning the prize. The first prize will be $50, second $25, third $15 and the fourth $10. It is estimated that a man and team can keep a mile of road in good condition by running a split log drag 30 hours during the year.

The leading lime producers of Virginia secured a temporary injunction against Governor Mann and the prison officials to prevent the State of Virginia from using its convicts to manufacture lime for agricultural purposes. The circuit court of Richmond dissolved the injunction, but the Supreme Court has granted the lime manufacturers an appeal from the decision. The petitioners claim that the state has no right to engage pay taxes and are engaged in a legitimate enterprise.

Grade Separation, North Toronto

IN compliance with the orders of the Dominion Railway Commission the Canadian Pacific and the Canadian Northern roads are pushing to completion a viaduct, which will eliminate all grade crossings over their tracks between the northern and southern parts of the city of Toronto. The importance of the work, which is the joint undertaking of the two companies, but which is being constructed by the C. P. R. engineering staff, can be readily appreciated. The northern part of the city is experiencing a period of expansion. Traffic of all descriptions has greatly increased and is bound to become far heavier as the residential district moves more and more to the north. This construction on the part of the railways will provide for an uninterrupted and perfectly safe flow of traffic north and south.

Both levels in use.

General Description

The work may be fittingly described as a four-track earthwork viaduct, extending from Summerhill avenue on the east to Dufferin street on the west. There is a natural descent from the east and the west towards Yonge street. The Canadian Pacific engineers took advantage of this configuration and merely reversed the inclination from Yonge street to the east and west so that the viaduct terminates on a level with the tracks already in use at Summerhill Avenue and Dufferin street. After passing Dovercourt Road the Canadian Northern line turns off to the northwest. The new construction is pierced north and south by numerous subways, namely at Summerhill Avenue, Yonge Street, Avenue Road, Davenport Road, Spadina Road, Bathurst Street, Howland Avenue, Christie Street, Shaw Street, Ossington Avenue and Dovercourt Road. From Yonge Street west to Bathurst Street tenders for the subways have been let and the contracts are well under way, Messrs. Wells & Gray having the construction of four of them in charge. The contracts for those west of Bathurst are under consideration at the present time.

It was found that the traffic east and west on Cottingham and the traffic north and south on Albany Avenue and Huron Street was not very busy and that these might be easily served by the neighboring subways, so these streets have been closed entirely by order of the Board of Railway Commissioners. Cottingham is now closed and the other two mentioned streets will be closed on completion of the work.

Earth Fill

As we have noted the viaduct is an earth-fill construction, being three miles in length and 68 feet in width and varying up to 14 feet in height. The fill from Summerhill Avenue to Davenport Road was placed on a timber trestle constructed for the purpose. A structure of caps, stringers and ties supported upon piles was erected and from this the fill was deposited from the railway company's work trains. West of Avenue Road a somewhat new method of operation is being employed. The tracks are supported upon a crib work, which is raised along with the filling until the proper level is reached. Supporting piles are then driven in place and the crib work removed. The earth for the filling is obtained nearly altogether from Leaside Junction. The material obtained in the excavation of the various subways is also used in this capacity. Up to the present time over 125,000 cubic yards of filling have been put in place. Having a supply of filling material available with such a short haul has proved most advantageous. Upon the completion of the fill the beams, stringers and ties are reclaimed for other work, but the piles are allowed to remain in place.

Subways

The subways, with the exception of Yonge Street, are of uniform construction. They provide for a 66-foot roadway, with 14-foot headway. This clearance will prove ample for all sorts of traffic. They are provided with end walls and approaches of concrete and a central dividing pier of the same material. The central pier has its advantages. It takes but little space, keeps the traffic in proper place, and may be used to some effect in strengthening the overhead steel work.

At Avenue Road the work is ready for the placing of the overhead steel. This was carried out by Jennings & Ross, Limited, of this city. Spadina and Davenport Roads are now closed and the traffic is maintained by the temporary bridge structure at Huron Street. Steam shovels are at work at Spadina Road and Davenport Road excavating for the subway.

Removal of lower track.

At the junction of Davenport Road and Poplar Plains Road a "T" subway is under construction.

Through this access may be gained to either street. A short distance north of the subway a cross road is being built connecting Bridgman Ave. to Macpherson Ave., which will further facilitate the passage from one road to the other for all traffic north of the subway. Necessary changes to the various public utilities present some obstacles to the accomplishment of the work. In order to procure the proper depression of the roadway, sewers, water mains, Toronto Power Company's conduits, Bell Telephone Company's conduits and gas mains all have to be lowered or cleared away to make room for the foundations. This work is now in progress.

Avenue Road subway under construction.

Yonge Street Subway

The Yonge Street subway involves a number of interesting features. It is to be 86 feet in width, that is, 20 feet wider than those previously described. The overhead clearance is to be 18 feet, which is somewhat out of the ordinary in subway construction. This headway was partly obtained by depressing the street level 9½ feet, and here again the water mains and sewers, conduits, and pipes presented some difficulty.

At this point the viaduct widens out to 120 feet and will bear six tracks with concrete passenger platforms between them. As in the others the walls and piers will be constructed of concrete but will be surfaced to resemble masonry. The roadway will be divided into three parts by two dividing abutments. The central portion will be reserved for the car lines; 20-foot roadways with 10-foot sidewalks will be constructed on each side. By this means car traffic, vehicular traffic and foot passengers will obtain ample accommodation. On the east side the subway will be extended 100 feet beyond the street line. This will provide accommodation for the underground baggage rooms of the North Toronto Union Station, which is to be erected east of Yonge street and south of the tracks.

Mr. B. Ripley, M. Can. Soc. C.E., M. Am. Soc. C.E., is in immediate charge of the work.

Some Observations on the Testing of Sand[*]

By W. B. Reinke

For any proposed piece of concrete construction, engineers as a rule, and rightly so, are very willing to inspect or have inspected the cement to be used, accepting as a matter of course the necessary expenses involved.

When the subject of sand testing is brought up, however, the reply is generally, "Oh! we don't care about that," or "We will have samples sent to this office and look at them to determine their value." As a rule, they are quite satisfied that they have taken care of everything needed to produce a good concrete when they write strict specifications for the cement. They "pat themselves on the back," look pleased and forget about the sand, overlooking the fact that this material is used as found in its natural state with every chance for wide variation in quality and that it forms from two to four times as much of the concrete as does the cement.

Careful Selection Required

Few specifications contain definite requirements as to the quality of sand, the subject being dismissed with a general clause, providing that it must be clean, sharp and free from loam. As generally interpreted, the word loam includes clay matter and finely divided silica. Experience has shown that for the best results, work sand may be too clean, that it need not necessarily be sharp, and that under some conditions a certain amount of clay or finely divided silica is advantageous. The quality of sand is, as a rule, judged by the eye and touch. No attention is paid as to what the mineral constituents composing it may be; what granulometric analysis it may have; whether it may or may not contain minerals in a combined or free state, which will make it harmful to the concrete; whether it is so finely divided as, through the formation of colloids or otherwise, to retard or inhibit hardening of the concrete; or whether it may contain soluble alkalies, which may hasten the set of the cement to such an extent that the initial set is broken while it is still in the mixer and the whole mass becomes for a period, so far as setting is concerned, so much inert or at best feebly cementitious material.

Necessity for Testing

For the last two years the company with which the writer is associated has investigated the reason for failure to harden properly of a number of pieces of concrete masonry. In some cases where the forms had been removed the concrete was showing signs of yielding to stress of its own weight, raising a question as to its ultimate stability. In others the hardening was being retarded, thus delaying the removal of forms.

From knowledge gained in these investigations, as well as results of many tests of sands carried on in our laboratory, certain salient features and characteristics of sands in general have been brought so forcibly to our notice as to make it seem imperative to pay quite as much attention, if not more, to the inspection of sand entering into any construction, as is paid to the inspection of cement.

It, therefore seems advisable that a committee of this Society be appointed to prepare definite specifications for sand and uniform methods for testing it.

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[*] Paper before the American Society for Testing Materials.

While the testing of sand is becoming more general, the work is being done under more or less tentative specifications prepared by individuals; no two laboratories seem to apply the same tests or use identical methods, the tests being carried out differently by each investigator. Most tests are made on samples delivered to the laboratories, no opportunity being allowed for the examination of the deposit or the selection of truly representative samples. The reason for this is chiefly one of dollars and cents, and since the condition obtains, the laboratory must do the best it can with the sample submitted.

Tests

The following are the usual tests to which samples of sand submitted for testing are subjected, but it is rarely that all are employed in any one laboratory:

1. Determination of the percentage of moisture;
2. Determination of the percentage of voids;
3. Granulometric analysis;
4. Determination of the percentage of silt;
5. Chemical analysis to determine silica and content of clay matter;
6. Loss on ignition;
7. Volume of mortar from a given amount of sand and cement;
8. Comparative tension tests of mortars made from work sand and standard Ottawa sand, using identical cement and only sufficient water to produce normal consistency.

At this point it is hardly necessary to call attention to the fact that although tension tests are used for testing sands, this practice would seem to be altogether arbitrary and has grown out of the long-established custom of making tension tests of cement, which, as every one knows, was instituted only on account of convenience of having small portable inexpensive machines, which could be carried from one place to another without much trouble.

We would suggest that all comparative sand tests be made on cubes or cylinders subjected to compression, as concrete itself is rarely subjected to tension. This practice has been adopted in Germany, where tension tests of cement and sand mortars have been largely eliminated.

To the foregoing tests should be added several not usually carried out:

1. Microscopic examinations, which need not necessarily be exhaustive;
2. The effect on strength developed by the use of different cements;
3. Permeability of resulting mortars;
4. Weight per cubic foot as received and dried;
5. Determination of the amount of organic matter contained;
6. Tension or preferably compression tests on wet mortars, having the same consistency as used in the work.

This last test the writer believes to be the most important, and one to which all sands should be subjected. To the best of our knowledge, however, it is not generally used by laboratories other than the one with which the writer is connected.

The general practice in testing sands is to compare work sand with standard Ottawa sand, using the same cement, the briquettes being made from mortars having normal consistency, that is, the consistency of a 1:3 Ottawa sand mortar when made according to the standard methods for testing cement. In the test just referred to the sand is made into a mortar of work consistency, that is, the consistency required in mortar to enable the concrete to be poured.

The practice of making comparative sand tests using wet mixtures was developed in our laboratory some years ago while we were trying to find the reason why a sand known to have caused trouble in a certain piece of concrete work gave, when mixed into mortar of normal consistency, tensile strengths greater than those obtained from the same cement and Ottawa sand.

The method of procedure in our laboratory is as follows: The sand to be tested and Ottawa sand are first made into mortars of normal consistency, using preferably cement from the work. These mortars are then made in briquettes, the whole operation being in accordance with the prescribed methods of this Society for the making of sand briquettes when testing cement. The amount of water necessary to make a mortar of normal consistency having been found, a new batch of sand and cement in the desired proportions is thoroughly mixed dry and placed in a cylinder that can be revolved, together with a number of flint pebbles, so that the proportion of the cement, sand and stone will approximate that desired in the actual work. To this mix is added enough water (generally about 50 per cent more than needed for normal consistency) to make a mortar having work consistency. The cylinder is then closed and revolved for five minutes. The flint pebbles are picked out by hand and the mortar is made into briquettes. This test more closely approximates the conditions found in actual work, and the strengths obtained from briquettes made from such a mortar, though, as a rule, far below those obtained from a mortar of normal consistency, correspond to those that may be reasonably expected from the mortar if the sand and same cement are used in construction.

Amout of Water Used

It is to be noted that in most cases, using the same cement, more water will be needed to bring a natural sand to normal consistency than is necessary with Ottawa sand. This difference in the amount of water required is accounted for by the difference in granulometric grading, the work sand, as a rule, having the greater amount of fine material, and hence more surface to be covered and a larger percentage of voids.

Further, it is to be noted that the strengths obtained from a natural sand when made into a mortar of normal consistency are often equal to or greater than those obtained with the same cement, using Ottawa sand. When the same natural sand and cement are made into a mortar of work consistency, which requires about 1½ times as much water as for normal consistency, the reduction of strength will be more or less marked, depending on the character of the natural sand. The strength of all sand mortars is affected by the amount of water used over that required for normal consistency. The more water used, the greater will be the loss in strength at early periods. The nearer a natural sand approaches the ideal in physical and chemical composition, the less will be the loss in strength for each additional per cent. of water added. The amount of water required to bring a given sand to work consistency forms one of the best measures of the quality of sand.

In mixtures using 50 per cent. more water than required to produce normal consistency, Ottawa sand and good natural sands lose from 25 to 35 per cent. of their strength up to the 28-day period, while a poor sand may lose as much as 70 or 80 per cent. of the strength developed when made into mortars of normal consistency. It has been found by experience that with two sands, other things being equal, the one having the smaller amount of fine material will have the less amount of surface to be covered and when mixed with a given amount of cement will need less water to produce a definite consistency than the one containing a larger proportion of fine material.

Many engineers maintain that in making comparative tests of sand, the same amount of water should be used with each sand, overlooking the fact that in actual work one sand will require more water than another to bring the mortar to the consistency required by the work. We cannot assume that the same percentage of water will give the same consistency with two different sands. If this practice is followed one sand may have too much water and the other too little. In the actual work where the sand is to be used, a concrete of a certain consistency will be made with no regard to how much water is needed to obtain it, and in order that the test give a correct indication of the strength the sand will develop under actual work conditions, the test mortars should be made of a corresponding consistency. As stated before, most natural sands take about 1½ times as much water to produce work consistency as is required for normal consistency. This, however, is not true of Ottawa sand which, while taking less water to produce normal consistency, requires more than 50 per cent. addition to produce a mortar of work consistency.

In general, it may be assumed:

1. That the less water required to produce a mortar of a given consistency, the higher will be the strength developed by the sand.

2. That the coarser the sand, other things being equal, the greater will be the strength developed.

3. That the higher the silica content, other things being equal, the greater will be the strength developed.

4. That where it is necessary to use sands of poor quality, loss in strength at early periods can be largely overcome by using a dry concrete.

5. That the loss of strength is confined chiefly to short periods, being practically overcome with time.

Water in Concrete Mixtures

THE occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand, and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid without adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand, and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement "float" in the water filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

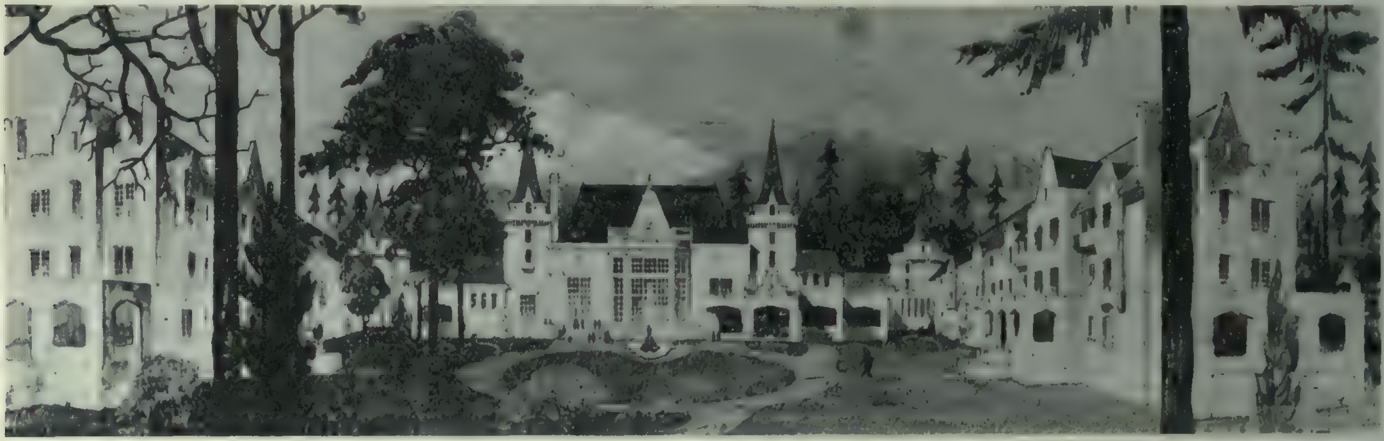
The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the course aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroughly drenched. Following thorough mixing, water as needed, is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.—Municipal Engineering.

Grand Trunk Pacific Hotel Development in the West

IN conjunction with the construction of its lines through the Rockies the Grand Trunk Pacific Railway Company has planned a system of hotels and hydropathic establishments to accommodate the extensive traffic which they expect to handle between Europe and the Orient. On the eastern side the first hotel provided is the Chateau Miette at Jasper Creek, then at Mount Robson a larger establishment is contemplated, and finally, a handsome ten-storey hotel is planned at Prince Rupert, the terminal hotel of the system and designed to accommodate over one thousand guests. The accommodation provided by these hotels should induce many tourists to visit the western mountains of Canada, whose scenery surpasses even that of the Alps.



Grand Trunk Pacific Chateau Mount Robson.

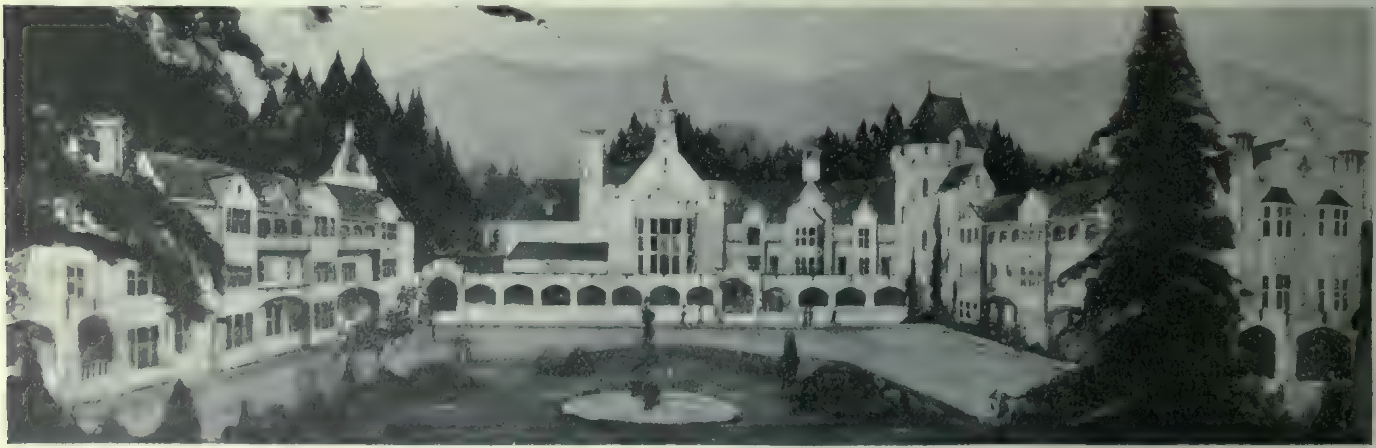
Chateau Miette

The Chateau Miette is designed on the lines of a hydropathic establishment to accommodate family parties. The building is a three-storey structure planned somewhat in the form of the letter "X," having all the common rooms at the intersection of the wings. This arrangement was decided upon in order to permit the guests to obtain the finest views with the least obstruction from other parts of the building.

In style the building is a modern adaptation of the old French chateau, with its high pitched roofs and numerous gables and harmonizing with the ruggedness of the surrounding country. Provision is made for tastefully laid out grounds, with walks, drives, tennis courts, statuary, etc. The Chateau Miette will provide accommodation for about 250 guests. The extensive dining hall, which is 40 by 80 feet, is to be lighted by three large bay windows. The lounging room will be 60 by 35 feet. The plans call for reading, recreation, writing, drawing and billiard rooms.

Chateau Mount Robson

The Chateau Mount Robson is to be more imposing and is designed to accommodate at least 500 guests. The portion to be built at the present time will contain about 150 bedrooms. The dining hall is to be 65 by 104 feet with a fine colonnade and six bay windows lighting the hall on both sides and forming alcoves for private parties. The lounging room is to be a very fine apartment, 112 by 64 feet, overlooking the tennis lawns and grounds. The drawing rooms, parlors, writing rooms and verandas are all designed on a commodious scale and command a fine outlook over the surrounding country.



Grand Trunk Pacific Chateau Miette.

The general style of architecture is similar to that of the Chateau Miette. The bedroom wings are three storeys high while the main entrance hall, lounging rooms, etc., are one storey high. The building is to be built of brick finished rough cast and to have terra cotta trimmings. The company is sparing no expense to make this spot particularly attractive and comfortable for travellers.

Hotel Prince Rupert

Hotel Prince Rupert is the terminal hotel of the Grand Trunk Pacific Railway on the Pacific coast. It is designed along commercial lines to meet the needs of an ever-increasing travelling public. The central block is a ten-storey modern hotel and further accommodation has been provided for in the future by two annexes, six storeys each, which will be connected by corridors with the central building. When completed the Hotel Prince Rupert will have over 600 rooms. The building will be fireproof throughout and equipped with all modern conveniences. All exterior work of the lower storeys will be in terra cotta, the upper storeys will be of facing brick. The plans provide for a lounging room 58 by 62 feet, a palm room 104 by 42 feet, a dining room 104 by 52 feet, and a lobby 52 by 62 feet. In addition there will be numerous drawing rooms, parlors, etc. The hotel is to face the water front and will possess extensive grounds. The estimated cost is one million dollars.

G.T.P. Hotel Prince Rupert.

The plans for these extensive buildings were prepared by Mr. R. M. Rattenbury, architect for the Grand Trunk Pacific Railway, to whom we are indebted for the accompanying illustrations and the information.

The Use of Hollow Brick or Tile

By S. H. Penlington, A.R.I.B.A.

Of all modern building materials the one having probably the greatest diversity of purpose is the terra cotta hollow tile. It possesses several qualities which are causing it to come largely into many forms of construction. While light and easily handled and quickly laid, it has a high crushing power, namely two tons per square inch. Furthermore it is a fire and sound proof material of a high order and can be readily made water proof. The terra cotta hollow tile lends itself to convenience in construction operations. Carpenters' fixtures may be nailed to it and the plasterers may apply any stucco work directly to the surface. These characteristics render it an exceedingly valuable material for building purposes.

It will be unnecessary here to give the live loads for various depths and spans of arches as the manufacturers specify these in their own catalogues. The hollow terra cotta tile is ordinarily made in three grades of density, medium, hard and dense. Where wood trimming is to be used "full porous" blocks must be employed to take the nails. The tiles used for arches are always strong enough to develop the full strength of the I-beams.

Advantages

Doubtless the rapidity with which this material may be put in position either in floors, walls or partitions is one of the factors bringing it into common use. In the great modern skyscrapers and other large buildings with numerous floors and thousands of feet of walls and partitions to build, time is of the greatest consideration. Then, too, the cumulative weight of the material resting upon the foundation is an important factor. Exterior walls faced with glazed terra cotta and interior partitions are the lightest that can be built to tulfil first-class fireproofing conditions. The reduction in the weight on the wall beams if an entire terra cotta wall is used, is from 50 to 60 per cent. over a brick design. So that time and lightness favor the selection of this building material where usable. In high buildings the question of wind bracing must always be considered. The deep floor obtained by the use of the hollow terra cotta tile is of great value in this respect. In interior work, partitions, elevator enclosures, etc., the hollow terra cotta tile is particularly effective. In addition to the manner in which it facilitates the carpentry and plastering, and its strength and lightness, it carries single floor loads easily and if required may be reinforced with steel rods to give additional stiffness to the structure.

Roofing

In roofs where the loads are light, especially thick web tile is made to receive the slating nails. This is called a book tile. They are laid with a small T-iron between the rows. Ordinary tile may be used, however, where greater strength is required.

Flooring

In flooring work arch tiles is the usual method of construction, that is, arch tiles of the same depth as the steel beams are used. They are set in cement mortar two inches below the steel to give the necessary fireproofing under the beams. This makes it necessary to have two inches of cinder concrete to bring the floor level with the beams. Another two and a half inches of cinder concrete is necessary to bed the sleeper joists, making a total of four and one-half inches. It can be seen that both of these systems make the floor unnecessarily heavy. It would doubtless be a great improvement to use a tile two inches deeper than the I-beam used. The difference in weight is shown below using a 10-inch I-beam.

Tiles and Beams of the Same Depth

Maple floor	4 lbs. per sq. ft.
4½ in. cinder fill	22 lbs. per sq. ft.
10-in. tile	36 lbs. per sq. ft.
¾-in. plaster	6 lbs. per sq. ft.
Total dead load	68 lbs. per sq. ft.

Tiles Two Inches Deeper Than the Beams

Maple floor	4 lbs. per sq. ft.
2½ in. cinder fill	11 lbs. per sq. ft.
12-in. tile	40 lbs. per sq. ft.
¾-in. plaster	6 lbs. per sq. ft.
Total dead load	61 lbs. per sq ft.

The weight of a reinforced concrete floor of the same strength would be as follows:

Reinforced Concrete Floor

Maple floor	4 lbs. per sq. ft.
2-in. cinder fill	8.5 lbs. per sq. ft.
4-in. concrete slab	48 lbs. per sq. ft.
Steel reinforcement	.5 lbs. per sq. ft.
Proportion of concrete fireproofing 10-in. I-beam	17 lbs. per sq. ft.
Suspended ceiling	8 lbs. per sq. ft.
Total dead load	86 lbs. per sq. ft.

There is used a segmented arch floor with suspended ceiling. Although this construction may be necessary in some cases it is an easy matter to design a very much lighter one to carry the same load. It would be necessary here to entirely surround the steel beams with cement concrete and also to carry the concrete over the tile of the arch, making a very heavy floor. It should also be noted that the cinder concrete is useless to prevent steel from corrosion. Therefore it is necessary to protect the steel with cement and sand before applying the cinder fill. Frequently it is necessary to leave sufficient room between the steel and floor boards for pipe ducts and thus the depth of the cinder fill is increased.

There are two other systems of hollow tile flooring. They are both designed to give the least dead load and to give a flat ceiling for plaster. The strength of these floors lies in the reinforcement, the tile being used only as fillers in the concrete to lighten the floor. The Johnson system of hollow tile flooring has no "shear" members in the reinforcement. This will reduce the usefulness of the floor by making it applicable only to short spans. The combination system is an ideal floor. It is designed as a reinforced concrete beam with the fillers between. Since the beams are designed with shear members the floor is good for any span.

The weight of the Johnson floor is as follows:

Maple floor	4 lbs. per sq. ft.
2-inch cinder fill	8.5 lbs. per sq. ft.
10-in. tile	36 lbs. per sq. ft.
1½-in. concrete between tiles	18 lbs. per sq. ft.
2-in. concrete	24 lbs. per sq. ft.
Steel reinforcement	.5 lbs. per sq. ft.
Total dead load	91 lbs. per sq. ft.

The weight of the combination floor is:

Maple floor	4 lbs. per sq. ft.
2-in. cinder fill	8.5 lbs. per sq. ft.
10-in. tile	36 lbs. per sq. ft.
4 by 10 in. concrete beam	40 lbs. per sq. ft.
Steel reinforcement	.5 lbs. per sq. ft.
¾-in. plaster	6 lbs. per sq. ft.
Total dead load	95 lbs. per sq. ft.

The safe live load for this latter floor from the manufacturer's catalogue is 100 lbs. per square foot on a 12-foot span, a factor of safety of 4.

The wall tiles are made of material similar to that of the floor tiles, the sizes being 12 by 12 in. and of varying thicknesses. The Dennison hollow tile is especially made for walls. This tile gives perfect bedding, short webs, and non-conductivity. The horizontal voids in the tile prevent the air from circulating in the walls from the top to the bottom.

Partition blocks are made 12 by 12 in. and from 2 in. up to 12 in. in thickness. The 2-in. material is used for closets, elevator enclosures, etc. This is also excellent material for room divisions up to 10 feet in height, but the 4-in. tile is generally used. This latter can always be reinforced with steel and concrete filling to sustain any concentrated load in an ordinary floor.

A split tile is made for wall furring. This is especially useful for wet walls.

Plainly then the architect or engineer has here a material that will fill the most stringent requirements. As we have shown, its lightness and the ease with which it may be handled, its strength and the readiness with which it lends itself to varying conditions are most marked. Without doubt as time advances this building material will find fresh applications and come more and more into use.

Ocean Rate Commission

THE government of the Dominion of Canada is taking steps to form in conjunction with representatives from the British Government, an ocean traffic commission. The efficiency of the Dominion Railway Commission has been most marked but their power to control traffic rates is limited by their lack of control over the steamship lines. The ocean rates have been increased 23 per cent. within a short period of time. In some cases these lines are subsidized by the government which has no means of fixing the rates of the lines involved. Such a commission should prove of the utmost importance to Canadian and British shippers.

Attention is drawn by the Engineering Record to the fact that the recent act of congress authorizing the valuation of railways, institutes a work so large that probably about two thousand engineers will be needed to fill positions ranging from those of a minor character in field parties to the responsible work in charge of divisions. All of the positions are to be filled through civil service examinations. Engineers with the necessary training will find it to their advantage to give the forthcoming examinations careful consideration. The salaries paid for this work will be at least as high as those paid by the railroad companies for similar work.

The new bridge now being built across the St. Lawrence river a few miles above Quebec, to replace that which collapsed during construction in 1907, with heavy loss of life, will have a total length of 3,239 ft. between abutments and a clear height of 150 ft. above high tide. Besides two 551-ft. anchor arm spans 310 ft. deep, it will have an 1800-ft. channel span consisting of two 580-ft. cantilever arms connected by suspended trusses 640 ft. long. The estimated cost of the bridge is about $12,000,000, including the contract price of about $8,650,000 for the steel work.

A French method of giving glass, pottery and other siliceous surfaces a metal coating consists in treating the well-cleaned surface with a solution of silver fluoride, exposing to a current of illuminating gas, heating to 50 degrees C., and while at that temperature exposing to a current of carbon sulphide. The result is a deposit of finely-divided silver on the non-conducting surface. This may be burnished for better appearance if desired, or the article may be placed in an electrolytic bath to obtain a coating of other metal.

Permissible Dilution of Sewage*

Hygienic Aspects—Not Used to Advantage—Unimportance of Organic Matter—Degree of Dilution—Summary

By George W. Fuller M. Am. Soc. C.E.

It is not the purpose of the writer to devote any remarks to a review of the literature of this subject, but, on the contrary, to confine himself to the more salient features of the proposition and to point out those matters now receiving most discussion from sanitarians and now needing most careful consideration with respect to judgment and policy.

While he shall not dwell on the literature of this subject he cannot refrain from pointing out that there has really been a great deal of information secured in this country with regard to the dilution method of sewage disposal. This is particularly true with regard to the Chicago drainage canal, the various streams of Massachusetts which have been reported upon by the Massachusetts State Board of Health, the general scheme of sewage disposal for the metropolitan district tributary to New York harbor, and more recently the various investigations which have been undertaken by numerous large cities, such as Philadelphia, Pittsburgh, Cleveland, Milwaukee. In the author's opinion it is very important for engineers and sanitarians having to deal with large sewage disposal projects to keep clearly in mind the experience of others who have had to do with these matters under various conditions in different parts of the country.

At the outset it needs to be explained that the liquid portion of all sewage or water-carried waste must go to the water courses sooner or later. The only exception occurs where the sewage is evaporated. Mention is made of this feature in order to accentuate the thought that the water courses of this country must receive the water-borne wastes in some form or another. The question becomes, therefore, one of the degree to which liquid wastes are improved as to their quality before they are finally disposed of by dilution in some water course.

It is perfectly obvious that as civilization advances, and the population of the country increases, there can be no longer any streams of original pristine purity. That condition absolutely disappears, and such disappearance is one of the penalties of civilization. On the other hand, there are a great many streams in this country—some large ones, as well as numerous small ones—which are over-polluted with water-borne wastes. This is due to an over-stepping of the proper limits of permissible dilution.

Definitions

In order to make a little more plain, perhaps, the viewpoint, on some of these matters, two or three definitions will be considered.

Sewage—The writer defines sewage as the spent water supply of a community together with those trade wastes and street washings which in some instances are removed in underground channels called sewers.

Sewage Disposal—The art of sewage disposal means the economical elimination or prevention of nuisances with respect to these water-borne wastes.

Types of Nuisances—Nuisances due to sewage naturally are grouped into two classes: One refers to conditions that are offensive to the senses of sight and smell. The other refers to the hygienic aspect of the matter and to the transmission of disease germs contained in the sewage to neighboring communities through the water of the stream into which the sewage is discharged. These disease germs refer, of course, to those of the water-borne group, such as typhoid fever, Asiatic cholera, and others of intestinal origin.

The hygienic aspect of sewage disposal is naturally related in many instances to questions of water supply. It is also intimately associated with shellfish problems along the seaboard. Public health officials also have to deal with this aspect of the question with respect to public bath houses and possibilities of transmission of certain diseases by flies from deposits along the shore of some highly-polluted water courses.

Hygienic Aspects of Sewage Disposal

The sterilization of sewage discharged into tidal waters in the general vicinity of shellfish layings has within the last few years proved an economical and, in the hands of careful operators, an efficient means of dealing with one of the important phases of the hygienic side of this question. While there are only a few sewage sterilization plants now in operation, there have been a dozen or more recommended for adoption and it seems unnecessary here to say more on this question in view of the thorough discussion which it has received from Professor Phelps in Water Supply and Irrigation Paper No. 229 of the U. S. Geological Survey. The author is of the opinion that hypochlorite of lime, or some similar sterilizing agent, has a great future before it in the treatment of sewage at places where shellfish are found within certain distances.

Sewage disposal in its relation to public water supplies is, of course, the most important hygienic feature, and it is a question upon which viewpoints vary widely. Some believe that all sewage should be purified so thoroughly that it will practically resemble spring water and so that there will be no need of water purification.

All questions of water supply and sewage disposal should be viewed in the light of all local conditions, having in view that the treatment adopted should give the best returns for the money spent when due regard is given to the benefit derived in the interests of the public health.

The Royal Commission on Sewage Disposal of Great Britain has considered this question at length and its conclusion was as follows:

> "We are satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority,

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*Journal of the Western Society of Engineers.

systematically and thoroughly, to purify the water before distributing it to their customers."

"Apart from the question of drinking waters, we find no evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of knowledge, we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

The conclusion of the commission is a sound one and as a general proposition water purification rather than sewage purification affords a better safeguard of the public health in the present state of the art. It is also to be noted that water purification is not only more reliable, but it is cheaper under most conditions.

In this connection it is to be borne in mind that untreated surface water supplies as a rule do not afford a thoroughly safe drinking water. The reason of this is that there are too many opportunities for pollution from the soil wash and indirect sewerage of small villages and hamlets, and the infection of the water from the casual huntsman, fisherman, or those who for pleasure or business traverse the watershed. There are, of course, exceptions to this rule, but they are growing fewer and fewer. This is well shown in Europe where, since the great cholera epidemic of Hamburg some years ago, it is an unwritten but practically effective law that all surface water supplies shall be filtered.

Many large cities in this country are provided with combined sewers, the entire flow of which at times of storms can scarcely be purified completely. It is true that hypochlorite of lime has proved to be of much help in securing an improved quality of drinking water at many places, but the fact remains that as a general proposition the surface water supplies in this country should be filtered in order to make them thoroughly first-class in point of hygienic character.

While it is believed that the purification of public water supplies in this country is a subject that must stand on it own feet first and foremost, it is undoubtedly true that there are some exceptions to this rule and that sewage purification sometimes should be provided to aid the neighboring water supply. The medical man feels that everything that can be done to destroy disease germs should be done, and is inclined to say purify all sewage and also purify all water. This brings up the question of much practical significance of how a certain expenditure of money can be best applied in the interests of the public health.

Water purification should come first so far as the hygienic side of the matter is concerned, and sewage purification or perhaps sewage treatment by sterilization should come into play in order to make sure that water filters are not overloaded if there is likelihood of inferior quality of filtered water being furnished the consumers.

Double filtration of water supplies and the judicious use of sterilizing arrangements and the advantageous employment of coagulating processes can all be brought to the aid of the water purification plant. Even with all of these precautions as to the water supply, there are times when purification of the sewage of a neighboring community or of the community whose water supply is under consideration, should be carefully provided for. We shall say no more on this question of the hygienic aspects of sewage disposal, as it is hoped that the viewpoint has been made plain that the dilution method of sewage disposal is not barred from this line under ordinary circumstances. The limitations in the dilution method are really to be found in relation to the nuisance question as noted by sense and smell, and this is the question that we shall now proceed to discuss at length.

Nuisances as Related to Sewage Dilution

Sewage dilution is an important, rational, and proper method of disposal of sewage if it is properly applied and is not abused. Disregarding the question of disease germs which we have already considered, the dilution method of disposal is a proper one when by dispersion in water the impurities of the sewage are consumed by bacteria and larger forms of plant and animal life, or otherwise disposed of so that no nuisance results.

The dilution method is by far the most prevalent one now in use in this country. As knowledge becomes more precise as to its advantages and disadvantages, the conclusion becomes more clear that the method has not been applied in a satisfactory way in a large number of instances. On the other hand, there seems to be no good reason why advantage should not be taken of this method within reasonable limits. Between the so-called complete purification of the sewage and the dilution method there are intermediate procedures which allow advantage in point of economy to be taken of the dilution methods, and at the same time the nuisances to sight and smell, which have been so common at various places, may be effectively prevented.

Nuisances attending the sewage dilution method may be due to the following:

1. Floating solids.
2. Settling solids.
3. Non-settling putrescible organic matters.

These three constituents, or groups of constituents, in sewage explain most of the difficulties that are encountered to-day with the sewage dilution method. All can recall instances where orange peel and other household wastes float in bodies of water around sewer outlets. Deposits of "sewage mud" or sludge are seen near the outlets, and the likelihood of their decomposing and producing foul odors particularly at times of low stream flow. There is also the condition where there is inadequate dilution of the sewage as it enters the stream, and where the entire body of water turns black owing to anaerobic decomposition or so-called septic action.

Clean Rivers—There is undoubtedly a well-defined movement on foot to free American rivers of small and moderate size of solid organic matter and filth coming from the flow of sewers. This movement is a proper one and, when combined with adequate purification of water drawn from rivers receiving such sewage, the whole question of sewage disposal by dilution assumes a more reasonable and favorable aspect than hitherto. Furthermore, it does not involve communities in the expense called for by sewage filtration. It modifies, however, the limits that are permissible as to sewage dilution and calls for a recasting of the engineer's views and calculations upon the question. This paper will outline briefly some of the features involvd in the permissible limits of sewage dilution in connection with "clean rivers."

Screens—In America there has not been as much progress as in Europe in the use of screens or other arrangements by which floating matters objectionable to the sight are removed from sewage as it enters the stream. In Germany so-called fine screens with an opening of 0.4 in. or less have had many warm advocates. The fine screens have not the standing to-day that they had a few years ago, in the opinion of many engineers, owing to the success attending the sedimentation devices as a cheaper and simpler means of keeping back floating matters and at the same time of removing the coarse heavy solids that subside. In America fine screens have been regarded with questionable favor, owing to the cost of their maintenance. Without discussing the relative merits of different devices, it may be stated that without question floating matters should be removed from sewage before the latter is disposed of by dilution in an adequate body of water.

Sedimentation Tanks—An examination of the Massachusetts State Board of Health reports, and other American data on pollution of streams, quickly shows that the stranding of solids in the vicinity of sewer outlets has in the past proved one of the drawbacks to the satisfactory use of the dilution method. This is particularly true at times of low river stages when banks of "sewage mud" or sewage sludge are exposed to "putrefaction" with attendant bad odors. Some 60 per cent. of the total suspended solids in the ordinary sewage are responsive to subsidence, and unless the sewage is discharged into a river with uniformly high velocities, these solids are bound to strand or settle. The removal of these "settling solids" is an important feature in the establishment of "clean rivers" in this country and, if a few of the larger streams are eliminated the sedimentation of sewage is going to come into general use as a preliminary step in the modern arrangements for sewage dilution.

In earlier days difficulties in disposing of the sewage sludge or solid matters deposited in tanks were the cause of the slow adoption of this important improvement. It is true that chemical precipitation and sludge presses provided a solution of the problem, but at an expense that proved discouraging to many communities, and such that in Europe the cities near the seacoast were led to "barging" the sludge to sea. It is believed that septicization, particularly as embodied in tanks of the two-storey type, will allow this matter in the future to be handled far more satisfactorily than in the past.

Unimportance of Organic Matter in Settled Sewage

If a sewage has been clarified to such an extent that there will be no deposits in the stream bed at or near the sewer outlet, and if the disease germs are killed, there then remains to be considered the sanitary significance of organic matter coming from the settled sewage, and diluted with large volumes of river water. In most cases where the sewage is diluted so that there is formed no offensive odors due to decomposition, and where the sewage has undergone sterilization, it does not seem likely to us that it is necessary in the interests of the public health to go to the expense in most cases of removing the dead organic matter of the settled sewage.

It is intimated by some that the germ theory of disease and the specific infection of water through disease germs does not necessarily tell the whole story as to the hygienic disadvantages of sewage-polluted waterways. On the other hand, the extensive investigations of the United States National Board of Health, as stated in their report for 1882, page 201, indicate that with sewage-polluted waters, it would be necessary to drink half a gallon at once of the waters under test in order to get as much nitrogen and carbon as is contained in a single medicinal dose of strychnine, which is stated to be one of the most energetic of recognized poisons.

A similar view as to the harmlessness of organic matter per se was stated by the late Dr. T. M. Drown in the Special Report of the Massachusetts State Board of Health, 1890, Part I, page 537.

More recently a similar view has been given by Dr. A. C. Houston, now Chief Water Examiner of the Metropolitan Water Board of London, in the Second Report of the Royal Commission on Sewage Disposal, page 27:

> "Organic matter per se in water is seemingly harmless; it is the bacteria likely to be associated with the organic matter that constitute the element of danger. Only bacterioscopic analysis can hope to reveal the kinds of bacteria in an effluent which are of a sort liable to be related to disease. Chemistry is quite powerless in this respect, and, indeed, all chemical standards of potability are apparently based on an assumed relationship, which may or may not exist, between the amount of organic matter and the number and kinds of the associated bacteria. Typhoid fever stools, whether sterilized and innocuous, or unsterilized and highly dangerous, would yield to chemical testing practically the same results as regards the nature and amount of organic matter present."

Furthermore, where there is adequate dilution of settled and sterilized sewage in a river used for a water supply, it is not difficult, as already stated, to effect a substantial removal of organic matters in works well adapted for water purification and involving coagulation, aeration, and sterilization by powerful oxidizing agents.

Degree of Dilution

On the assumption that floating and settling solid matters are removed from the sewage and that disease germs are killed, where necessary, by sterilizing chemicals, the permissible limits for the dilution of sewage may be discussed. The limits should be such that there should be present at all times and in all places sufficient dissolved oxygen to prevent anaerobic or so-called putrefactive decomposition becoming established, and furthermore that there should be a reasonable margin of dissolved oxygen to take care of fish life unless it should prove in some instances that the question of fish life is not of sufficient significance to justify consideration.

On the degree of dilution the first scientific data in this country were obtained in the early days of the consideration of the Chicago drainage canal, and it is from the technical staff of the Chicago Sanitary District that engineers have received their latest information bearing upon this important subject. A few years ago, and in fact until quite recently, all data as to the degree of dilution of sewage referred to crude sewage with its floating and settling solids. The Chicago drainage canal was established on the legal limit of 3 1-3 cu. ft. of water per second to dilute the sewage of each 1,000 persons connected with the sewers. That limit was probably too low for the crude sewage of a city which has such a large proportion of manufacturing wastes in its sewage flow as is the case here in Chicago. For a city without manufacturing wastes it is probably a fair limit, although some data obtained from Massachusetts suggest that it might be wiser to provide a somewhat more liberal volume of water for dilution.

A dilution of 4 cu. ft. per second per 1,000 population is as close a general figure for crude sewage as can now be obtained, although undoubtedly there are various local factors which influence the dilution and may establish a range as wide as from 3 to 7 cu. ft.

As to the degree of dilution necessary for settled sewage, present evidence indicates that at least 2.5 cu. ft. per second per 1,000 population should be provided for residential communities and where the diluting water is well supplied with atmospheric oxygen. For manufacturing cities, where the diluting water is moderately depleted in oxygen during the summer months, this dilution may perhaps have to be doubled, that is, increased to 5 cu. ft. per second per 1,000 population.

There is no precise rule now available, and the above ranges establish as closely as can now be done the permissible limits in the dilution which properly should be applied to settled sewage in preference to raw sewage with floating and settling solids in it.

Dispersion—Mixing—One of the great drawbacks to the dilution method of sewage disposal as applied in earlier years was then the tendency to conduct the sewage only to the margin of the stream and perhaps only to the high-water shore line. This explains the nuisances that prevail in many American cities where the stream flow throughout the entire cross-section of the river is sufficient to provide reasonable results by the dilution method. Enough has been said to indicate that if dilution is to be advantageously used, it should be done under conditions where the sewage is so mixed with the stream flow that the degree of dilution above mentioned will be secured at all points. Naturally, streams with comparatively high velocities allow better results to be obtained than those in which the velocity is reduced or checked entirely at times by mill ponds or other obstructions.

Residual Oxygen

This is a question upon which there are many divergent views. Until it is put on a more satisfactory basis than at present, it is hardly feasible to state the degree of permissible dilution more closely than given above. Colonel Black and Professor Phelps have advocated that a residual margin of 70 per cent. of dissolved oxygen should be provided for the waters of New York bay. A more common opinion places this margin at 50 per cent. Messrs. Wisner and Pearse (of the Sanitary District of Chicago) have put this margin at 2.5 c.c. of dissolved oxygen per liter, which is equal to about 20 per cent. of saturation of oxygen during winter months, and 30 per cent. for the summer temperatures. These gentlemen, however, have reference to fish life. The author's experience is that if stranded solids have been kept out of the stream there will be no occasion for difficulty as to anaerobic or putrefactive decomposition, provided there is some dissolved oxygen present in the stream at all times and at all places. One of the earliest and most important points established at the Lawrence Experiment Station was that a little oxygen, say 1 per cent. to 3 per cent. of that necessary for saturation, would allow oxidation and nitrification to take place as satisfactorily or nearly so, as if the water were saturated with oxygen. There is no reason known to the writer for departing from the teachings of those early experiments at Lawrence, and he believes that estimates of 50 or 70 per cent. for the required residual of dissolved oxygen can be explained only by extraordinary allowances made for the consumption of oxygen by existing sewage sludge, or by more than liberal allowances of oxygen for major fish life. In fact, whatever margin is needed above a slight positive quantity at all times and places in the stream is, in his opinion, solely accountable for by the oxygen necessary for fish.

Fish Requirements—Data are somewhat meagre as to the amount of dissolved atmospheric oxygen which is required in the streams to protect major fish life. The quantity no doubt varies with different species of fish and perhaps other local conditions. In the Lower Elbe near Hamburg it is stated that the margin of dissolved oxygen during the ordinary summer periods falls as low as 20 per cent., and the figure in the Lower Thames is understood to be about 30 per cent. At Hamburg there has been no serious complication as to fish life other than during the summer of 1911, when it is understood that for three or four weeks fish actually migrated from the vicinity of the city. This does not mean that there was any nuisance as to putrefactive odors. In fact, it is stated that none existed. It shows also another point and that is that since the fish returned after a period of three or four weeks, it will be quite debatable whether once or twice in a generation it is necessary to prevent the migration of fish, if by such prevention there will be involved expenditures of vast sums of money for the more complete purification of the sewage.

It was told the author in Berlin last summer that an amount of residual dissolved oxygen equal to 1 c.c. per liter was considered sufficient under ordinary circumstances in the immediate vicinity of a sewer outlet, although 1.5 c.c. were preferable.

Fungus Growth—Professor Thumm, of Berlin, has stated that in waters containing a great abundance of oxygen it is possible that offensive odors might result through the growth of certain fungi, namely, Leptomitus, Sphaerotilus and Cladothrix. The staff of the Royal Prussian Testing Station have observed that these growths are said to be characteristic of streams receiving a lot of industrial wastes, such as come from wood pulp mills. The growths seem to be favored by the presence of much putrescible organic matter, ample dissolved oxygen, and a high velocity of stream flow. These comments are not in harmony with the author's recollections of the life history of these organisms, unless it be that their growth is fostered in certain deposits which are dislodged under certain conditions. The question is an interesting one, and it is the only suggestion that the writer has heard of, which limits the permissible dilution of sewage in other than by the dissolved oxygen, in cases where disease germs are destroyed or may be properly ignored. This is a question which needs further study, and it may be entitled to more consideration that is now realized in America.

Comprehensive Designs

While the writer is a firm believer in the dilution method of sewage disposal within permissible limits which he has tried roughly to outline above, he is aware that many American towns and cities are likely to grow to proportions where the dilution method will require more and more complete treatment of the sewage in order to be satisfactory. He believes that it is the part of wisdom to prepare designs for sewage disposal works so that if filtration is not needed at the outset it can be adopted as conveniently as practicable in later years and without embodying too great a sacrifice in works now undertaken. This means, among other things, that intercepting sewers, sites for screening plants, and sedimentation tanks could well be arranged with the idea that some day filtration also must be provided. If this were done it would probably save considerable money that otherwise might be lost.

Relaxations—In England the author found the principal topic of conversation among engineers to be the forthcoming report of the Royal Commission on Sewage Disposal and the disposition in that report to provide for "relaxations." By this is meant that there would be installed, piecemeal, works which would provide ultimately for purification to the degree set out by standards recommended by the commission a few years ago. It is proposed now to take full reasonable advantage of dilution, but to arrange the works, so that further and more complete treatment may be secured when and as required in the future. This is a reasonable programme, and it is what has been thought of by the writer in connection with a number of recent problems in this country and also when the remarks above with respect to "comprehensive designs" were made.

Separate Sewers

So far as household wastes are concerned in all new systems and in many cases of extensions to existing sewer systems, it will be helpful to adopt the " separate system" to a greater extent than has been the vogue hitherto. The prevention of a mixture of the sanitary wastes of the household with the storm water from the streets will aid materially in minimizing the expense and in increasing the success attending sewage purification, sewage treatment, and the utilization of the dilution method within safe practicable lines.

Summary

It is permissible to dispose of sewage by dilution provided that complications can be prevented so far as disease germs are concerned, and this should be best done in connection with water filtration, and further provided that offensive conditions to sight and smell do not result.

In some large streams, as in lower Mississippi near New Orleans, sewage which is passed through coarse screens may with care be disposed of in a satisfactory way. In large lakes, tidal estuaries, moderate and small streams, it is important, if not necessary, for the success of maintaining "clean rivers" or " clean bodies of water" to free the sewage from floating and settling solids.

Permissible dilution of sewage without treatment in water courses with fairly high velocities range apparently from about 3.5 to 7 cu. ft. per second per 1,000 population, depending upon the manufacturing wastes in the sewage and the dissolved oxygen content of the diluting water. For well settled sewage, these limits become about 2.5 to 5 cu. ft. per second per 1,000 population according to present information.

Factors in the Problem of Highway Maintenance

HIGHWAY maintenance is an engineering problem as important as highway construction, but the failure to recognize its significance in the past has led many road officials to subordinate it to the execution of new work. Given only secondary consideration, inefficient administration systems have developed, and in consequence repair and maintenance have suffered greatly. Some of the defects in the highway organizations now in vogue, with possible remedies, have been pointed out by Dr. L. I. Hewes, chief of economics and maintenance, in a chapter on road management in a recent bulletin issued by the U. S. Office of Public Roads. The salient points developed in the chapter are presented in this article.

Viewing public roads as a whole, the defects of small administrative units are conspicuous. The number of men who have more or less authority and personal direction over road matters in some sections of the country is extraordinary. There are at least 150,000 such road officials in this country. The term of office of these men is but a year or two, and rotation in the office tends to be the rule.

It would seem that just where the stimulus of effective organization is most needed it is absent. The only successful attempts at systematic repair and maintenance on record are those which have been managed with skilled and strong central control. Almost without exception, those states which have undertaken state aid in any form for road building have, in the annual reports, reiterated the necessity of removing the responsibility of repair and maintenance of such roads from local authorities. In a number of states this change has been made, and the results have been an immediate improvement.

A fundamental difficulty with the organization of road systems which must handle repair and maintenance appears to be the failure to recognize that road work is a trade which requires training. Training for road work must necessarily be obtained at the expense of the community. As a rule, road officials are not in office long enough to mature their experience, and there is a constant economic waste of road funds.

Repair and maintenance operations upon all public roads necessarily extend over a period of years. In order to secure effective execution of such operations, a comprehensive plan for several years is necessary. The work for each season must be carefully laid out as far in advance as possible. Where maintenance work has been seriously undertaken under such a system it has responded with gratifying results.

Whatever the civic sub-division may be which constitutes the administrative road unit, a good road map showing all the various classes of roads is desirable. Realizing this, the state of New York has undertaken the preparation of a comprehensive atlas of all its roads. The roads are drawn uniformly ¼ in. in width at a scale of 1 mile to 3 in., which allows all culverts and bridges to be shown. The Ohio State Highway Department has issued a bulletin giving maps of all roads in the state by counties. In this also the scale is 1 mile to 3 in.

It has been found that the best results follow in an administrative district where the mileage of roads is sufficient to warrant the continuous employment of a man who is either a highway engineer or a competent road-builder, whose interest is primarily in road work, and who has actual charge of road matters in his district. Where such a man is employed from year to year he can select competent men for road work, and he is able to plan with confidence systematic improvements which must wait for successive annual appropriations.

Good business organization in road work demands an adequate bookkeeping system from which unit prices for various classes of work can be easily derived. Too frequently road accounting presents an accurate list of men to whom money has been paid for material or labor, but from which no estimate of the cost of future repair and maintenance work can be established.

Large jobs of repair are usually most advantageously handled by contract. Contract work must, however, be done under competent inspection and with proper plans, profile, and written specifications. Where road work is in continuous charge of one competent man it is possible for him to gain information from time to time which fits him to draw up proper specifications, avoid the repetition of mistakes, and benefit by the experience of other highway engineers. With a rotation of road officials there is little incentive for a man to familiarize himself with the best practice. He is not interested primarily in road matters and can not be expected to educate himself by reading road journals or attending road gatherings.

Value of Traffic Census

It will be more and more necessary in the future to study the service of various roads by accurate traffic censuses. From the investigations that have already been made it appears that for any civil sub-division a relatively small percentage of all the roads carry nearly all the travel. In France a traffic unit called the "collar" is used. The "collar" is a single horse harnessed to a vehicle, and all other traffic is reduced to "collars," including automobile traffic. The "collar" has not been adopted in the United States as a traffic unit. It is unfortunate, moreover, that no agreement exists among road men at present as to the detailed method of measuring traffic. Traffic censuses were taken in Illinois in 1906-7, in New York in 1909, and in Massachusetts in 1909 and 1912. These censuses counted the travel, but no common unit is yet available for reducing such traffic data; moreover, the useful tonnage is a most important item from an economic standpoint, and it is seldom counted.

It is well established that an improved road draws to itself increased traffic. To determine the future use of roads, it will be necessary not only to know the travel passing over the road before improvement, but also to know the increase of travel which is likely to be diverted to the road when it becomes improved. It is undeniable that travel upon roads in general is rapidly increasing numerically in tonnage and in mileage of travel radius. Preliminary study is clearly necessary, therefore, to enable road men properly to relate the first construction costs to probable maintenance charges. There should be an ample "factor of safety" in road design to allow for increased service.

Under a competent and continuous administration there are many details which can be worked out for road betterment which are otherwise neglected. It is necessary for economy to have the location of deposits of all road material within a road district placed on the road map and the quality of each deposit carefully recorded. The care of all road machinery should be in competent hands, and it should be housed and ready for use when the season commences.

A gradual improvement in the grades of more important roads can be undertaken with an established profile toward which some work is directed each year. It is quite probable that the prevailing lack of permanent culverts and bridges on highways is partly due to the unwillingness of short-term road officials to spend a considerable amount of money in one place. Under a continuous administration some permanent culvert or bridge work may be undertaken from time to time along a plan which contemplates the final improvement of all such structures.

Road Patrols

It is probable that the continuous employment of road patrols will be too expensive for a large part of our road mileage for some time to come. It is equally true, however, that on many miles of road the presence of a road patrol at a cost of from $60 to $75 per month will be economy. It has been repeatedly observed that the work of such road-men in preventing water breaks and wash from rainstorms and thaws at the right time has in itself justified their salaries. A continuous maintenance gang of foreman and eight or ten men, with suitable equipment, is a practical and economical maintenance force for county-road systems, aggregating 100 miles or more, where a patrol system can not be economically established. Whatever system of road labor is adopted, the work should be organized early in the year and experienced men developed and retained as far as possible. The foreman of a repair gang on road work should have sufficient knowledge and experience to justify spending his entire time in supervising and planning the work without attempting to labor with his men. The element of thoroughness in details, such as complete cleaning of mud holes, sufficient material, swift repair of water breaks, etc., can not be over-emphasized. There is always enough necessary planning and supervision to keep a good road foreman occupied.

The supply of road material for repair and maintenance operations should be at frequent intervals along all roads—for example, there should be sufficient broken stone of both sizes and screenings at hand on all macadam roads, and the quantity should be known. With the increased use of bituminous material it is necessary also to supply at convenient intervals stores of such material, and men working on the roads must be furnished with necessary small tools, including tar kettles, heating apparatus, pouring pots, and stiff push-brooms.

European Practice

On the continent of Europe and in England, where road repair and maintenance have been conspicuously successful, it has been the practice to issue printed instructions covering the smallest detail to all men engaged in the work. It is also the plan to require reports of work done and of quantities of material used at frequent intervals, and sometimes daily. Roads are frequently inspected and accurate estimates of all quantities of work are made from year to year.

The superiority of the French road system is not due to any extraordinary natural conditions or advantages but to the efficiency of the administrative organization. The basis of the administrative system is the publicly maintained Ecole des Ponts et Chaussees, where the road engineers and officials receive their technical training. A regularly recruited corps of trained and experienced men is thus constantly in charge of all the important roads. The department of the Ponts et Chaussees constitutes also a centralized source of information concerning the roads of the entire country.

For the purpose of road maintenance and construction the organization is as follows: (1) Inspectors-general of bridges and highways; (2) chief engineers, charged with the work of a "department"; (3) ordinary engineers and under engineers, charged with an "arrondissement"; (4) principal and ordinary conductors, charged with a sub-division; and (5) cantonniers, each having from 4 to 7 km. (2.48 to 4.05 miles) of highway under his immediate supervision.

Long-Term Bond Issue

Repair and maintenance have not been given sufficient consideration in planning road finances. It is becoming yearly more common for local authorities to issue bonds for road construction. During 1912 nearly $29,000,000 in bonds were issued by counties and road districts in various parts of this country for road construction. It is not uncommon to find such bond issues planned with no provision whatever for a repair and maintenance fund. No road can last thirty years without repairs, yet thirty-year bonds are repeatedly issued for road improvement. Many such bonds are commonly issued and the proceeds are expended without adequate supervision and under weak administrative systems. Every bond issue should be accompanied by a direct tax providing sufficient revenue for the upkeep of the roads with a good margin of safety, and the term of the bond should in most cases be shortened. Without doubt a serial bond is to be preferred to the form of retirement by a sinking fund. Serial bonds may be arranged so that the annual tax for interest and retirement is constant. With a serial bond there is a large percentage of the road actually paid for before it is worn out, even with long-term issues.

There is apparent contradiction in the cost figures for repair and maintenance exhibited by expenditures on roads of a given class as a whole and the figures obtained by analysis of the cost of necessary operations on a given type of road. On a 15-ft. bituminous-macadam road an annual charge of $700 a mile is nearly 8 cents per square yard. Although the cost of repair and maintenance in a number of states has recently averaged above $700 per mile, the annual cost of necessary operations for repair and maintenance by any given method is, on an average, considerably less than 8 cents per square yard.

The apparent contradiction is partly due to the excessive accumulation of resurfacing charges. Resurfacing charges have recently risen because of the particular phase of average-life period reached by a large mileage of state-aid roads and because of the emergency created by the new traffic, and especially because of the combination of the two causes. Insofar as surface treatment is absolute maintenance this present prevalent method of maintenance includes the former annual resurfacing charges which ordinary macadam roads required, but which for a number of years did not appear in the repair and maintenance figures. The present years are, therefore, bearing out not only accumulated past resurfacing charges, but are now carrying an increment of annual cost directed toward the increased life of the new road surface.

Assuming the cost of bituminous resurfacing at 72 cents per square yard; the annual maintenance, including necessary surface treatment, 4 cents; and the total annual charge for ordinary macadam resurfacing and maintenance, 5.9 cents; then if it is desired to find the number of years, n, a road reconstructed with bituminous surface must wear, without resurfacing but with regular surface treatment, in order that the total annual cost shall be the same as for ordinary macadam, there results from the above figures $(72 + 4n) \div n = 5.9$, whence $n = 37.9$ years, nearly.

It is possible that considerable resurfacing of bituminous-bound macadam roads will ultimately be necessary, and in this case there will be a rise in repair costs when the life period is reached. Maintenance of roads subject to automobile traffic tends more and more to become absolute maintenance. Not only does automobile traffic become increasingly destructive to a road which is once allowed to ravel, but the reaction of road surfaces upon automobile tires is now a matter of much importance.

Increased knowledge is needed of the actual relations between first costs and interest and of the life, service, and maintenance cost of the road. In future investigations for determining the type of road to be built it will be necessary to provide for large increases in traffic and carefully to balance the advantages of long-lived road surface, with little or no factor of safety and immediate and high maintenance costs.

U. S. Delegate

Among the notable delegates at the Third International Road Congress at London was Mr. Robt. Foote Hall, who went as a representative of the Universal Portland Cement Company and was also commissioned by the Department of Agriculture of the United States as a collaborator with the Office of Public Roads, Washington, D.C.

Mr. Hall is the son of Brigadier-General Robert H. Hall, of the United States Army. He was born at San Antonio, Texas, on August 24, 1870, and until leaving home for school and college, lived at various military outposts with his father. He graduated at the University of Michigan in 1894 and received the degree of LL.B. in 1895. He began the practice of law in Chicago in 1895 but later abandoned the legal profession to engage in business. At the present time he is assistant sales agent for the company which he represented. Mr. Hall is a member of many important clubs and organizations, including the University Club of Chicago and the Military Order of Loyal Legion of the United States. As a member of the Illinois Highway Improvement Association he has been active in the campaign of that state for good roads and has delivered many addresses on the subject.

Mr. Robt. Foote Hall, Chicago.

Western Building Reports

Regina

Building operations show considerable activity in the city of Regina. Plans are in preparation for the building of a new Anglican Synod House. The Scott Fruit Company are erecting a $25,000 warehouse three storeys in height. The cement basement is to be provided with double walls for cold storage purposes. Knox Presbyterian congregation has purchased land for the erection of a $37,000 school. The city authorities are undertaking considerable work and are calling for tenders for the construction of 500,000 square feet of concrete sidewalk. Plans are being called for the addition to the city hospital and for the construction of a new isolation hospital. A company has been organized in the city for the purpose of constructing and operating a flax mill with a capacity of 1,000 bushels of flax per day. The mill is estimated to cost over $100,000.

The new Sherwood million dollar department store is well under way. Excavation has been completed and the steel work started. Mr. Chas. D. Oliver, Canadian representative of the system M, has the contract for the steel work in his hands. This is said to be the first building erected in Canada on this system. The columns, girders and beams used in the building are composed of structural steel used in tension only, strength in compression being developed by the surrounding steel work. The building, which will be three storeys in height, will cover an area of about 1½ acres. The footings and steel work are calculated to carry five storeys as it is proposed to add another two storeys as soon as the business of the firm warrants it. The street front will be ornamented with terra cotta work and ornamental iron. All the modern conveniences found in the largest stores on the continent will be installed. Pneumatic cash tube system, post office, railway, express and theatre ticket offices will be among the innovations. There will also be found in the equipment rest room, writing room and hospital. Furnishings throughout will be in mahogany. Messrs. Brown & Vallance, of Montreal, are the architects.

Sherwood Building, Regina.

Messrs. Clemesha & Portnal have been awarded first prize in the competition for supplying plans for the Regina proposed city police station. The building will be three storeys in height and in addition to the cells will provide a parade room, office, gymnasium, waiting room and detention rooms.

Winnipeg

Ten million two hundred and fifty thousand dollars is the total building permits issued up to July 17th this year for the city of Winnipeg. Two new sub-postal stations, one in Fort Rouge district and the other on Portage avenue west are to be constructed during the summer. Mr. Chas. F. Roland, Commissioner of the Industrial Bureau, says that the city is about to experience a manufacturing development. Numerous enquiries are coming in from the United States and England with regard to sites and possibilities. The enquirers include one from a Connecticut firm asking advice in regard to the establishment of a malleable iron foundry, one from a Chicago firm concerning the manufacturing of a general line of elevators and conveying machines, several in regard to the manufacture of automobiles and motor cars. From England information is sought with regard to the establishment of motor car and motor boat manufacturing and also the manufacturing of leather goods. Perhaps the most promising from the Homeland is the investigations being made with regard to the establishment of a rope, binder twine and machine packing factory.

Prince Albert

A plant to be erected by the Imperial Steel & Iron Company of this city is under way. When completed the works will be capable of handling 4,000 tons of iron per month and will employ from six to seven hundred hands. The site covers 31½ acres and the buildings in all number eleven. Among the various departments there will be established a jobbing sheet and plate mill, a horseshoe factory with electrical equipment, a finishing mill, a scrap, shearing and preparing department, provided with seven pairs of shears, the largest capable of cutting six inches of cold steel, and a power house.

Edmonton

That the building trades are busy in Edmonton may be ascertained from the fact that the permits for the month of June totalled $1,428,650 and included 104 residences. Alterations involving the building of fifty rooms will be made in the Windsor Hotel. Mr. James Ross, president of the Ross Bros. Hardware Company, is having plans prepared for an apartment house costing $140,000. The building is to be erected this season. Shubert & Company, of Edmonton, have made arrangements for a $50,000 6-storey modern office building. Considerable municipal work is contemplated. Mr. W. L. Richardson, Director of Technical Education for the city, has recommended the erection of seven buildings near the High School. Some 225 men are at work on 43,000 feet of sewerage now being built.

The Governor of North Dakota in solving the good roads question by the plan of issuing bonds, paying the interest from an automobile tax, increasing the latter from $3 to $5 per year, so a part of the principal can be used each year, is generally indorsed by advocates of good roads in this state. The plan overcomes many of the objections advanced against other suggestions for raising funds for good roads in that it makes the automobiles pay for the entire improvement. The fact that it eliminates the protests of the farmers who object to special taxation for road purposes is expected to be a strong feature in securing its adoption. Despite their vital interest in good roads, most farmers of the state strenuously object to an increase in road taxation. Educational campaign for good roads has never been very systematically worked up and it will take some time to create sentiment favorable to direct taxation.

Several large works are in prospect in the city of Wellington, New Zealand, the chief being the new Roman Catholic cathedral (to cost £110,000), a new building for a large commercial firm (about £4,000), and a new government railway terminus.

The Walkerton Electric Light and Power Co.

New Hydro-Electric Plant on the Saugeen River, Two Miles Above the Town

The Walkerton Electric Light & Power Company of Walkerton, Ont., have just placed their new hydro-electric power station in operation. The new plant is situated about 2 miles above the town of Walkerton on the Saugeen River, where a substantial concrete dam has been built, giving a normal head of 9 ft. The power house has been built about 800 yards below the dam by which arrangement an additional head of approximately 3 ft. is obtained, so that a normal working head of 12 ft. has been secured.

New power house—Walkerton

The plant at present consists of a 150 kw. 2300 volt, 3-phase, 60-cycle generator operating at 120 r.p.m. The generator is a Swedish General Electric vertical type machine, with ball thrust bearing carrying the weight of the rotor and water wheel runner. The water wheel, which is direct connected, is William Kennedy manufacture. The exciter is a separate unit of sufficient capacity for a duplicate alternator, for which provision has been made in the power house.

Generator, switchboard, etc.—Walkerton

The Power Company are at present installing additional 125 street lamps. An order has also just been placed for a second machine of 75 kw. capacity which will be installed in the old power station and will be used for light load service as it is the intention to give a 24-hour supply. All the electrical equipment has been supplied and the new generator will also be furnished through Messrs. Kilmer, Pullen & Burnham, of Toronto.

Linking Up the Canadian Northern Transcontinental Lines

The Dominion of Canada will soon be equipped with a second completed transcontinental railway line. The process of building the Canadian Northern Railway has been unlike that by which the other transcontinental lines have been developed. It has been the policy of the Canadian Northern Company to build or acquire lines in widely separated parts of the Dominion and then in the course of time to link up these lines to form a continuous road.

Their first line was built from Gladstone to Dauphin, Man., in 1896 and since that more than 4,600 miles have been built from Port Arthur on Lake Superior to Edmonton Alta. In eastern Canada lines were acquired in Ontario and Quebec. To give a continuous line from tide water at Quebec to tide water at Vancouver, a great amount of railway construction has been undertaken and much has been completed. A line was built from Toronto north to Sudbury and beyond to Ruel. Another line was started from Toronto east to Ottawa. This latter line is nearly complete. Less than ten miles of track are yet to be laid. The portion connecting Sudbury with Port Arthur, and hence with the lines in the west, is almost complete and the construction men of the company assert that the line will be finished before December 31st. From Edmonton to the Pacific Coast the work is yet under way. By the end of July it is expected that steel will be laid to Albreda Summit through Yellowhead Pass, a distance of 350 miles from Edmonton. From Port Mann, situated at deep water on the Fraser river, grading and bridge work is so far advanced that the track layers should be at Kamloops, 243 miles on the way towards the Yellowhead Pass, towards the end of December. More than 80 per cent. of the grading in the direction of Kamloops and the line extending to Vancouver from Edmonton has been finished and 50 per cent. of the steel is laid. Early in June active work commenced on the line from Port Mann to New Westminster. This is but a short distance and is a part of the railway into Vancouver. The entrance to this latter city will include a tunnel 4 miles long to False Creek flats where the Canadian Northern Pacific passenger terminals will be located.

New Dock on Burrard Inlet

Additional details regarding the new public dock to be built by the Dominion Government on Burrard Inlet, between Salsbury and Commercial drives, at a cost of $500,000, have been made public. The dock will be of reinforced concrete with a concrete superstructure, and will be 800 feet long and 300 feet wide. Earth is to be excavated to a depth of 35 feet with reinforced concrete ribs, which may be filled with stone ballast. The coping of the dock will be 22 feet above water. It is expressly stated in the specifications that the excavations of earth and rock be removed by two separate operations of ordinary dredging and blasting, and the contractor will be paid at so much an hour a head for what material he actually removes. There will be a depth of 36 feet in the slips on each side of the slips. It is planned to build the dock in concrete stations 100 feet long and 39 feet high. These sections will be floated into position and then sunk at their proper places. Bulkheads of 12 by 12 timber will face off the dock. An interesting feature of the specifications is one providing for artificial light to enable night work to be carried on, which shows that the government intends to rush the work to completion in the shortest possible time. Bids will be received up to August 21.

The German Society of Engineers voted to present the Grashoff Memorial Medal to George Westinghouse, the inventor, of Pittsburg, Pa. Count Ferdinand Von Zeppelin is also a holder of this medal.

C. P. R. Conduit Construction

With a view of eliminating the overhead transmission lines of the C. P. R. telegraph company and simplifying the signal system in the yards from Delorimier Avenue and Notre Dame Street to Ontario Street, Montreal, the C. P. R. decided to lay conduits between those points. It is obviously difficult to handle signal work in a large railway yard from overhead construction; conduits do away with delays from ice and snow inevitable in pole work, and although the capital cost is larger, the maintenance charges are by no means as heavy. The contract was carried out by Dietrich, Limited, Montreal.

The whole installation is located between two main lines entering Place Viger station, and involved work under two bridges and over one subway. This point is a particularly busy one, and with the railway service being carried on during the entire period, the work was one of more than ordinary difficulty. The conduit is approximately one mile in length, and consists of 4-way vitrified clay duct laid in a complete envelope of concrete 3 in. thick. There are 16 concrete manholes 4 ft. x 5 ft. x 6 ft. inside measurement. The manhole space varies from 75 ft. to 575 ft., due to leads being taken off most of the manholes in order to operate the automatic signal system in the yards.

Laying Conduit in Hochelaga Yard, C.P.R., Montreal.

Almost from the start springs and quicksands were encountered, this necessitating the carrying of a 6 in. glazed tile drain for a distance of 2,600 feet. The drain was carried at a uniform depth of 6 feet from the surface, the entire yard being a grade of about one per cent. Fifteen pair 14 gauge, lead-covered, paper-insulated cable is used throughout.

Dietrich, Limited, have also completed the laying of two conduits in Toronto for the C. P. R. telegraph department. One on Dundas street west, Toronto, was notable for the large number of springs and quicksands, which involved the use of sheet piling throughout the job. In the other conduit, on Yonge street, the difficulty was due to the many wires and pipes. Besides gas and water mains, there were the lines of the Toronto Hydro, Toronto Electric Light Company, and the Bell Telephone Company, and a place had to be found for the C. P. R. conduit between these various wires and mains. The difficulties, however, were overcome, and the job successfully completed.

Further Plans Approved

The Quebec Public Utilities Commission, sitting in Montreal, have approved further plans of the Electrical Service Commission for placing wires underground. The conduits approved will be a continuation of those now being laid on St. Catherine street by Mr. G. M. Gest, the new section being from Guy to Atwater avenue; while the other conduits passed will run under Bleury street and Park avenue (from Craig street to Pine avenue).

Dr. Herdt, the chairman of the commission, explained the plans, stating that they might have to be varied a little as a great many obstructions were encountered that were not found in the city's records and street plans. At the corner of McGill College avenue and St. Catherine street (Mr. Gest's contract) they had an unusual amount of trouble on account of sewers and other pipes and conduits.

The new plans having been approved, tenders will be called for the construction of the conduits. The plans for the additional section of St. Catherine street are similar to those now being carried out, but a different system has been adopted for Bleury street. In conjunction with the civic conduits, one will be constructed for the Bell Telephone Company, the ducts being separated by 6 in. of concrete. The work will be carried out under the supervision of the Commission, the Bell Telephone paying the cost. In the civic conduits there will be a main run of 28 ducts with other laterals on the west side of the street, with a feed across at certain intersections to manholes on the east side, thence north and south for certain distances under the sidewalk for serving each building.

In connection with the Bleury street plan, a new lighting scheme will be installed, consisting of 41 standards. Police patrol and fire alarm standards will also be erected.

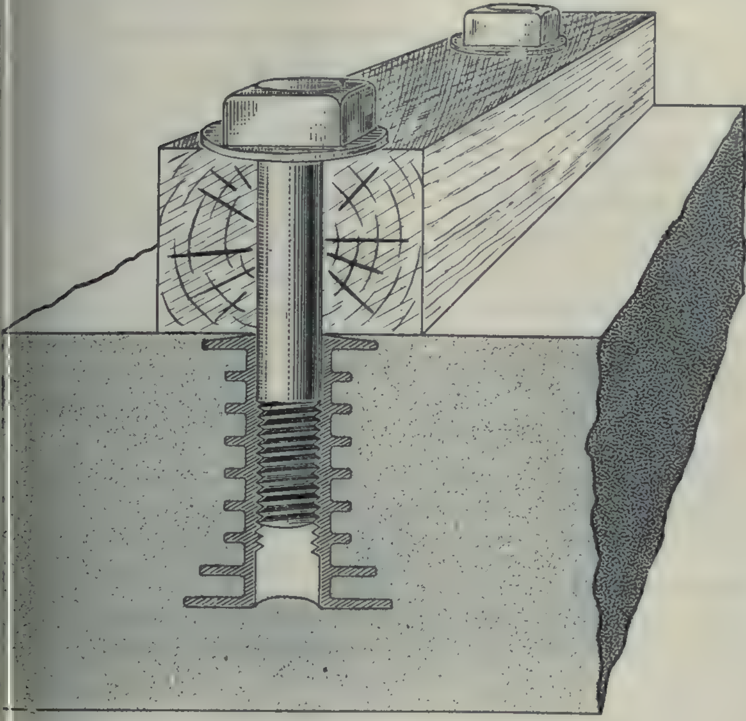
Westmount Conduit Work

The Westmount, P.Q., Council have awarded a contract to R. T. Smith & Company, Montreal, for the construction of a conduit on Western avenue. The conduit, designed by Mr. G. W. Thompson, the general manager of civic affairs, will be constructed of vitrified clay ducts, of 3½ in. square bore, and will cost about $25,000. It is probable that, in the future, the conduit will be linked up with the system which is now being carried out by the city of Montreal, under the direction of the Electrical Service Commission. Wires for the police call, lighting, fire alarms and any other lines through the city that may be required will be placed in the conduit. Manholes will be built in every section of the conduit. The ducts will be purchased by the council, and R. T. Smith & Company will carry out the work of laying. It is intended that the Western avenue conduit shall form part of a general system for the city, which will involve the removal of the poles. The amount to be expended at the present time will be charged to the surplus arising from the electric lighting department, and for this purpose the amount set aside against depreciation of the electric plant will be reduced from eight to four per cent. annually.

In connection with the scheme, the city are installing on the same avenue 50 standard inverted magnetite arc lamps, manufactured by the Canadian General Electric Company. These are 14 feet high, and will replace the present bracket arc lamps.

Fastening Masonry to Concrete Ceilings in Factories

Many engineers and those interested in the building and using of concrete ceilings for factories, will appreciate the practical working features of a plan herewith illustrated for installing threaded inserts at regular intervals in ceilings when the mixture is being poured, the threaded devices being then available after the wood forms are removed and the concrete hardened for fastening 2 x 4's or 4 x 4's in any layout desired.



Cut through section, 4 x 4 fastened by inserts.

The finish is neat and does not detract from the smoothness of the wall and is better than any plan which involves drilling holes after the concrete has hardened. The insert acts as a re-inforced hole as strong as the ceiling itself.

The illustration shows a cut-through section of a 4 x 4 fastened by means of the inserts and ordinary machine bolts. The 4 x 4 is attached every two feet. Shafting or machinery is then fastened to the timbers in the ordinary way.

One prime advantage of including this arrangement of inserts in plans for a factory ceiling is that the timbers can be changed around or replaced with little trouble and without drilling new holes, and greater strength and security is obtained.

Personal Mention

Messrs. Robert W. Hunt & Company, Limited, announce that Mr. C. W. Gennet, Jr., has assumed the duties of Treasurer and Manager at their principal office in the McGill Building, Monteral. Mr. Gennet has heretofore been in charge of the parent Company's Bureau of Inspection of Rails and Fastenings at the home office in Chicago.

Arthur H. Blanchard, M. Can. Soc. C. E., Professor of Highway Engineering in Columbia University, has returned from Europe where he attended the London Congress of the Permanent International Association of Road Congresses as a delegate from the State of New York and several societies. After the adjournment of the Congress Professor Blanchard made an investigation of various pavements and roads in England, France and Germany.

Many engineers and contractors whose business relations have brought them in contact with the Hamilton and Toronto Sewer Pipe Company will hear with profoundest regret of the death of Mr. Daniel New, for several years president and managing director of the above company. Though in ill-health for the past year Mr. New was not kept from active work until a few weeks ago. His death occurred on Thursday, July 17. One son, Mr. Hyland H. New, and a brother, Mr. Jno. New, both of Toronto, survive, as well as a brother in Hamilton.

Chief Architect Ewart, of the Public Works Department, has left Ottawa for a trip of official inspection which will take him across Canada. Mr. Ewart will go as far as Vancouver and will stop at all places where important public works are in progress and look them over. The department has at present several large undertakings under way in the west and more of them planned, such as large dry docks on the Pacific coast, internal storage elevators at various western points and some large public buildings.

The following are among the Canadians who registered recently at the Office of the High Commissioner of Canada in London:—Mr. W. E. Robertson, of Messrs. R. Robertson & Sons, Limited, contractors, Toronto; Mr. W. F. Tye (Past President of the Canadian Society of Civil Engineers), Toronto; Messrs. A. T. Laing, John McGowan and Peter Gillespie, of the University of Toronto; Messrs. A. R. Holden and R. C. Holden, Montreal, and Mr. David C. Dick, of Coburg, Ont.

Builders' Exchange Picnic

The annual picnic of the Toronto Builders' Exchange, held Tuesday, July 22nd, at Queenston Heights, was a most enjoyable outing. About two hundred members and their families left on the nine o'clock boat for the Heights. Upon their arrival luncheon was eaten and the amusements followed. Races which gave all ages and both sexes an opportunity to display their fleetness and skill were run off. Perhaps the most exciting event was the baseball match between the East and the West. The East was captained by Mr. Chas. Bulley, and the West by Mr. J. M. Scott. After six strenuous innings the West was declared winner by a score of 17 to 10. The party returned to Toronto by the nine o'clock boat delighted with their outing on the historic Canadian field.

Mainly Constructional

The News in Brief—From Coast to Coast

The Montreal Board of Control has voted the clerks in the building department an increase of $50 each, the assistant building inspectors $100 each, and the plumbing inspectors from $75 to $100 each.

The new Equitable Life Insurance Building in New York, 38 storeys high, will contain approximately 36,000 tons of structural steel, the inspection of which, both mill and shop, has been intrusted to Robert W. Hunt & Company, general offices, Chicago.

An English company has made a proposal to the city of Toronto that the new mechanical filtration plant be installed adjoining the main pumping station at the foot of John street. They offer to put in a complete plant at a cost of $1,500,000.

Building permits at Winnipeg for the year have exceeded $10,000,000. It is expected that the work of erecting the Pantages Theatre, which will cost $180,000, will soon be proceeded with.

The Dominion Brick Company, Limited, of Tofield, Alta., has completed the installation of its machinery and is proceeding with the manufacture of brick. The company anticipates the initial output to be 20,000 per day.

It is expected that the total value of assessable real estate in Montreal for the current year will reach approximately $725,000,000. As a comparison it is interesting to note that the figures in 1904 and 1909 were $207,338,500 and $329,933,900 respectively.

It is stated that the city of Edmonton needs over $60,000,000 to carry out local improvement work generally and that $15,000,000 of this is urgently required. This latter amount includes $6,000,000 for sewers, $4,500,000 for paving and $3,000,000 for water.

Tracklaying crews of the Grand Trunk Pacific will reach Smithers, the first division point east of Prince Rupert, in a few days, according to the latest reports of construction engineers. The new transcontinental line is expected to have trains running regularly between this point and Prince Rupert before the close of August.

The city of Toronto will install a new garbage disposal system next spring at a cost of one million dollars. The systems calls for the construction of an incineration and reduction plant, together with four loading stations. It is estimated that the cost of operating for the first year will amount to $12,500 with a slight reduction after that.

We desire to acknowledge the receipt of the Municipal Handbook of the City of Toronto for the year 1913. This booklet contains a great deal of valuable information with regard to the city of Toronto, its officials and organizations. The matter is well arranged for reference and will prove very helpful to those requiring information concerning civic affairs.

A membership campaign is now being carried on by the Builders' Exchange of the city of Montreal, for the purpose of inducing builders to participate in the benefits of the organization. The campaign will continue until August 7. The membership in the Exchange stands at 300, but it is believed this number can be augmented by another 200 firms directly or indirectly connected with the building trade.

The civil service commissioners have announced that applications will be received up to August 4th from candidates qualified to fill the following positions in the inside division of the civil service of Canada. An assistant engineer in the department of railways and canals, subdivision A. of the first division, initial salary $2,800 per annum. An assistant civil engineer in the department of railways and canals, subdivision B of the first division, initial salary $2,400 per annum. An assistant civil engineer in the department of railways and canals, subdivision B of the first division, initial salary $2,100 per annum.

The Federal Government have awarded the contract for the proposed dry dock at St. Joseph de Levis, Quebec, to M. P. and J. T. Davis, at the price of $2,721,116, which was $700,000 lower than the estimates of the Government engineers. Messrs. Davis have the advantage of a large amount of plant on the ground, as they are the contractors for the sub-structure of the Quebec bridge and also for the Quebec section of the Transcontinental Railway. It is understood that two English, three Canadian and one American firms put in bids. The dock will be 1,150 feet long and 120 feet wide, and will accommodate two of the largest vessels on the St. Lawrence route.

The Dominion Government has expropriated over 200 acres of land in Grantham Township for the first section of the new Welland Canal. The price to be paid for some of the land will run as high as $1,000, while it is understood that the average price will be $500 an acre.

The architects who have been entrusted with the work of preparing plans for the new Union Station at Toronto, have just completed an extensive tour of the most modern stations in the United States in search of suggestions. Those engaged in this work are Messrs. H. R. Safford, Chief Engineer of the G. T. R.; J. M. R. Fairbairn, Chief Engineer of the C. P. R.; J. R. W. Ambrose, Grade Separation Engineer of the G. T. R.; G. A. Ross and H. G. Jones, of Montreal, architects, and J. M. Lyall, architect, of Toronto.

The G. T. P. mainline to Prince Rupert will be ready for business by the first of June, 1914, and it is understood that this connection with Montreal will be made over the Temiskaming Railway, the G. T. P. having obtained running rights over the Ontario Government system. A year later, or about the first of July, 1913, the G. T. P. trains will be able to enter Montreal over what will be practically their Montreal branch, which is being built by the North Railway Company, from the city to the crossing of the Transcontinental at Bell River.

An order has been placed recently by the Grand Trunk Railway for 75 of the most up-to-date locomotives. Fifty of them will be used on the Canadian lines, while the other 25 will be used in the United States. These locomotives will be of the most modern type, and the largest in the country. They will cost $25,000 each, so that the company will pay out $1,875,000 with the next year for motive power. Most of them will be built in the Montreal shops, and some in Philadelphia. The work will entail the employment of many hundreds of men.

The first work of building and developing, on an extensive scale, public highways through the timber country near Fort William and Port Arthur has proved even more successful than had been anticipated either by the Ontario Government, which has projected the development, or the men who are supervising . Some two hundred men and forty teams are now constructing and putting into shape roads in the vicinity of Fort William. One highway that will be completed this autumn is the Pigeon River road, which will be run through to the international boundary, where it will connect with a road being built in Minnesota northward from Duluth.

The Ontario Provincial Government will build over one thousand miles of colonization roads this season. At present gangs totalling 4,500 men are pushing work with all possible speed. The work is in the hands of some 650 overseers, but it is the intention to increase this number to some 300. Three thousand additional men will be set to work cutting out, ditching and grading. The twenty provincial inspectors who have the oversight of the whole work report that the conditions, labor and constructive work were never more satisfactory than at present. Since the latter part of April 800 miles have been completed.

The rather unique and decidedly interesting catalogue of the Ceresit Waterproofing Company has come to hand. This catalogue should prove of very great interest to all users of cement. Since this latter form of building material has come into general use there have been many attempts to make it absolutely waterproof. The Ceresit Company claim to have accomplished this task. The company asserts for its paste that it is moisture proof, pressure proof and does not in any way discolor the concrete. The Ceresit Waterproofing Co. will be pleased to forward their catalogue to any sending in a request to their offices at 446 Commercial National Bank Building, Cor. Adams and Clarke Streets, Chicago.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.
Cement walks, Echo Place, planned by Brantford Twp. Council from city limits to Echo Place. Clerk, J. A. Smith, Brantford.

Galt, Ont.

Huntingdon, Que.
Macadamizing roads for Village Council. Tenders received by Sec.-Treas., R. S. Feeny, until August 2nd, for macadamizing 4 miles roads. Plans, etc., at office of Sec.-Treas.

Laval des Rapides, Que.
Waterworks, cost $26,000, planned by Town Council. Engineers, Ouimet & Lesage, 76 St. Gabriel Street, Montreal. Pumping station, 1 electric pump, 70 h.p.; 1 gasoline pump, 70 h.p.; 1 electric pump, 20 h.p.; 1 gasoline pump, 20 h.p. Water pipes, filtration plant, etc. Specifications and plans at office of Engineers. Tenders called as soon as money is voted.

Montreal, Que.
Tenders received by Board of Commissioners, Secretary, L. N. Senecal, until August 5th for construction of a granite block pavement on Cote St. Paul Rd., from Notre Dame St. to Lachine Canal. Engineer, Geo. Janin, City Hall.

Roads and sewers planned, Mt. Royal Tunnel City. Mayor, T. S. Darling, 230 St. James St., Montreal. Tenders will be called about August 15th, for asphalt roads, stone supplied by owners.

Peterboro, Ont.
Sewer, cost $13,250, planned by City Council. Clerk, S. R. Armstrong. City Engineer, R. H. Parsons, City Hall.

St. Anicet, Que.
Tenders received by Sec.-Treas., Jos. Racine, until August 4th, for macadamizing 21 miles of roadway.

St. Hyacinthe, Que.
Gravity filters, cost $60,000, planned by City Council. Mayor, P. F. Ryan, Chairman Waterworks Board, Elie Bourbeau. Supt. of Board, A. Measier. Engineer, J. O. Meadows, c/o Montreal Water & Power Co., Montreal. Gravity filters, 2,000,000 imp. gals., sedimentation basin, 1 electric pump and 1 steam pump low life, each 2,000,000 gals. By-law to be submitted. Tenders will be called after August 1st.

Toronto, Ont.
Sewers for Board of Control. Tenders received by Mayor, H. C. Hocken, City Hall, until August 5th, for laying sewers on a number of streets from Beverley to Yonge, and from Yonge to Sumach. Plans at office of Waterworks Section, Dept. of Works, City Hall.

Welland, Ont.
Sewers planned by Town Council. Chairman Sewage Committee, James Hughes. Engineer, D. T. Black. Tenders received by Clerk, C. M. Webber, until August 4th. Separate sewers on Maple and Oakland Aves., William, Asher, River, Duncan, Cody and John Sts. Plans at office of Engineer and Contract Record, 220 King W., Toronto.

CONTRACTS AWARDED

Brockville, Ont.
Asphalt pavement, cost $20,000, Perth St. Mayor, John MacKenzie. Clerk, Geo. Dewey. Engineer, Geo. Bryson. General contractors, The Godson Contracting Co., Ltd., Manning Chambers, Toronto. For pavement from King St. to the G. T. R. a distance of 7 blocks.

Montreal, Que.
Electric pump, cost $6,356, High Level Reservoir. Engineer, T. W. Lesage, Supt. of Waterworks. General contractors, Can. Allis-Chalmers Co., 613 Can. Express Bldg. Board of Commissioners, Secretary, L. N. Senecal.

Water main, cost $8,400, McTavish, for Board of Commissioners. Sec., L. N. Senecal. Engineer, T. W. Lesage, Waterworks Dept. General contractors, Gilbert, Paye & Co., 2065 Chateaubriand.

Winnipeg, Man.
Asphalt pavement planned by Board of Control. Sec., M. Peterson. General contractor, J. W. Astley, Engineer of Construction, City Yards, at $676.45 for laying No. 2 asphalt pavement on Wentworth St. from Grosvenor Ave to 1st lane north.

Valves. General contractors, Drummond McCall & Co., Ltd., Montreal, for gate valves for connections to new 18,000 gal. reservoir. Two 18 in. gate valves, at $145; 1-30 in. gate valve, at $405; 3-36 in. gate valves, at $630. Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Railroads, Bridges and Wharves

Aurora, Ont.
Bridge. Clerk, R. W. Phillips, 57 Adelaide E., Toronto. Engineer, Frank Barber, 57 Adelaide E., Toronto. Tenders received by Engineer until August 6th, for reinforced concrete beam bridge on Yonge St., North of Aurora. Plans at office of Engineer.

Calgary, Alta.
New C. P. R. stations will be built on the Vegreville-Calgary line at Rise Deer, Benyou, Redland, Rockyford, Barntill, Hawick, Lyall, Norfolk, Cheslermere Lake and Barlow. On the Saskatoon-Calgary Line at Excel, Cereal, Chiriook, Dobson, Youngestown, Stanmore, Richdale and Modena.

Bridges planned by City Council. Removal of Louise Bridge to 15th St., cost $82,000; concrete bridge at 4th St. W., cost $82,000; Bow River, concrete, cost $319,000, and 9th St. W., concrete, cost $173,000. By-laws to be submitted. Clerk, J. M. Miller. Engineer, Geo. Craig.

Cheverie, N.S.
Extension to wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Aug. 14th. Plans, specifications, etc., at office of W. P. Morrison, Acting Dist. Engineer, Halifax, N.S., E. G. Millidge, Dist. Engineer, Antigonish, Postmaster, Cheverie, and Dept. Ottawa.

Elmwood, Ont.
Steel bridge, for Co. Grey. Tenders received by Alex. Wilson, Elmwood, until August 11th, for steel bridge and concrete abutments 90 90 ft. C to C. Plans at office of Henry Metcalfe, Hanover, and James Warren, Walkerton, Ont.

Inglewood, Ont.
C. P. R. Co. has been authorized to reconstruct bridge No. 18.1 near Inglewood station, Twp. Chingwacousy, Ont., Div. Orangeville Sub-div.

Island River, N.B.
Dredging, Gloucester Co., for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Aug. 5th. Plans, etc., at Dept., Ottawa.

Kenora, Ont.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Ont., Dom. Govt. Dept. of Public Works, until Aug. 14th. Plans, specifications, etc., at office of F. G. Harcourt, Dist. Engineer, Port Arthur, J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Postmaster, Kenora and Dept., Ottawa.

Langstaff, Ont.
Bridge. Clerk, R. W. Phillips, 57 Adelaide E., Toronto. Engineer, Frank Barber, 57 Adelaide E., Toronto. Tenders received by Engineer, until Aug. 6th, for reinforced concrete culvert.

Lansdowne, Man.
Bridge, over White Mud River, for Rural Municipality of Lansdowne. Sec.-Treas., M. E. Boughton, Arden, Man. For steel truss bridge over White Mud River, between Sec. 11, 12, 13, 14 and 15 miles south of Keyes Station C. P. R. Abutments and wing walls of reinforced concrete construction. Length 60 ft. Separate tenders may be submitted. Plans, specifications, etc., at offices of Sec.-Treas., and Dept. of Public Works, Winnipeg. Tenders received by Sec.-Treas. till 10 a.m. Aug. 6th.

McKillop Twp., Ont.
Drain planned. Tenders received by Clerk, M. Murdie, Winthrop, until Aug. 13th.

Metcalfe & Ekfrid Twps., Ont.
Improvements to "Kettlewell" tile drains planned. Tenders received by Clerk, Richard Ward, Strathroy, Ont., until Aug. 2nd.

Moose Jaw, Sask.
C. P. R. Co. authorized to construct

additional line, mileages 1-15.38 from Broadview. Div. engineer, T. Martin.

Newcastle, N.B.
Wharf, cost $10,000, contemplated by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineers now working on plans.

Ottawa, Ont.
C. P. R. Co. has been authorized to construct spur for Watson & Todd, Ltd.

Province of Quebec.
Bridge, cost $6,000, over St. Francis River, for Municipal Council of D'Israeli. Mayor, D. Binet. Plans, etc., at offices of sec.-treas. One span, 100 x 17, concrete, steel and 4-in. rod pine.

Bridge, over Lacroix Creek, planned by Municipal Council, Gracefield Township. Mayor, T. W. Perras. Plans, etc., at office of sec.-treas., E. Mercier. One span, 180 x 17, concrete, steel and 4-in. red pine.

Bridge, over White River, for Municipal Council of St. Celestin. Mayor, Jos. Ed. Noel. Sec.-Treas., Calixte Doneau. Plans, etc., at office of Sec.-Treas. One span, 70 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $5,600, Fraser Bridge, for Municipal Council of Cap St. Ignace. Mayor, A. Methot. Sec.-Treas., Jos. Boissinot. Plans, etc., at office of Sec.-Treas. One span, 100 x 17, concrete, steel and 4 in. red pine.

Bridge, over Island Brook, for Municipal Council of Newport Twp. Mayor, H. A. Stevenson. Sec.-Treas., A. S. Farnsworth. Plans, etc., at office of Sec.-Treas. One span, 30 x 28, concrete, 10-18 in. I beams, steel and 4 in. red pine.

Bridge, cost $3,000, over Senoscouk River, for Municipal Council of St. Hubert. Mayor, H. Dalloine. Sec.-Treas., Ep. Michaud. Plans, etc., at office of Sec.-Treas. One span, 45 x 17, concrete, steel and 4 in. red pine.

Bridge, over Red River, for Municipal Council of Coteau du Lac. Mayor, Dr. Elz. Deguire. Sec.-Treas., A. Dauth. Plans, etc., at office of Sec.-Treas. One span, 75 x 17, concrete, steel and 4 in. red pine. Plans drawn.

Bridge, cost $10,250, over large Creek, planned by Municipal Council of St. Hugues. Mayor, Jos. Picard. Plans, etc., at office of Sec.-Treas., W. Meloncon. One span, 30 x 16, concrete, 5-18 in. I-beams, 55 lbs., 34 ft. long, steel and 4 in. red pine.

Bridge, cost $4,400, planned by Municipal Council of Ste. Catherine. Mayor, J. Henchey. Plans, etc., at office of Sec.-Treas. One span, 40 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $7,600, over Bain's Creek, planned by Municipal Council of Gracefield Twp. Mayor, F. W. Perras. Plans, etc., at office of Sec.-Treas., E. Mercier. One span, 60 x 17, concrete, steel and 4 in. red pine.

Two bridges, cost $11,000, over Harvey Canal, planned by Municipal Council of St. Henri de Faillon. Mayor, Philippe Villeneuve. Plans, etc., at office of Sec.-Treas., Jos. Marcotte. Three spans, 30 x 17, 75 x 17, 80 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $7,000, over Peribonka Falls, for Municipal Council of St. Henri de Failon. Mayor, Philippe Villeneuve. Plans, etc., at office of Sec.-Treas., Jos. Marcotte. One span, 190 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $6,100, Wattopkah River, planned by Municipal Council of Windsor Mills. Mayor, A. Frudeau. Plans, etc., at office of Sec.-Treas., J. A. Begin. One span, 140 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $3,260, over Colbert Discharge, planned by Municipal Council of Baie du Febvre. Major, Octave Lemire. Plans, etc., at office of Sec.-Treas., N. U. Frechette. One span, 30 x 16, concrete, 5-18 in. I-beams, steel and 4 in. red pine.

Bridge, cost $4,300, over Green River, for Municipal Council of L'Ile Verte. Sec.-Treas., J. J. Lapointe. Plans, etc., at office of Sec.-Treas. One span, 125 x 17, concrete, steel and 4 in. red pine.

Rustico, P.E.I.
Dredging harbor. Tenders received by Secretary, R. C. Desrochers, Dom. Govt., Dept. of Public Works, Ottawa, until August 6th. Specifications and plans at Department, Ottawa.

Rochester Twp., Ont.
Eight bridges planned by Twp. Council. Clerk, M. N. Mousseau, S. Woodslee, Ont. Engineer, James Laird, Essex. By-law to be submitted Aug. 16th. Steel and concrete construction.

St. Catharines, Ont.
Electric railway for C. P. R. Div. Frt. Agent, E. N. Todd. City Council asked to aid construction of line from Hamilton to Niagara Falls.

Scott, Que.
Steel bridge, over Chaudiere River, for County of Beauce. Engineer-in-charge, L. A. Valloe, 80 St. Cyrille St., Que. Tenders received by Sec.-Treas. of Scott, until August 1st. Bridge over river between Parishes of Scott and St. Bernard, Beauce County.

Toronto, Ont.
Railway building, cost $28,000, West Toronto, planned for C. P. R. Co. New Repair shop. Steel, brick and concrete construction.

Station and viaduct, cost $5,000,000, planned for C. P. Rly. and G. T. Rly., Head office, Montreal. Architects, Ross & McDonald, 1 Belmont St., Montreal, and Traders Bank, Toronto. Work to commence about February, 1914. Brick, concrete and structural steel construction.

Scarboro Twp. will build new steel and concrete bridge near Scarboro Golf Club Grounds. Clerk, Thos. Crawford, Agincourt.

Vancouver, B.C.
Dock, cost $750,000, foot of Salisbury Drive. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans, specifications, etc., at offices of C. C. Worsfold, Dist. Engineer, Victoria, Dist. Engineer, Confed. Life Bldg, Toronto, and J. L. Michaud, Dist. Engineer, Post Office Bldg., Montreal, Postmaster, Vancouver and Dept., Ottawa. Tenders received by Sec. till Aug. 21st.

Walkerton, Ont.
Bridge flooring for Town Council. Chairman of Commission, A. E. McNale. Tenders received by Chairman until Aug. 4th, for recovering East End bridge, steel and cedar flooring.

West St. John, N.B.
Dredging, for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Aug. 5th, for dredging at Wellington and Nelson Slips and Navy Island, St. John Harbor, N.B. Tenders to include towing of plant to and from the work. Specifications and plans at Dept., Ottawa.

Winnipeg, Man.
Station, cost $35,000, St. Boniface (Desmeuron St., for Canadian Northern Rly. Co. Two storeys and basement, pressed brick construction, stone foundation, tile and maple floors, shingle roofing. Plans drawn.

CONTRACTS AWARDED

Collingwood, Ont.
Dredging planned by Dom. Govt., Department of Public Works, Secretary, R C. Desrochers, Ottawa, Ont. General contractor, C. S. Boone Dredging & Construction Co., Ltd., 17½ Adelaide St. E., Toronto, Ont.

Colborne, Ont.
Station planned for C. P. R. Work in charge of B. Beatty, Coldwater. 24 x 98, frame and roughcast construction, cement foundation.

Digby, N.S.
Dredging. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Maritime Dredging & Construction Co., St. John, N.B.

Killarney, Ont.
Dredging, cost $8,000, Dom. Government, Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractors, C. S. Boone Dredging & Construction Co., Ltd., 17½ Adelaide St. E., Toronto, Ont.

Levis, Que.
Dry docks planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, M. P. & J. T. Davis, Levis.

Ottawa, Ont.
Booster building, cost $6,000, Centre, for Ottawa Elec. Rly., Albert St. Architect, J. Albert Ewart, 193 Sparks St. General contractor and mason, Geo. Crain, Clemow Ave. Steel, Dom. Bridge Co., Sparks St. Tin, McFarlane & Douglas, 1250 Slater. Painting, Geo. Higman & Sons, 176 Rideau. Plumbing, McKinley & Northwood, Rideau. Electrical, Company.

Prov. of Quebec
Bridge, cost $22,500, over Jesus River, for Municipalities of Terrebonne and Ste. Rose. Mayor, Terrebonne, Ernest Mathieu. Sec.-Treas., Terrebonne, Amedee Jasmin. Mayor, St. Rose, Jos. Charbonneau. Sec.-Treas., St. Rose, Henri Chapleau. Plans, etc., at office of Sec.-Treas. Three spans, each 165 x 17, concrete steel and 4 in. red pine.

St. Catharines, Ont.
Welland canal, cost $3,500,000. Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, Dominion Dredging Co., Ltd., 17½ Elgin St., Ottawa. Contract for Sec. No. 1 Welland Canal. Other tenders to be called shortly.

Stratford, Ont.
Bridge, cost $2,400, Romeo. City Council. Mayor, C. N. Greenwood. En-

gineer-in-charge, A. B. Manson, City Hall. General contractors, Stratford Bridge & Iron Works.

Public Buildings, Churches Schools, etc.

Calgary, Alta.
R. C. Diocese are contemplating erecting church and priests house on their property in west end of city. Architect has not yet been appointed.

Edmonton, Alta.
Club and apartments, cost $200,000, 2nd and Victoria, for Northern Club, Jasper Ave. Architects, Magoon & MacDonald, 604 Tegler Block. Work has stopped temporiarily. Seven storeys, 50 x 150. Foundations in.

Estevan, Sask.
Church for R. C. Congregation. Tenders received by Rev. C. Soquet from whom plans and specifications may be obtained.

Fort William, Ont.
Addition to orphanage, Franklyn, for Roman Catholic Denomination. Architect, H. Russell Halton, Room 7, Stanley Block, Port Arthur, Ont. Tenders received by architect. 3½-storeys, 50 x 100.

Fredericton, N.B.
School, cost $40,000. Sec., Chas. Sampson. Architect, F. Neil Brodie, 42 Princess, St. John. Two storeys, cement foundation, pressed and stock brick construction. Plans in progress.

Le Pas, Man.
Court house planned by Prov. Govt. Prov. Architect, V. W. Horwood, 261 Fort Street, Winnipeg, has been instructed to prepare plans at once.

Medicine Hat, Alta.
Public market, contemplated by City Council. Clerk, H. Baker. Debenture by-law to be voted on Aug. 12th.

Citadel, cost $20,000, for Salvation Army. Tenders received by Architect, Major Miller, Salvation Army, Toronto. Three storeys.

Milner, B.C.
Tenders received by Minister, Hon. Thos. Taylor, Victoria, Prov. Govt. Dept. of Public Works, until August 4th, for construction of a 2-roomed school building. Plans, specifications, etc., at office of S. A. Fletcher, Govt. Agent, New Westminster, R. A. Paynes, Sec. of School Board, Murrayville, and Dept., Victoria.

Montreal, Que.
Church and presbytery, cost $200,000, Delorimier and Gilford, for St. Dominic's Parish. Architect, Raoul Gariepy, 25 St. James St. Tenders will be received by wardens of St. Dominic's Church, c/o Architect. Two Oxford-Gurney 8 x 10 water boilers or equivalent and 1 galvanized iron boiler, 50 gal. required. 70 ft., 200 x 85, concrete, brick and Montreal stone foundation, Montreal rough stone, limestone, brick and steel beams, terra cotta, structural steel and cast iron templates.

City Hall alterations, cost $10,000, Longueuil (St. Charles). Architect, Alf. Prefontaine, Longueuil. Electric wiring to be done under supervision of Louis Lesuier, Town Engineer.

Booth memorial hospital, cost $150,000, Outremont (Outremont and Just Ave.), for Salvation Army, 341 University. Architect, Major Miller, 20 Albert St., Toronto. 3½-storeys, basement and wings, cement foundation, Montreal stone, terra cotta, tile and brick construction. Plans in progress. Work to start in spring of 1914.

North Sydney, C.B.
Church for Calvary Baptists. Chairman Bldg. Com., F. L. Kelly. Architect, Leslie R. Fairn, Aylesford, N.S. Tenders received by Chairman up to 8 o'clock August 20th for erection of church bldg. Plans and specifications with H. E. Whitman, Commercial street, North Sydney, and with architect.

Newcastle, N.B.
Sunday school, cost $5,000, for Presbyterian Church. Chairman of Committee, E. A. McCurdy. Wood or concrete construction, concrete foundation. Tenders will be called shortly.

Newmarket, Ont.
Building for County Industrial Home Commissioners. Plans, specifications, etc., at J. G. Cornell's Kingston Road, Scarboro, J. S. McNair's Elgin Mills, Commissioners, at the home, Newmarket, and at office of County Clerk, Toronto. Bulk tenders received by J. G. Cornell, Scarboro P. O. until Aug. 1st.

New Westminster, B.C.
Public building. Residential Architect, Wm. Henderson, Victoria. Tenders received by Sec., R. C. Desrochers, Dom. Govt. Dept. of Public Works, until Aug. 12th. Plans, specifications, etc., at office of Secretary, Architect or Post Master, New Westminster.

Province of Ontario
Three wireless telegraph stations, cost $25,000 each, planned by Marconi Telegraph Co., 137 McGill St., Montreal. Builders, Owners. Stations on Lake Ontario and Lake Erie, each includes 1 steel tubular mast 250 ft. high and about 2 ft. diameter, 2 residences, 8-rooms each, operating house, about 30 x 25, concrete construction, engines and dynamos 8 h.p. capacity.

Ottawa, Ont.
Theatre, Albert St., for J. H. Ferguson, 590 Gilmour St. Architect, A. L. Weeks, 75 Sparks St. Building to include theatre, stores, offices and apartments. Plans prepared.

Police station, cost $150,000 to $200,000, contemplated by the City Council. Chief Commissioner, Mayor, J. A. Ellis.

Addition to No. 1 Salvation Army citadel, cost $7,000, Slater. Tenders received by Architect, Major Miller, Salvation Army, Toronto. Brick foundation and construction.

Picton, Ont.
New hall, cost $4,000, for Salvation Army. Three storeys. Tenders received by Architect, Major Miller, Salvation Army, Toronto.

Point Grey, B.C.
Incineration for Municipal Council. Clerk, G. G. Heighway, Kerrisdale. Tenders received by Council at Kerrisdale till 5 p.m. Aug. 18th, 1913, for erection of incinerator of 25 tons, including smoke stack. Floors to be strong enough to carry 10-ton truck.

Quebec, Que.
Poultry building, Exhibition Grounds, planned by Prov. Govt. Exhibition Board. Architect, J. L. Pinsonneault, City Hall. Tenders will be called shortly.

Hospital for contagious diseases planned by the city. Architect, J. Leon Pinsonneault, City Architect, City Hall, Que.

St. Catharines, Ont.
Moving picture theatre, cost $5,000, St. Paul street. Architect, Joseph Daw, 165 St. Paul street. One storey, frame construction, 150 x 77. Plans in progress.

Sault Ste. Marie, Ont.
Addition to children's shelter, cost $10,000, contemplated by Children's Aid Society, Soo and Algoma. Building committee, Mayor T. E. Simpson, President; Dr. Shannon , M. Sherridan, R. Brydes, J. P. Reid, Inspector. One storey addition and wing, reinforced concrete and stone construction. Plans in progress.

St. John, N.B.
Incinerator, cost $55,000, for City Council. Clerk, H. E. Wardroper. Commissioner of Works, M. E. Agar. Work held up indefinitely.

Alterations and addition to court house, cost $100,000, for City Council. Clerk, H. E. Wardroper. Commissioner of Works, M. E. Agar. Three storeys, stone construction, etc. Indefinitely postponed.

Remodelling No. 3 army hall, cost $3,000, Bringley street. Tenders received by Architect, Major Miller, Salvation Army, Toronto. Three storeys, frame construction.

Toronto, Ont.
Library and entrance, cost $5,000, for St. Patrick's Church, McCaul street. Architect, J. P. Hynes, 199 Yonge St., tenders in. Contract will be awarded shortly. One storey, 24 x 32, structural steel and brick construction, cement foundation.

Church and sunday school, cost $50,000, for Howard Park Methodist Church, Sunnyside and Marmaduke. Architect, W. G. Burns, 74 Indian Grove. Tenders called in a week's time for masonry, carpentry, roofing and plumbing, other trades later. Two storeys, 54 x 108, steel, stone construction, stone foundation.

Lodging house, cost $100,000, Queen E., planned for Salvation Army. Architect, Major Miller, Salvation Army, Toronto. Fireproof construction. Modern equipped lodging house to accommodate 500 men.

Park pavilion, cost $3,500, High Park, planned by Parks Dept., City Hall. Architect, G. Gouinlock, Temple Bldg. One storey, 40 x 56, brick construction, concrete foundation. Plans drawn.

Alterations to church, cost $20,000, Arthur and Grace, for St. Francis R. C. Church, Arthur St. Tenders received by Architect, J. P Hynes, 199 Yonge St. One storey, 40 x 40, terra cotta, stone and brick construction, stone foundation.

Vancouver, B.C.
Industrial home, cost $30,000, Lansdowne Ave., for Salvation Army. Tenders received by Architect, Major Miller, Salvation Army, Toronto. Three stys.

Victoria, B.C.
Theatre, cost $125,000, Government and Comorant Sts., for Elliott, McPherson & Fullerton, c/o Architect, Jesse M. Warren, 503 Central Bldg. Blass B construction, brick and steel, 1 balcony, 14 boxes, latest ventilation system, steam heating, electric lighting, accommoda-

tion for 1,000 people. Equipment required.' Plans in progress.

Wallace, N.S.
School, cost $5,000, planned. Further information from Sec. School Board. Two storeys, frame construction, stone foundation, shingle roofing, hot air heating seating.

Welland, Ont.
High school, cost $60,000, West Main St. Sec., W. H. Lowe. Chairman, A. J. J. Brennan. Architect, D. J. Forbes, Temple Bldg. Two storeys, 130 x 67, cement foundation, brick, structural steel and artificial stone construction.

Winnipeg, Man.
Theatre planned for Canadian Provincial Theatres, Ltd. Manager, Wm. Hill, 901 Lindsay Bldg. Company intend to build chain of theatres throughout Canada.

New wing, cost $8,000, Balmoral Lodge, for Salvation Army. Tenders received by Architect, Major Miller, Salvation Army, Toronto. Three storeys.

CONTRACTS AWARDED

Armstrong, B.C.
Drill Hall, Dom. Govt., Department of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. General contractors, Campbell & Wilkie, 615 Pender St. W., Vancouver, 40 x 80, brick construction.

Amherst, N.S.
Citadel, cost $6,000, Princess St., for Salvation Army, Toronto. Architect, Major Miller, Salvation Army, Toronto. General contractors, Victor Woodworking Co., Ltd. Three storeys, brick veneer construction.

Berlin, Ont.
Theatre, cost $125,000. Architects and Owners, Griffin Amusement Co., 8 Queen E., Toronto. Work will be done by day labor and will start about Aug. 20th.

Bury, Que.
Drill hall, cost $11,750, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Ayton Cromwell, Cookshire, Que.

Bridgeburg, Ont.
Moving picture theatre, Dufferin St., for Butler Bros., Chicago, Ill. General contractor, O. C. Teal, Bridgeburg. One storey, 30 x 100, frame construction. Foundations in.

Brockville, Ont.
Technical school addition, cost $3,000, planned by Board of Education. Builder and general contractor, H. Dunham. Two storeys, cement block construction, stone foundation.

Calgary, Alta.
Church, cost $25,700, Riverside, for German Evangelical Lutheran Church. Architect, Geo. Dowler, Alexander Corner. General contractors, Conrad Rohl, Box 1153. Two storeys, 46 x 110, brick construction, cement foundation.

Colgate, Sask.
School, cost $6,500, for Town Council. General contractors, Frank Rooney, Weyburn. Two storeys, brick construction, cement foundation.

Coquitlam, B.C.
School, Port Moody Road. General contractor, Charles M. Nicholson, New Westminster, at $1,190.

Chatham, Ont.
Renovating theatre, cost $50,000. Architects and Owners, Griffin Amusement Co., 8 Queen E., Toronto. The old Family Theatre to be completely renovated. Work will be done by day labor and will start at once.

Duncans, B.C.
Post office, cost $38,463. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Res. Architect, Wm. Henderson, Victoria. Mason, Rourke, McDonald & Moncrief, 142 Hastings St. W., Vancouver.

Elmira, Ont.
Post office, cost $35,000. Dom. Government, Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractor, E. A. Bleakney, Gananoque, Ont. Three storeys, 132 x 66.

Edmonton, Alta.
Church, cost $55,000, Kinistino, for Sacred Heart Congregation. Architects, Hardy & Markland, 16 Victoria Block. General contractors, Turner Bros. and Clindinning, 10th Ave. N., S. Edmonton. Two storeys, 62 x 92, brick and structural steel construction.

Kingston, Ont.
Citadel, cost $20,000, Princess, for Salvation Army, Toronto. Architect, Major Miller, Salvation Army, Toronto. General contractor, W. H. Watts, Kingston. Two storeys, stone and brick construction.

Le Pas, Man.
Wireless station, cost $75,000. Builders and owners, Marconi Telegraph Co., 137 McGill St., Montreal. Station includes one 2 ft. tubular steel mast 250 ft. high, also 2 houses 8 rooms each and operating house, 25 x 35, concrete construction. To be operated by 20 h.p. engine and dynamo.

Lindsay, Ont.
Armoury for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. General contractors, James Bogue, Lindsay.

Madoc, Ont.
Drill hall, cost $16,800. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. General contractor, L. E. Allen, Belleville, Ont. Stone foundation, brick construction, corrugated iron, felt and gravel roofing.

Maple Creek, Sask.
Drill hall, cost $27,313. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Navin Bros., Moose Jaw.

Montreal, Que.
Steel shed, cost $16,595, Lachine Canal, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Builders, Canadian Bridge Co., Ltd., Walkerville. Concrete foundation, corrugated iron or concrete construction.

Church, cost $12,843, Alma, for Italian Methodist Mission, c/o Rev. E. I. Hart, 164 Windsor St. Architects, Peden & McLaren, 20 St. Alexis St. General contractor, J. W. Gordon, 2211 Clarke St. Two storeys, 52 x 37, cement foundation, roughcast and Laprairie brick construction.

Convent, cost $100,000, for R. C. School Commissioners, Verdun. Architect, J. E. A. Benoit, 1198 Wellington St. General contractor, carpenter and painting, T. Sauve, 124 Church Ave. Mason, John Quinlan, 4412 St. Catherine W. Iron and steel, Phoenix Bridge Co., 83 Colborne. Brick, S. Marchessault, 8 Pacific St. Heating and plumbing, Berrier & Berrier, c/o General Contractor. Electrical, T. Desalliers & Fils, 1275 Wellington. Plastering, Jos. Fbien, 146 Lasalle Road.

Postal station "F," cost $57,000, Notre Dame and Richmond. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, D. J. Spence, 46 Beaver Hall Hill. General contractor, Jos. Bourque, Post Office, St. James St., or cor. St. Catherine E. and Maisonneuve. Two storeys and basement, 85 x 50.

Post office "L," cost $70,000, Westmount (Greene Ave). Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, A. Piche, 52 Victoria Square. General contractors, John Quinlan & Company, 4412 St. Catherine W. Two storeys and basement, 102 x 85.

Newcastle, N.B.
Wireless station for Universal Radio Co. (The Poulson Syndicate). General contractors, Galbraith & Cate, Room 44, No. 179 St. James St., Montreal. Company purchased 57 acres. Seven towers will be erected, 50 h.p. engine required to drive dynamo.

Ottawa, Ont.
Church, cost $40,000, for Christian Scientists, Metcalfe St. Architect, J. P. MacLaren, 104 Sparks St. Carpenter, Alex. Christie, Elgin Street.

Orillia, Ont.
Sunday school, Peter street, for Presbyterian Church Congregation. General contractor, W. H. Bennett, wishes estimates on ash trimmings, maple and oak stairs and doors, hardwood floors.

Preston, Ont.
Post office, cost $44,861, Dom. Government, Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, Ont. General contractor, Geo. E. Proctor, Sarnia, Ont.

Point Grey, B.C.
Four manual training schools, cost $4,000 each. Architect, J. H. Brown, Crown Building, Vancouver. General contractor, Alexander Grant, Eburne, received contract for buildings at Eburne, Kerrisdale and Shaughnessy Heights, at $3,230 each, Fred E. Gregory, Vancouver, was awarded the West Point Grey Bldg., at $3,165.

Radville, Sask.
Motion picture theatre, cost $6,000, planned by Odd Fellows Lodge. Architects and general contractors, Carlisle & Janousky. Two storeys, 50 x 80, frame, cement foundation, electric lighting, steam heating, motors and generators. Upper storey to be used as hall.

Renous, N.B.
Church, cost $25,000, for R. C. Congregation, c/o Rev. D. S. Murdock. General contractors, B. Mooney & Sons, 112 Queen St., St. John. Roofing and metal work, Jas. McDade, Mill St., St. John.

Regina, Sask.
Police station, cost $211,050, Osler St. Clerk, A. W. Pool. Architects, Clemesha & Portnall. General contractors, Parsons Construction Co., at $206,900. Heating and plumbing, The Regina Plumbing & Heating Co., at $4,150. Three storeys, and basement, terra cotta, stone and brick construction.

Sault Ste. Marie, Ont.
School, cost $25,000, Murray. Architects, Demar & Murdock. General contractors, A. C. McLeod & Son. Plumb-

ing, Stone & Walsworth. Two storeys, 48 x 80, solid brick construction, stone foundation.

Selkirk, Man.
Alterations and addition to hospital, cost $64,000. Prov. Govt. Dept. of Public Works. Acting Minister, G. Coldwell. Prov. Architect, V. W. Horwood, 261 Fort St., Winnipeg. General contractors, Carter-Halls & Aldinger Co., Ltd., 1010 Union Bank Bldg., Winnipeg.

Steelton, Ont.
Fire hall, cost $15,000, Wallace Terrace, for Town of Steelton and Lake Superior Corp. Architect and Engineer, W. B. Redfern, Steelton. General contractors, McIntyre, Haining & Kelly, Sault Ste. Marie. Two storeys, 76 x 35, structural steel and solid brick construction.

Toronto, Ont.
Postal station "G," cost $200,000, Queen and Saulter. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, Ont. Architect, E. J. Lennox, 164 Bay St., Toronto. General contractors, Witchall & Son, 163 Havelock St., Toronto.

Grand stand, cost $100,000, Queen E., for Ontario Jockey Club, Leader Lane. Architect, Geo. W. Gouinlock, Temple Bldg. General contractors, Wickett Bros., 35 Deer Park Cres. Steel, Hamilton Bridge Works, Hamilton. 50 x 400.

Toronto, Ont.
Church, cost $10,000, for Eglinton Baptists, Castlefield ave. Architect & builder, W. G. Renney, 100 Erskine ave. General contractor will sublet. One storey, 26 x 58, Roman stone and brick construction, brick foundation, galvanized iron, slate, felt and gravel roofing.

Weston, Ont.
Nurses' Home for National Sanitarium Association. Sec.-treas., R. Dunbar, 247 King St. W., Toronto. Architects, Denison & Stephenson, 20 King St. W., Toronto. Masonry and brick, Davidge & Lunn, 684 Bathurst St. Carpentry, F. J. Sproule, 34 Shanley. Steel, McGregor & McIntyre, 73 Pearl St. Galvanized iron and roofing, A. Matthews, Ltd., 256 Adelaide S. W. Plastering, Petrie & Co., 351 Dupont St. Painting, A. E. Bennett, 121½ Broadview ave.

Toronto, Ont.
College buildings, cost $500,000, Avenue Road, for Bishop Strachan School. Secretary, H. Jones, Lyndhurst avenue. Masonry, H. Page & Co., Queen's Park. Four storeys, steel, stone and brick construction, concrete and stone foundation.

Business Buildings and Industial Plants

Brantford, Ont.
Offices, cost $5,000, Wadsworth, for G. T. Ry. Co. Agent, R. Wright. Company's architect is preparing plans. Two storeys, 28 x 47, cement foundation, Logan block brick construction.

Calgary, Alta.
Ice plant, cost $200,000, planned. Crystal Ice Co., 417 Judge Travis Bldg., has purchased 11 lots on 11th ave. and 16th street west. Will manufacture artificial ice.

Packing industry and stock yard contemplated. Interested, City Council and President Negilus of the United Farmers of Alberta. Option taken on site of $360,000.

Galt, Ont.
Plant planned by B. F. Sturtevant Co., Hyde Park, Boston, Mass., who have purchased factory of Can. Motors Co. and will manufacture motors, dynamos, generators, dry kilns, ventilating fans, etc.

Lacombe, Alta.
Bank and offices, cost $25,000, Barnett ave., for Royal Bank. Two storeys, 40 x 56, red brick construction. Plans prepared.

London, Ont.
Storehouse, cost $5,000, planned for London Rolling Mills. Manager, J. White. Building to replace one destroyed by fire. One storey, fireproof construction and floors.

Medicine Hat, Alta.
Departmental store, cost $500,000, planned. The Hudson's Bay Company has purchased site 300 x 130, on Toronto St., on which they intend to erect store in 1914.

Moncton, N.B.
Biscuit factory contemplated for J. A. Marven Ltd., 514-526 Main St. 60 x 260. Plans will be prepared.

Stores, cost $4,500, St. George, for Murdock McLeod, Church St. Masonry, O. J. Dunham, 50 Brydges. Tenders being called by architect, W. C. Barnes, Wyse Bldg., for carpentry. Two storeys, 20 x 60, brick construction. Foundations in.

Montreal, Que.
Wholesale grocery and warehouse, cost $45,000, near 1170 St. Lawrence Blvd., for P. Adelstein, 1173 St. Lawrence Blvd. General contractors, concrete and brick and carpentry, Gilbert Demers & Satrazin, 861 St. Lawrence. Tenders received by general contractor for other trades. Four storeys and basement, 33 x 70, concrete foundation, stone and solid brick construction.

Hotel, cost $40,000, Laurier ave. Tenders received by architect, W. E. Doran, 189 Bleury, from July 28th to August 5th. Three storeys and basement, 35 x 70, concrete foundation, Montreal stone and brick construction. Owner's name withheld.

Factory contemplated for Wilson Carbon Paper Co., Ltd., 335 Lagauchetiere W. Plans not yet decided upon.

Addition to store and ice cream parlor, cost $15,000, 322 St. Catherine W., for Geo. Nicholas & Co., 322 St. Catherine St. W. Tenders received by architect, D. J. Crighton, Jacobs Bldg., until July 30. Three storeys, 30 ft., cement foundation, structural steel and brick construction.

Ottawa, Ont.
Business block, cost $145,000, for American Bank Note Co., Wellington St. Architect, J. Albert Ewart, 193 Sparks street. Carpentry, J. & C. Low, 262 Catherine. Foundations in.

Orillia, Ont.
Factory planned for C. N. W. Shoe Co., London, Ont. Ratepayers passed bylaw to loan $25,000 for 20 years, no interest, free site and fixed assessment. Work on building to commence at once.

Princeton, B.C.
Lodge and office bldg., cost $10,000, for I. O. O. F. Architects, McLean & Russell. Two storeys, 50 x 100, brick veneer construction, stone foundation. Tenders received by architects till August 1st.

Toronto, Ont.
Garage, cost $180,000, University Ave., for G. H. Gooderham, 49 Wellington St. E. Architect, E. J. Lennox, 164 Bay St. Stone, steel and brick construction. Plans ready.

Sporting goods factory, Albany, for Harold A. Wilson & Co., 299 Yonge St. Architects, Chapman & McGiffin, 95 King E. 55 x 175. Plans prepared.

Offices (freight), cost $250,000, Simcoe St., for C. P. R., King and Yonge. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg., Montreal. 7-storeys, 50 x 140, structural steel, reinforced concrete and brick construction, cement foundation. Plans drawn.

Stores and apartments, cost $15,000, Carlton, for Robert Davies, 36 Toronto St. Tenders received by architect, H. Simpson, 82 King St. E. Three storeys, 50 x 60, steel, brick and stone construction, stone and brick foundation.

Trenton, Ont.
Store, cost $15,000, for S. B. McClung & Co. Architect, Geo. Kelly. Two stys., 33 x 150, pressed brick, structural steel and iron construction.

Winnipeg, Man.
Publishing plant, cost $173,000, Smith St., for Tribune Publishing Co., 211 McDermot ave. Architect, John D. Atchison, Trust & Loan Bldg. General contractors, Hazelton & Walin, 303 Donalda Bldg. Permit has been issued to increase height of new 3-storey building to six storeys.

Laundry, cost $30,000, for St. Boniface Hospital Board. Architect, J. A. Hudon, 7th floor Builders Exchange Bldg. General contractors, J. H. Tremblay Co., Ltd., 814 Sterling Bank Bldg. Steel, Vulcan Iron Works, Point Douglas avenue. Roofing, Winnipeg Ceiling & Roofing Co. Electrical work, Shipman Electric Company, 396 Portage avenue. Two storeys and basement, 100 x 33.

Dominion Trusts Co., Ltd., 402 Pender St. W., Vancouver and Main streets, Winnipeg, contemplate erecting 16-storey office building on site of their present building on Main street. Work will not go on this year.

CONTRACTS AWARDED

Calgary, Alta.
Addition to malt house for Canadian Malting Co. General contractors, Canadian Stewart Co., 901 Eastern Townships Bank Bldg., Montreal. It is also contemplated to extend the elevator accommodation.

Garage, cost $6,000, Sixth Ave., for Alberta Government, Fourth St. W. Architect, Mr. Blakey, Public Works Department. Superintendent, M. Calder, Public Works Dept. Work being done by day labor. One storey, 32 x 74, sand stone construction, cement foundation.

Warehouse, 10th ave. west, for the Consolidated Rubber Co. General contractors, Canadian Stewart Co., 901 Eastern Townships Bank Bldg., Montreal.

Eburne, B.C.
Garage, cost $18,000, for D. S. McLaghlan. Architect, F. J. Peters, 837

(Continued from page 72)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned and endorsed "Tender for Toronto Harbour Works," will be received at this office until 4 p.m. on **Monday, August 25, 1913**, for the construction of a Sea Wall, Breakwater, Ship Channel and Retaining Walls at the City of Toronto, in the County of York, Province of Ontario.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, Ont.; Harbour Commissioner's Office, 76 Adelaide St. West, Toronto; H. J. Lamb, Esq., District Engineer, Windsor, Ont., and J. L. Michaud, Esq., District Engineer, Post Office, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 12, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44297 F

Sealed tenders addressed to the undersigned and endorsed "Tender for Public Building, Sudbury, Ont.," will be received at this office until 4 p.m., on **Wednesday, August 6, 1913**, for the work mentioned.

Plans, specifications and forms of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, at the Post Office, Sudbury, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45139. 31

DERRICKS FOR SALE

One 25-ton Terry & Tench travelling stiff leg derrick.

One 20-ton stiff leg derrick.

One 15-ton stiff leg derrick.

No reasonable offer refused.

National Sand & Material Company, Ltd.
30-31-32 Welland, Ont.

Tenders for the Construction of Sewers

Sealed tenders will be received by Mr. C. M. Webber, Town Clerk, Welland, Ontario, up to 5 p.m. on **Monday, August 4th, 1913**, for the construction of Separate Sewers on the following streets:

Maple Avenue, William Street, Oakland Avenue, Asher Street, River Road, Duncan Street, Cady Street, John Street.

Specifications and tender forms may be had at Engineer's Office, Welland. Plans and specifications may also be seen at office of Contract Record and Engineering Review, 220 King St. West, Toronto, on or after the 25th inst.

A marked cheque for 10 per cent. of the amount of the tender must accompany each tender or an acceptable bidder's bond of same value will be accepted.

The lowest or any tender not necessarily accepted.

The tenders may be awarded separate or in bulk.

JAMES HUGHES,
Chairman Sewerage Committee.
Welland, July 22nd, 1913. 31

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Wharf at Vancouver, B.C.," will be received at this office until 4 p.m., on **Thursday, August 21, 1913**, for the construction of a Wharf at Vancouver, B.C.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C., The District Engineer's Office, Confederation Life Building, Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office Building, Montreal, Que., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and places of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 8, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44661.

F

For Sale

FOR SALE.—Three Second-Hand Contractor's Dinky Vulcan Locomotives in first-rate condition. One 9-in. x 14-in. and two 10-in. x 16-in. Also a 50-ton Steam Shovel, and some contractors' Dump Cars. Apply to The Canadian Fairbanks-Morse Co., Ltd., 444 St. James Street, Montreal. 30-31

TENDERS

Will be received by the undersigned up to **Friday, August 15th, 1913**, for the erection of a three storey concrete and brick Municipal building for the Town of Cobalt, approximately 43 ft. x 100 ft., according to plans and specifications prepared by Messrs. Angus & Angus, Architects, North Bay.

Contractors are required to enclose a marked cheque along with each tender for five per cent. of the amount of same, the lowest or any tender not being necessarily accepted.

Work to commence immediately on award of contract.

Plans and specifications may be seen at the office of the architect or at the office of the undersigned.

R. L. O'GORMAN,
Town Clerk,
30-31 Cobalt, Ont.

BRIGHTON, ONTARIO

NOTICE

Whole or separate tenders will be received up to noon of **Monday, July 28th**, for the erection of a factory building. Plans and specifications for which may be seen at the office of the architect, W. A. Mahoney, O. A. A., Guelph, or at the office of Geo. Drewery, B.A., Barrister.

Lowest or any tender not necessarily accepted.

(Signed) GEO. DREWERY, B.A.,
Barrister,
30-31 Brighton, Ontario.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on

Tuesday, 19th August, 1913

for the construction of the following works:—

Midway Sewer System

Outlet via Hiawatha Ave., Gerrard St. and Morley Avenue

Division No. 2, West Toronto

Woodville Avenue

Balsam Avenue, Queen Street to Kingston Rd.

East Toronto, Section A, Outlet

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

The tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a guarantee company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, July 24th, 1913. 31

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, Rainy River, Ontario," will be received until 4.00 p.m., on **Tuesday, August 12, 1913**, for dredging required at Rainy River, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of the tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent., (5 per cent.) of the contract price, no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45359. 31

Tenders Wanted

Sealed tenders will be received by M. D. Hallman, Esq., Court House, Berlin, up to 3 p.m., on **Friday, August 8**, for the construction of the following for the County of Waterloo.

1. 35 ft. concrete arch at Hawkesville.
2. Retaining wall at New Hamburg.
3. Extra steel joints on concrete floor for the 120 ft. x 18 ft. New Hamburg bridge.

For plans and specifications and other information apply to

S. CASSEL, Esq.,
New Hamburg.

J. G. HURST Esq.,
Connestogo.

BOWMAN & CONNOR,
Engineers,
Toronto and Berlin.
31

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, Little Current," will be received until 4.00 p.m., on **Tuesday, August 12 ,1913,** for dredging required at Little Current, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of the tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 per cent.) of the contract price, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45519. 31-32

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, A1 ... ... $700

Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new $2,500

Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1 ... ... $3,500

Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1 ... ... $2,800

TRACTION ENGINE

Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?

TRY US!

WILLIS SHAW MACHINERY CO.

La Salle Street, Chicago. Ill,

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont.
29-t.f.

Business Buildings and Industial Plants

Hastings St. W., Vancouver. General contractor, C. H. Taylor, Carter-Cotton Bldg., Vancouver. 1½ storeys, concrete foundation, mill and roughcast construc.

Edmonton, Alta.

Warehouse, cost $55,000, 3rd ave., for A. MacDonald Co., Ltd., 2nd street. Architect, W. A. Irish, 219 Kennedy Bldg., Winnipeg. General contractor, A. J. Gillis, Chisholm Block. Four storeys, 56 x 150, stone and brick construction, cement foundation.

Hamilton, Ont.

Alterations and addition to store, cost $15,000, James St. N., for M. & S. Epstein, Dom. House Furnishing Co., 120 James St. N. Architect, W. A. Edwards, 7 Hughson St. S. General contractor, Geo. E. Mills, King St. E. Three stys., 70 x 100.

Warehouse, cost $16,000, Park St. S., for Geo. H. Rillett, 830 Main St. E. Architect, A. W. Peene, Clyde Block. General contractor, Geo. F. Webb, Wentworth St. S.

Kingston, Ont.

Factory, cost $20,000, for Kingston Floor & Wall Tile Co. General contractor, Wm. McCartney, Earl St. One sty., 300 x 100, brick construction, concrete foundation. Foundations in.

London, Ont.

Biscuit factory, cost $260,000, East, for McCormick Mfg. Co., Wellingston and Dundas streets. Manager, Geo. McCormick. Architects, Watt & Blackwell, Bank of Toronto Chambers. General contractors, Can. Frost & Winchester Co., Ltd., 5 Curry Hall, Windsor. Contract for steam plant, including engines, boilers, etc., awarded to Messrs. Leonard & Sons. Contract for generators and electrical equipment awarded to Canadian Westinghouse Co., Ltd., Hamilton, Ont. Belting, piping, etc., to be purchased later.

Medicine Hat, Alta.

Warehouse, cost $25,000, (N. Railway), for Dominion Grocery Co. Architect and general contractor, Lussier Construction Co., Toronto St. Two storeys, 40 x 90, red brick construction. Foundations in.

Stores, cost $8,000, for Herbert Baker, City Clerk. Architects, Bourne & Morrison, Huckvale Block. General contractors, Crossley Bros. Two storeys, 25 x 80, red brick construction, felt and gravel roofing.

Montreal, Que.

Alterations to Place Viger Hotel. C. P. R., Windsor St. Architects, C. P. R. Engineering Dept., Windsor St., c/o Mr. Videtto. General contractors, Canadian Stewart Co., 901 E. T. Bank.

Bank, cost $50,000, Papineau and Mt.

Royal, for Royal Bank of Canada, 147 St. James St. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractors, masonry and carpentry, Purdy & Henderson, New Birks Bldg. Plastering, McNulty Bros., 182 Mountain. Roofing, heating and plastering, Hickey & Aubut, 93 Dominion. Painting, Alex. Craig, 41 Jurors. Electrical work, Electrical Repair & Contracting Co., 119 Lagauchetiere W. Marble, Mariotti Marble Co., 269 Ottawa. Two storeys, 60 x 50, granite construction.

Orillia, Ont.

Stores, cost $5,000, Mississaga St., for Geo. Vick & Sons. Work done by day labor, under supervision of Mr. W. H. Bennett. Two storeys, 36 x 50, brick construction, steam heating, steel beams, 8 radiators required. Foundations in.

Quebec, Que.

Warehouse, cost $5,000, for J. Arthur Turcotte, St. Paul St. Architect, general contractor, mason and carpenter, Jos. Chevalier. Iron and steel, Eastern Canada Steel & Iron Works, Ltd., St. Malo. Roofing, S. Falardeau. Four storeys, 27 x 54, stone foundation, structural steel and Scotch brick construction.

Toronto, Ont.

Storage shed, cost $9,000, Dufferin, for Dom. Radiator Co., Dufferin St. General contractors, Brown & Cooper, 297 Carlton St. All contracts but carpentry to be sublet. One storey, 136 x 182, structural steel and frame construction, cement foundation.

Warehouse, 405 King W., for Warwick Bros. & Rutter, 401 King W. Architects, Steele & Sons, Stair Bldg. General contractors, Harris & Harris, Confederation Life Bldg. Carpentry, R. G. Kirby, 539 Yonge St. Steel, McGregor & McIntyre, Pearl St. Roofing, W. E. Dillon Co., 78 Richmond E. Painting, Geo. H. Shackleton, 43 Collier. Four storeys, 100 x 50. Plumbing, J. H. Warwick, 226 Wellesley street. Ornamental iron, Shipway I. B. & Mfg. Co., 773 King W.

Alterations to bank building, cost $3,000, Dovercourt, for Standard Bank, 9 Front E. Architects and builders, Baldwin & Woods, 9 Front St. E. Two stys., 16 x 25, structural steel and Indiana stone construction, cement and stone foundation. Plans drawn.

Factory, 570 King W., for Can. Rogers & Co., 570 King W. Architect, company's engineer. General contractors, owners. Engineers will supervise construction. Work to start shortly. Steel and brick construction, stone foundation.

Vancouver, B.C.

Garage, cost $30,000, Seymour street, for Wm. Frederick Gardiner, 347 Pender St. General contractors, Dominion Construction Co., 509 Richards St. Three storeys, 50 x 120, concrete and pressed brick construction.

Wadena, Sask.

Hotel, cost $26,000, for Ike Diner, Yorkton, Sask. Architect, Max Blankstein, 450 Dufferin ave. General contractors, Alex. Black Lumber Co. Three storeys, 46 x 72.

Winnipeg, Man.

Store and office, cost $20,000, for W. Zimmerman, 669 Main St. Architect, Max Blankstein, 450 Dufferin ave. General contractor, G. Martin, 80 Dubus St., Norwood. Two storeys, 18 ft. 4 in. x 85 ft., stone foundation.

Woodstock, N.B.

Warehouse, for Geo. E. Barbour Co., Ltd., North Market Wharf, St. John. Architect, F. Neil Brodie, 42 Princess St., St. John. General contractor, Fred Ryan, Fredericton. 1½ storeys, 40 x 80, cement brick foundation, pressed brick construction.

Residences

Calgary, Alta.

Residence, cost $5,000, Bankview. Architect and owner, Thos. Beggs, 2524 16 B St. W. Two storeys, 36 x 50, frame construction, cement foundation. Plans ready.

Medicine Hat, Alta.

Residence, cost $6,000, Toronto Street, for T. E. McPailon. Architects, Bourne & Morrison, Huckvale Block. 2½ stys., 80 x 39, frame, cement foundation. Plans ready.

Manse, cost $9,500, Esplanade, for Presbyterian Church. Pastor, W. Morrow. Architects, Bourne & Morrison, Huckvale Block. 2½ storeys, 35 x 35, red brick, artificial stone and roughcast construction, brick foundation. Plans drawn.

Flats, cost $7,000, Guy, for Montreal Quilting Co., 156 Guy. Tenders received by architect, Robert Findlay, 10 Phillips Place. Three storeys, 156 x 49, cement foundation, brick construction.

Montreal, Que.

Flats, cost $5,200, for Mr. Courvillon, Wellington St., Verdun. Architect, L. W. Julien, 270-2 Ethel St. Three stys., 25 x 48, brick construction, cement foundation. Plans drawn.

Apartment house, cost $1,000,000, Dorchester, for Montreal Apartments Ltd., 15 St. James St. Architect, R. Charbonneau, 15 St. James St. Tenders will be called about July 28th. Ten storeys, 168 x 124, stone and cement foundation, stone trimmings.

St. Paul's Island, N.S.

Tenders received by Minister, Alex. Johnston, Dom. Govt. Dept. of Marine & Fisheries, Ottawa, until August 12th noon for construction of double wooden dwelling for superintendent and staff at St. Paul's Island, N.S. Plans and specifications at agency of Dept., Halifax, Post offices at Sydney, North Sydney, Baddeck and Glace Bay, N.S., and at Department, Ottawa.

Toronto, Ont.

Five pair residences, cost $20,000, Castmount ave., for Consolidated Building & Supply Co., Temple Bldg. Manager, H. J. Rea. Tenders received by owners for all trades. Two storeys, brick and stone construction, stone foundation.

Apartment house, cost $7,000, Laburnam ave. Tenders received by architect, J. A. Thatcher, 31 Queen W. Three storeys, 40 x 50, brick and stone constr., stone foundation.

Residence, cost $10,000, Yonge Street, for J. McNab Anderson, care architect, J. M. Jeffreys, 708 C. P. R. Bldg. 2½ storeys, 32 x 40, brick construction, stone foundation. Plans drawn.

Residence, cost $6,000, Wells Hill, for R. Mowbray, 6 Howard St. Architect, J. H. Stanford, Bloor and Ossington. 2½ storeys, 33 x 34, brick construction and foundation. Plans ready.

Windsor, Ont.

Bachelor apartments, cost $18,000, Ferry St. Architects, Leybourne & Whitney. Three storeys and basement, 34 x 50. Brick construction and foundation. Plans in progress.

CONTRACTS AWARDED

Edmonton, Alta.

Rooming house, cost $20,000. Owner and general contractor, Jno. Johnson, 50 Stewart St. Architects, Hardie & Markland, 16 Victoria Block. Three storeys, frame construction. Foundations in.

Medicine Hat, Alta.

Apartment house, cost $22,000, 6th and

Cap. 75000 gals. Height 85-ft.
Canadian Car and Foundry Co., Montreal

Canadian Plant
Chicago Bridge & Iron Works
BRIDGEBURG - ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES—BRIDGEBURG, ONT., CANADA
Chicago, Ill. U.S.A.
New York, N.Y., U.S.A.
Dallas, Texas, U.S.A.
Greenville, Pa., U.S.A.

SHOPS—BRIDGEBURG, ONT., CAN.
Chicago, Ill., U.S.A.
Greenville, Penn., U.S.A.

Grand Trunk Pacific Ry.
Lines West of Winnipeg

How Much is Your Power Loss Annually?

In the big Canadian plants where ***efficiency*** methods are being effectively employed to ***check*** leakages, this is the question that is being given the most ***serious*** consideration.

Because it has been found that such losses—which in many instances reach ***astounding*** figures—are due, mainly, to ***indifference*** and lack of ***care*** in the selection of suitable belting.

Your Loss or Your Gain Depends Upon Your Belting

That is what gives importance to this—our message to you.

For ***forty*** years, we have been producing Rubber Beltings that have become the ***standards*** by which other beltings must be judged.

We have studied the power transmission question from every angle and brought to bear upon it the experience, brains and skill of our ***experts***—familiar with actual working conditions—and the resources of ***largest*** and ***best*** equipped plant in Canada.

And we have produced four grades of Power Belting that are 100% efficient in ***Reliability*** and ***Service*** in Power Transmission.

"PARA" "KEEWATIN" "LUMBER KING" "COLUMBIA"

These are the beltings used wherever ***efficiency*** is the first consideration—wherever Beltings are bought on their ***merit.***

Every step in their manufacture is governed by the ***prudence*** and ***experience*** of a lifetime—plus the ***unwavering*** determination to produce beltings that would measure up to every ***Service*** test.

If You Are Not Getting the Service You Expected From the Beltings You Buy, Get in Touch With Us. We Can Help You — And We Know How.

WRITE OUR NEAREST BRANCH TO-DAY.

We are Specialists in Beltings For Every Purpose.

Canadian Consolidated Rubber Co., Limited

Montreal

SALES BRANCHES :

Halifax, ST. JOHN, Quebec, MONTREAL, Ottawa, TORONTO, Hamilton, London, Berlin, Brantford, North Bay,
WINNIPEG, Regina, Saskatoon, Edmonton, Calgary, VANCOUVER, Victoria

Fewings St., for Wm. Steinecke, Cecil Hotel. Architects and builders, Harrison & Ponton, Huckvale Block. Three storeys, 36 x 96, red brick construction, cement foundation.

Montreal, Que.
Apartment house, cost $40,000, Lorne Crescent. Owners and general contractors, Hand & Pick, 609 Belmont avenue, Westmount. Builder, D. J. Crighton, Jacobs Bldg. Five storeys, 59 x 71, concrete foundation, reinforced concrete, terra cotta and brick construction.

Toronto, Ont.
Three detached apartments, cost $15,000, Ossington, for W. S. Grimshaw, 1990 Davenport Rd. Architect, N. G. Beggs, 12 Cosgrave Bldg. Work to be done by day labor. Will start at once. Owner buys all material. Plumbing will be sublet. Three storeys, 33 x 67, brick construction, stone foundation.

Power Plants, Electricity and Telephones

Ayr, Ont.
Ratepayers passed by-law to use Hydro Electric power. The neighboring villages of Princeton, Drumbo and Plattsville also voted favorably. Clerk, A. J. Reid.

Brantford, Ont.
Hydro Electric system planned for Municipal Council of Grand View. Further information from David Tattersoll or Edward Cowler, Grand View.

Brockville, Ont.
Conduit and wire, Perth street, for Brockville Light & Power Dept. Manager, E. J. Philip. Will require large quantities of underground conduit, cable, etc., all electric service wires, etc., are to be put underground before laying of new pavement. Further information from manager.

Calgary, Alta.
Power sub-station, Crescent Heights, planned by City Council. Clerk, J. M. Miller. Engineer, Geo. Craig. General contractors, Bennett & Debnam, 5 Thomas Block. Two storeys, 50 x 80, brick and reinforced concrete construction, cement foundation.

Halifax, N.S.
Halifax Power Company intend developing two sites on Indian River to supply power for industrial and lighting purposes in Halifax. Each site will include two units of 1,200 kv.a. each. Power to be carried over duplicate transmission lines.

Ingersoll, Ont.
Electric lighting equipment planned by Town Council. Clerk, W. A. Smith. Cluster lights and other improvements contemplated.

Kingston, Ont.
Conduits planned by City Council. Overhead wires are to be put underground. Full information from C. C. Folger, General Manager Civic Utilities.

London, Ont.
Machinery for McClary Mfg. Co. Messrs. E. Leonard & Sons, awarded contract for new engines in connection with power plant for factory.

McKillop Twp., Ont.
Extension, telephone system, cost $2,400, for Township Council. Clerk, M. Murdie, Winthrop, Ont.

New Hamburg, Ont.
Electric lighting. Ratepayers passed by-law to give Electric Light Co., Mill St., a 10-year contract and a 30-year franchise. Manager Byron Heaslip.

Ottawa, Ont.
Exchange Bldg., cost $45,000, First ave. for Bell Telephone Co. Architect, J. Albert Ewart, 193 Sparks St. General contractor, Geo. Crain, Clemow ave. Plastering, Frank Hunt, 115 Arlington. Painting, P. Stewart, Bank St. Heating and plumbing, Holloway & Son, 373 Somerset.

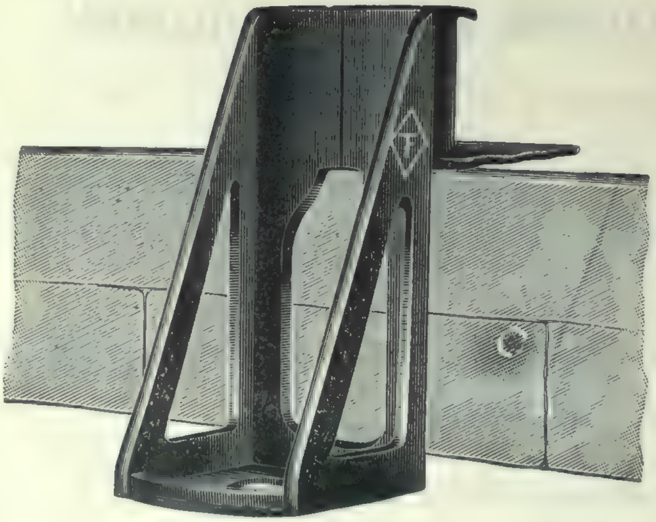
River Glade, N.B.
Power house for Jordon Sanitarium Commissioners. Dr. Townsend, River Glade. Architect, F. Neil Brodie, 42 Princess, St. John. General contractor, R. A. Corbett, Douglas ave., St. John.

Toronto, Ont.
Electrical plant, cost $250,000, planned for Hot Point Electric Heating Co. President, Willis Booth, Los Angeles, California. Company expect to build branch plant employing about 150 hands.

Watford, Ont.
Hydro electric lighting planned by Town Council. Clerk, W. S. Fuller. By-law has been voted on.

Yorkton, Sask.
Telephone Exchange, cost $15,000. Plans, specifications, etc., at office of Department. Tenders received by Minister, Hon. J. A. Calder, Regina. Provincial Govt., Dept. of Railways, Telephones & Telegraphs.

Large Stock of Wall and Beam



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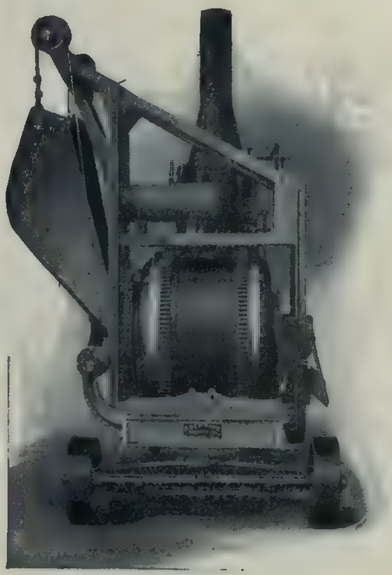

We know that concrete mixers get hard service—and so we build THE KOEHRING to *stand* hard service.

We do it by putting the right kind of material into every part of THE KOEHRING—and *enough* material.

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Then there are features of design that add greatly to its lasting qualities.

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks....	$11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	30 00	
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	26 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock .... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 10 per cent.; lead waste, $9.00, less 10 per cent.; caulking lead, 6¾ cents per lb.; traps and bends, 35 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅛-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, $9.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil in bbls., 64c. per gal. of 9 lbs.

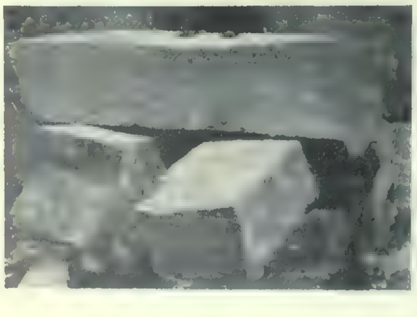
Raw Linseed Oil, in bbls., 61c. per gal. of 9 lbs.

Turpentine, in barrels, 56c. per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.



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Alphabetical Index of Advertisers
Page 16

Vol. 27 August 6, 1913 No. 32

The Application of Specifications

WITHIN the last few years great changes in engineering and constructional work have taken place. Projects greater in their scope than the past could even dream of are undertaken. New materials are coming into use and old materials are being applied in new capacities. With this development has arisen the need for detailed specifications as to the material to be used, its sizes and strength, method of erection, etc. The address of Mr. Robt. Hunt, president of the American Society for Testing Materials, delivered at the recent annual meeting of that society, contained a number of suggestive thoughts upon this subject.

Four phases of the question were dealt with, the increased need of specifications, the necessity of their being practical, the subject of international specifications and an intelligent application of the specifications to the work done.

It was pointed out that, in the not very remote past, managers were quite indifferent to the details prescribed by their customers. If it suited and amused the customers to formulate such things, well and good, but the manufacturer knew his own product and manufactured it to suit himself. This however involved the element of progress. It was learned that what was adequate for the wants of yesterday was totally inadequate for the wants of to-day; that observation should be made as to the behavior of materials of known composition under certain conditions and circumstances; moreover, that the conditions under which materials were used varied so greatly, that what was satisfactory in one case was unsatisfactory in another. Hence the need for detailed specifications.

With the growth of this feature there is perhaps a tendency to make demands which cannot be fulfilled. Specifications must be kept practical. As an illustration, it was shown that steel without any phosphorous in its composition would be most desirable, but so long as that metal is unattainable what is the use of specifying it? Knowing that the iron ores of the country are adaptable only to certain processes, it seems unwise to expect the engineers of that country to adopt specifications which would leave their own people out of consideration.

The question of an international code of specifications seems hardly advisable for two reasons. The material to be used upon any construction depends upon the products of the country in which the construction is being made and the peculiar needs of the people themselves. Germany is a large producer of iron ores which lend themselves to the Bessemer steel process but two costly failures have proven that the ores of the United States are not adapted to the economic production of such steel. Therefore the United States could not be expected to feel any great interest in international Bessemer steel specifications. In Europe the railways are characterized by light equipment and short lines. Hence they will not require the same character of rails as nations using heavier equipment and longer lines. These two examples serve to prove the difficulty of providing a series of international specifications. However there is a field in which all countries may unite and that is, in the studying and discussion of scientific investigation and of the details of testing materials.

No matter how carefully specifications are formulated they cannot eliminate the necessity for judgment being exercised in their application. Three of the national technical societies of the United States have had committees carefully investigating the steel rail production. The rail committee of the American Railway Engineering Association has gone extensively into the question and its steel rail specifications are accepted as being those of the highest authority. In a recent order for rails those tested fell within the specifications, although showing a considerable number of failures. On consideration it was decided not to ship any of the rails that had been rolled on that order. This seems like a very laudable non-adherence to the specifications. "Such instances do not prove that specifications are without value. They afford an available means of formulating the most advanced state of the art and if drawn according to the best judgment of men familiar with the practical workings of that art, they will be to the highest interest of both the producer and the user."

Highway Improvement in Ontario

THE Provincial Government of Ontario has launched a good roads movement of considerable magnitude. The sum of five million dollars is being expended in northern Ontario for the construction of colonization roadways which must ultimately be of great advantage, not only to new Ontario but also to the province at large.

The second part of the project deals with the roadways of the older part of the province and will involve the expenditure of probably ten million dollars. In order to cope with the question efficiently a commission of experts, consisting of Messrs. Charles A. Magrath, C.E., William A. McLean, C.E., and A. M. Rankin, has been appointed to prepare a report for the Government. They are to investigate and study all matters relating to the construction, maintenance and financing of public highways.

The question presents two phases: first, the construction, and second, the maintenance. The construction should involve at least two kinds of roads. There should be a system of provincial highways connecting the larger urban communities built and maintained by the government as a general public utility. The county and township roads having a more strictly local importance should be built and maintained largely by the locality served. Under the Highways Improvement Act the Government provided one-third of the construction for those counties availing themselves of the provisions of the Act. This ratio seems fair but may have to be increased in order to induce the counties to graple with the problem.

In determining the kind of road to be constructed the question of permanency relative to the amount of traffic must be considered. To construct an unnecessarily good road where there is but little traffic is as lacking in economy as the construction of poor roads where there is heavy traffic.

The question of maintenance of the roads of county and township involves considerable difficulty and a portion of the maintenance will probably have to be borne by the government. The cost embraces not only material but also a force under the guidance of trained men so as to keep the roadways in constant repair. The construction of the county highways will probably be the best educator in teaching that the old system of statute labor in vogue in many places is exceedingly wasteful and in inducing the ratepayers to provide the necessary funds.

The project will call for a large number of specially trained men both in construction and maintenance.

How the control of these jointly constructed roads shall be shared by the central government providing a portion of the cost, and a self-governing municipality providing the remainder, will require a good deal of earnest study but doubtless can be made to work with as little friction as the government inspection and assistance of public schools.

Method of Highway Organization

APROPOS of the extensive road work to be undertaken in Ontario a brief explanation of the manner in which state aid and county supervision is worked out in the state of Illinois may be in place. The centre of the road organization for that state is a commission of three men, with a highway engineer and an assistant highway engineer. The commissioners receive an annual salary of $3,500 each and the engineer $4,000 and the assistant engineer $2,500 per annum. Provision is made for the appointment of a county superintendent for each county. In order to secure trained men the county board must submit to the state commission a list of from three to five names. These candidates will be submitted to examination by the State Highway Commission. Those eligible will be reported to the county board and the latter body will appoint one from this approved list. The salary is to be fixed by the county board. The county superintendent will be the deputy of the state highway engineer and will take complete charge of the road and bridge work of the county.

Certain roads of the county are to be known as state-aid roads. The cost of half the improvement will be paid by the state and the other half by the county. In order to obtain the state grant the county must file maps showing what roads are to be state-aid roads and must also take the necessary steps to finance the county's half of the cost of construction.

Editorial Comment

TESTS at the Lawrence experiment station, Mass., indicate that the aeration of sewage by a current blown or drawn through greatly hastens the process of purifying. Filters of the sand-filter type were able to purify efficiently six to eight times as much after aeration as before. In percolating filters the sewage could be handled after aeration three times as fast as before aeration.

* * *

DURING the year 1912, 20,275,120 tons of shipping passed through the Suez canal, an increase of 2,000,000 over 1911. The total receipts were the greatest in the history of the canal and totalled $27,300,000. During the year, 5,373 ships passed through, of which 3,335 carried the British flag.

* * *

IN some parts of Europe, particularly in Germany, the steel railroad tie is coming into use. In the stretch between Berlin and Hamburg where the ties are used the track was of excellent quality both as to surface and alignment. With the light German locomotives the noise was diminished rather than increased.

* * *

THE exhibit of the National Bureau of Standards at the recent Chicago cement show demonstrated the effect of electrolysis on the reinforcing rods of concrete. The moisture and impurities in the concrete set up local currents in the iron by which iron oxide is produced. The oxide occupies a greater volume than the iron and exerts a pressure which eventually cracks the concrete. The amount of pressure was determined by means of a steel cylinder with a bore of 1½ in., in which was fitted a steel rod 1 in. in diameter and the space between was filled with cement. This was immersed in water and the iron core connected to an electric circuit. The expansion of the outer cylinder was measure and it was found that the oxidation of the iron core produced a maximum pressure of 4,700 pounds per square inch.

In view of the inquiry now going on in connection with London's motor traffic, including the question of the motor omnibus, it is of interest to note that, while in 1903 there were 3,500 horse omnibuses plying the streets of the Metropolis, this number has now been reduced to 100, and it is expected that by the beginning of 1914 the horse omnibus will have finally vanished. Mr. Richard Tilling, whose firm started the Tilling omnibuses in the year of the Great Exhibition, has recently stated that "there will not be a single omnibus horse to be seen in London by the end of this year." Old horse omnibuses are now used as bungalows and cricket pavilions.

Bearing Metals and Methods of Testing*

Various Compositions—Friction Test—Temperature Test — Improved Hammer Test — Conclusions

By T. D. Lynch

One does not have to go very far into the study of materials for use in the construction or maintenance of machinery until the question of the proper bearing material is presented. Shall it be made of solid bronze or shall it be made of a bronze or cast-iron shell lined with babbitt? If the latter, what shall the composition of the lining be and how can it be tested?

The discussion following will be confined primarily to the babbitted type of bearing with special reference to the importance of proper heat treatment in order to produce a good babbitt and further to the description of certain tests that have been made in connection with the study of the subject.

The introduction of lined bearings dates back to Sir Isaac Babbitt who first used a composition containing approximately 90 per cent. of tin, the remainder being copper and antimony. This babbitt is sometimes known as "Genuine A-1," and when properly made is tough, hard, has a low melting point, good anti-fractional qualities and is more nearly fool-proof than any other babbitt in use. It has therefore become a valuable standard for the comparison of quality. However, the price of tin has become so high (approximately 50 cents per pound), that the problem of a substitute for the A-1 babbitt has become of great commercial importance; so much so that almost every conceivable formula of tin, lead, antimony, copper, zinc and nickel have been suggested and many of them tried in service as a substitute for the A-1. Some of these have met with success while others have met with very marked failure. This infinite variety of possible compositions, together with varying temperatures and hit-or-miss methods of handling the material has produced innumerable variations in the efficiency of the product.

Both laboratory and service tests have shown that good results may be had with the lead-base as well as the tin-base babbitts, so the problem reduces itself to a study of the conditions necessary to produce certain anti-frictional and mechanical qualities, and of the methods of testing for them.

During recent years we have been conducting a series of tests in the laboratories and works of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, for the purpose of determining some reliable yet practical test that would indicate the essential qualities and give a check on the materials used and on the method of manufacture, by means of which we may learn why a certain babbitt should be used, how it should be treated, and what it will do when completed and in service.

Friction Testing

The first test was conducted on a well-known friction testing machine, the results of which were not conclusive in that they could not be duplicated from day to day even on the same test sample. The experiences of others were then sought and among them the late Dr. C. B. Dudley was appealed to for a reliable friction test. He replied that he had tried all known laboratory tests and semblance of tests, to be convinced that only the service test could so far be relied upon.

We next turned our attention to a practical service test on motors operating under severe shop conditions. Ten motors were selected for the test. They were of varied sizes but all had cast-iron shells lined with tin-base babbitt metal. The bearings were all replaced with other bearings lined with the lead-base metal carefully and properly made. In every case the lead-base lining stood up as well and in some cases better than the tin-base lining—the severe conditions under which they were operating remaining the same.

This test was so satisfactory and apparently so conclusive that the lead-base metal was adopted for the bearings of a certain line of motors and accordingly manufacturing was begun under normal shop supervision, but very soon bearing troubles were reported from the test floor. Some of the relatively few bearings which gave trouble were brittle while others were soft and wiped out. The existence of these opposing characteristics of failure in a few bearings, in spite of the good results found in a large majority of the bearings on test as well as under normal service conditions, gave us much concern, and the difficulties encountered shattered the faith so far placed in the lead-base metal, because it was not entirely clear as to what had caused the occasional failure.

In order to determine the underlying causes for these varied characteristics a test to destruction was planned. With this object in view a test bearing was made from a lead-base metal but under careful supervision; each bearing was measured accurately, each set of measurements including five diameters equally spaced at each end and at the middle of the bearing. The bearings were then mounted in a test motor. A 265-lb. weight was mounted eccentrically on the pulley end of the shaft. The motor was run at speeds increased by easy steps until the limit of the motor frame was exceeded and the frame destroyed; yet the bearing remained in good condition.

A second test was planned using the same bearing and a 25 h.p. motor. This motor was back-geared to a counter shaft to which in turn was coupled an arm driving an eccentric weighing 750 lb., thus producing a shock similar to the effect found in the operation of a rock crusher. A generator was belted to the same counter shaft in order to load the motor in the test. The motor was run light for several days with shock effect only. It was then loaded by steps until an excessive overload was reacher, which in addition to the continual shock caused by the eccentric produced a condition much more severe than is allowable even in extreme practice. Yet with all this the bearing remained in good condition and check measurements showed negligible wear.

In this connection it may be well to state that there is a distinct difference between bearing metal and bearings because bearing troubles may be due to many causes not inherent in the metal—such as defective alignment, improper lubrication, insufficient clearance, sand in oil, abnormal belt pull, etc., all of which must be considered separately from the bearing metal itself.

---

*Before the American Society for Testing Materials.

The Brinell Test

No definite measure of quality could be deducted nor conclusions drawn from the above tests, therefore other tests were sought which would give a measure of comparative value. The Brinell test was next tried as follows: a 500-kg. weight on a ball 10 mm. in diameter for a period of 30 seconds was used. The sample was poured into an open steel mold 2 in. in diameter by ⅝ in. deep, previously heated to about 150 deg. C. Before making the impressions the specimens were faced off, removing just enough metal to even up the two flat surfaces. The Brinell test was then made on the bottom end of the specimen at three equally spaced points on a circle one-half the radial distance from the center. An average of the three readings was recorded as the hardness of the metal. A Brinell hardness numeral of 30 for tin-base and 23.5 for lead-base metal was found to give most excellent results, other things being normal; but this test did not reveal the whole story, since it failed to differentiate between toughness and brittleness.

Hammer Test

A further test was found to be necessary in order to detect and study these two characteristics, so a hammer test was devised which has shown results that indicate the qualities of the babbitt more clearly and definitely than any other quick test. The test specimen if soft peens out, if brittle it breaks, while if soft and brittle it peens out and crumbles.

This test resembles the most severe service conditions with the wiping action left out and is introduced here as worthy of the most careful consideration, and the many tests made have proven it to be extremely useful in giving a measure of brittleness and toughness. When used in combination with the Brinell test we have no difficulty in detecting defective babbitt metals.

A series of hammer tests was inaugurated with special reference to the comparative qualities of the lead-base and the tin-base metals. These tests included a great variety of heat treatments and methods of handling the metal and their results emphasized the favorable possibilities of the lead-base metal, but also showed clearly that the temperature of both the smelting and pouring of the metal must be kept within narrow limits.

The samples for test were made as follows:

The metal was poured into a metal mold producing a rough casting 1¼ in. in diameter by 5-16 in. thick, which was then turned to 1 in. in diameter by ¼ in. thick. The turned sample was placed on the anvil of the testing device and the hammer set in motion. Readings were taken at frequent intervals, observing thickness of sample and number of strokes, from which curves were plotted.

Samples were taken from the kettles where the different alloys were being smelted, from stock ingots remelted in a hand ladle and from various babbitting pots. A careful record was made of all conditions that might affect later results, including the temperature and general condition of the metal, as well as the temperature of the molds into which they were poured. The results of the tests on these samples demonstrated clearly that some were hard and brittle, some soft and brittle and others soft and plastic, while still others were hard and tough. The tin-base samples showed much less variation than the lead-base although some of the very best results obtained were from the lead-base metal. These observations and tests further indicated that smelting and pouring temperatures especially of the lead-base metal were of prime importance.

Temperature Tests

The following detail study of the lead-base metal was then made on material known to be of good quality before subjecting it to different temperatures. The samples were 12 in number.

No. 1 was poured at 320 deg. C. The metal showed a granular and brittle condition due to having been poured too cold.

No. 2 was poured at 700 deg. C. The unstable character of this sample was due to having been poured too hot.

No. 3 was heated to 700 deg. C., allowed to become cold, then reheated to a similar temperature many times and finally reheated and poured at 460 deg. C. This sample was also unstable due to repeated overheating, even though poured at a proper temperature.

No. 4 was heated at 550 deg. C. and allowed to become cold, then reheated to a similar temperature many times and finally reheated to about 490 deg. C. and poured. It showed a brittleness due to repeated overheating, even though the temperature was only slightly higher than that necessary for the pouring of good bearings.

No. 5 was heated to 700 deg. C. and cooled to 400 deg. C. before pouring. It was softened as the result of the single over-heating.

Nos. 6 and 7 were poured at 360 deg. C. Both shewed a decided improvement over No. 1 but were poured at too low a temperature to produce the proper hardness and toughness necessary for a good bearing.

No. 8 was heated quickly to 600 deg. C. and poured at once. Very little damage was done by the one overheating.

No. 9 was heated similarly to 600 deg. C. but cooled to 460 deg. C. before pouring. Better shaped curves were produced than in No. 8.

Nos. 10 and 11 were poured at 480 deg. C. and No. 12 was poured at 460 deg. C.; all were hard and tough giving curves characteristic of a good babbitt.

A large number of tests were also made on babbitts of a great variety of composition for the purpose of comparison. No babbitt tested gave better curves than those made from the lead-base metal when carefully and properly made, thus demonstrating the possibilities of the lead-base metal.

This series of tests was so conclusive as to the importance of temperature limitations that a temperature regulator was designed and installed on each babbitting pot. These regulators were so adjusted and safeguarded as to render it impossible for the temperature of the babbitt in the pot to exceed a fixed limit.

It has been found to be entirely practical to automatically regulate the temperature of the metal in the pot so that the variation from a fixed point need not be more than plus or minus 10 deg. C., and this variation is well within the range of safety for the lead-base as well as the tin-base metal.

The hammer testing device proved so interesting and instructive that an improved drop-hammer was designed and built. This hammer has a stroke of 1¾ ft. lb., and requires only about five per cent. of the number of strokes, and a correspondingly shorter length of time for the test than was required on the first device. All of the more recent tests including the following have been made under the new hammer, and represent a few of a long series of tests made in connection with commercial work with special reference to the following features: raw material used, smelting and refining in the crucible or kettle, Brinell hardness of standard samples of the ingot as poured, remelting and pouring temperatures at the babbitting pot, temperatures of the shells into which the metal is poured, Brinell tests and hammer tests taken from the babbitting pots at frequent intervals, and to a limited extent the microscopic structure of babbitt known to be good as well as that known to be defective.

Conclusions

The conclusions drawn as a direct result of these tests, together with a large amount of service experience, may be summarized as follows:

1. The number of compositions of babbitt metals should be as few as possible, preferably one of the tin-base and one of the lead-base and each should be made the best of its class.

2. The constituent metals must be of superior grade, carefully tested and inspected, since the first requisite is a good raw material.

3. The alloying or smelting is of vital importance and must be so done that the high and low-melting-point metals may be properly alloyed far below the melting point of some of the component parts. A temperature of 500 deg. C. and less has been found to be sufficient to obtain satisfactory alloying of babbitt metal. The melted metal should at all times be kept covered with powdered charcoal or other protection from oxidation.

4. Pouring the babbitt too cold tends to produce a granular or coarse crystal formation and pouring it too hot tends to produce a softening effect. The lead-base babbitt is not nearly as fool-proof as the tin-base, and therefore the range of pouring temperature is more limited. However, a pouring temperature of 460 deg. C. (450 deg. to 470 deg. C.) for both lead-base and tin-base babbitts has been found to give most excellent results.

5. Heating the shell to 100 deg. to 150 deg. C. before the babbitt is poured into it tends to prevent blowholes and similar defects and also prevents the lining from shrinking away from the shell.

6. Babbitted bearings must not be jarred while the metal is solidifying since any disturbance at this temperature tends to enlargement of the crystals and corresponding brittleness.

7. The matrix of the lining metal should be just stiff enough to support the hard crystals. These hard crystals should be as numerous as possible and yet not lie on each other to cause brittleness.

8. A Brinell hardness of 23.5 for lead-base and 30 for tin-base babbitts has been found to give most excellent results.

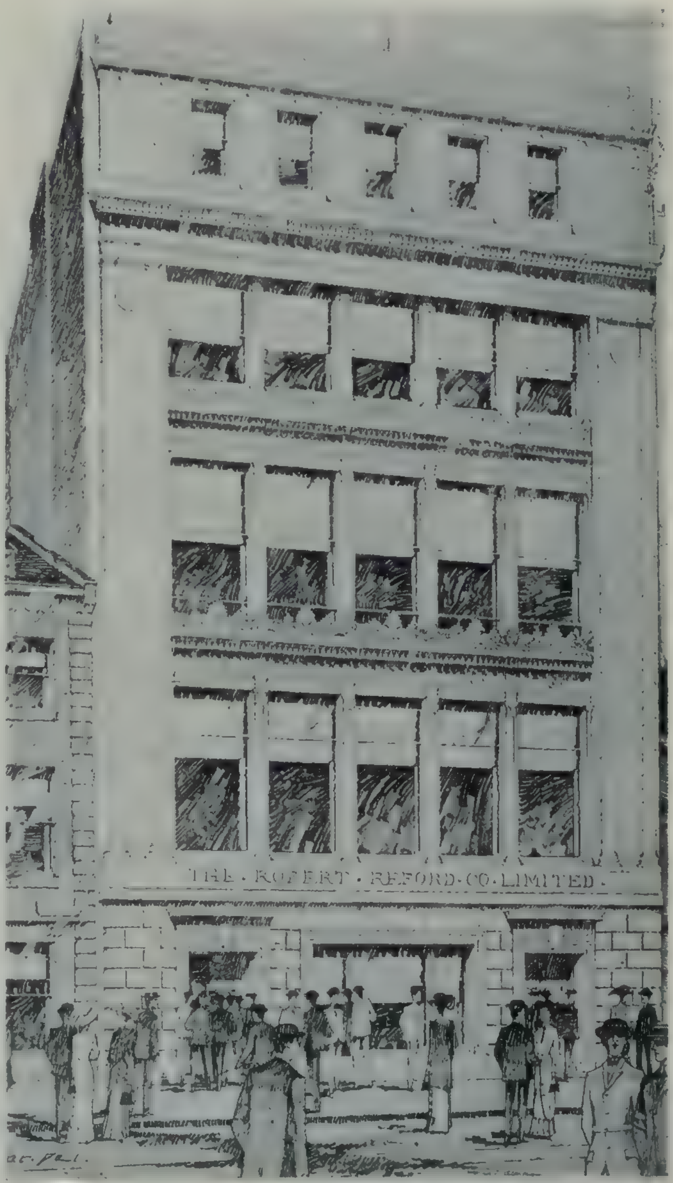
These tests and suggestions are offered simply as a study to be furthered by those interested in applying babbitted bearings to their several service conditions; and while no final decision can be reached as the result of these tests, they certainly do emphasize the great importance of working closely to given compositions, and of following definite processes checked by chemical tests, Brinell tests, hammer tests, careful supervision, and finally by the court of last resort, service.

A Chinese student of mechanical engineering at Massachusetts Institute of Technology, is experimenting with Chinese bamboo for concrete reinforcement purposes, having had a quantity shipped to him from his native land. Bamboo is the standard building material of many tropical countries and is widely used also in China.

New Building for Robert Reford Company, Montreal

From designs by Messrs. Ross and Macdonald, Montreal, the Peter Lyall Construction Company have commenced the construction of an office building of four storeys and a basement for the Robert Reford Company, shipping agents, Montreal.

The new building will be partly on the site of the present structure, and will extend the full depth of the property, with elevations on both Hospital and St. Sacrament streets. Separate entrances have been provided, each remote from the other, for the saloon and steerage passengers. The general office will occupy a large area in the centre of the building; this room will be one of the finest in the city in its location, lighting, architectural treatment, and area. The site is 180 by 40. The foundations will be of concrete, with a base of granite, the remainder of the exterior being of grey limestone. The frame of the building will be of concrete. A large quantity of marble will be utilized in finishing the hall. The rooms will be finished in stone, marble and white quartered oak.


THE · ROBERT · REFORD · CO · LIMITED ·

Proposed office building for Robert Reford Company

Interior Appointment and Equipment of a Modern Bank

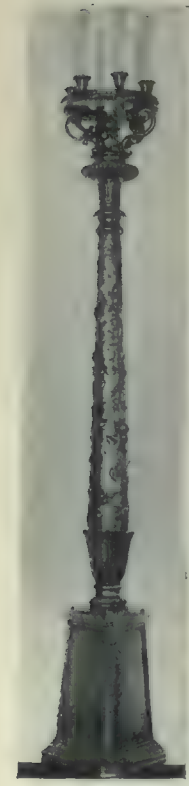


Fig. 1

IN the issue of the Contract Record of April 10th, 1912, was published a description of the constructional features and exterior detail of the new general offices of the Bank of Toronto, at that time in the process of building in the city of Toronto. Since then the work has been pushed to completion and as the interior appointments and equipment involve a number of extremely interesting features, we publish in this issue a description of the chief points of interest to be found in the interior arrangement and business facilities of the institution.

The new Bank of Toronto building, with its beautifully pillared walls, situated at the corner of Bay and King streets, Toronto, conveys to the sense of sight the very idea that the word bank should convey to the mind—strength and solidity. The exterior is of the lightest pink Tennesse marble, which against the winter snow inspires a sense of warmth. The building is one of the most attractive in the city. The material of which it is constructed, its beautiful Corinthian columns and the wealth of sculpture work challenges and holds the attention. The sculpture ornamentation was designed by the architects, modelled by L. Tonnetti, Neumann & Even, of New York, and carved by Ardolino Bros., Toronto, and, while there is much of it, one never feels that it is overdone.

The institution stands as every building of a public character should stand, a monument of the architectural and constructional skill of the day in which it was built. It was designed by the architects, Messrs. Carrere, Hastings and Eustace G. Bird, of Toronto. The power plant was laid out by the same architects with Messrs. Clark and McMullen and Riley as consulting engineers.

INTERIOR STRUCTURAL DETAILS

Just as in the exterior plan the architects have striven to make the building suggestive of the purpose for which it is intended, so in the interior they have consciously striven after a certain effect and have been most successful in the accomplishment of that object. As one passes into the rotunda, there comes a sense of restfulness; in some intangible way there is conveyed to the mind a consciousness that numerous elements have been wrought into harmonious unity, without a single discordant color tone.

The block, which constitutes the general offices of the Bank of Toronto, is of six storeys, four above the ground floor, with basement and sub-basement. There are two entrances, the Bay street and the King street, the latter being the main entrance. On going into the building from King street, one passes through the

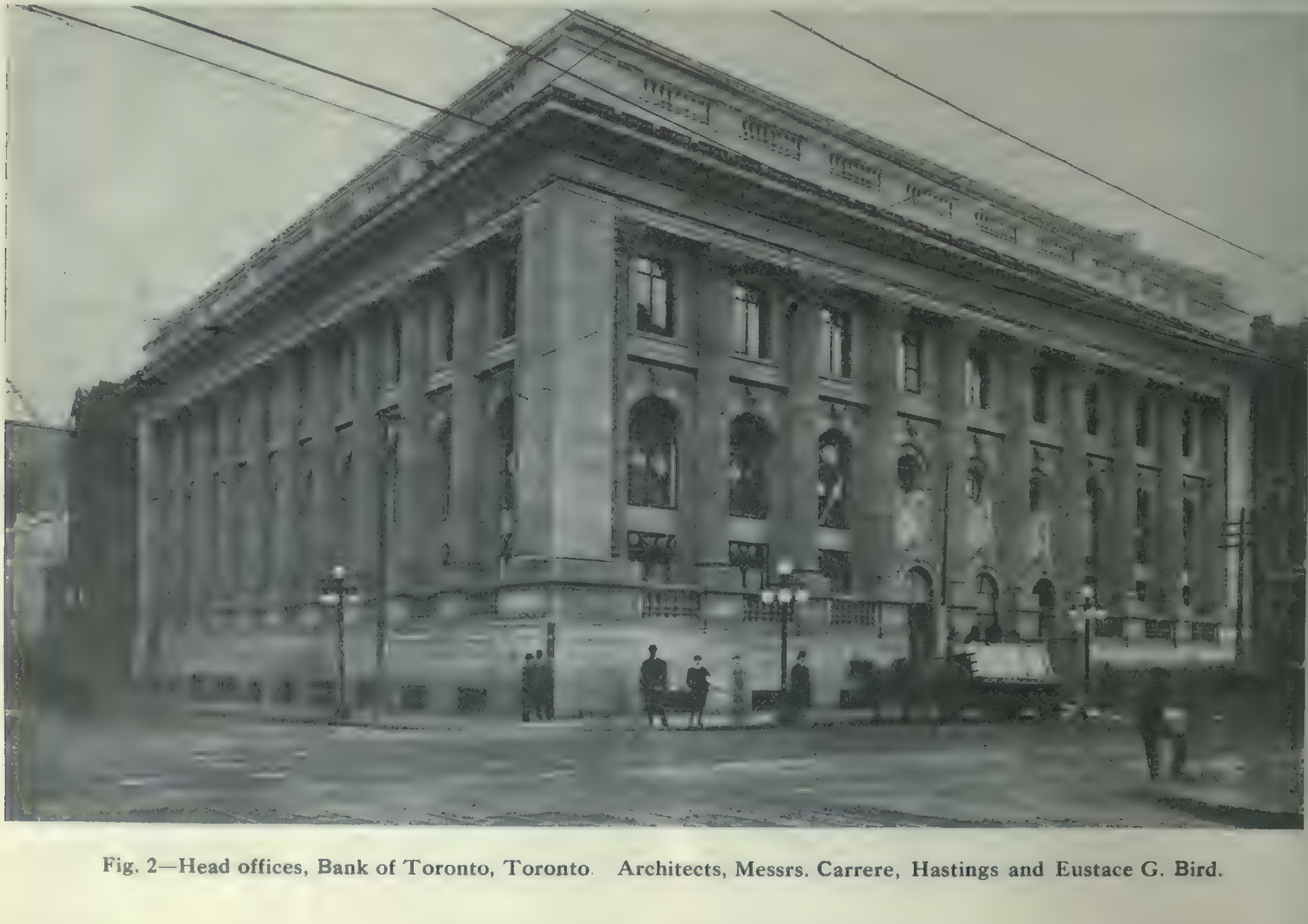


Fig. 2—Head offices, Bank of Toronto, Toronto. Architects, Messrs. Carrere, Hastings and Eustace G. Bird.

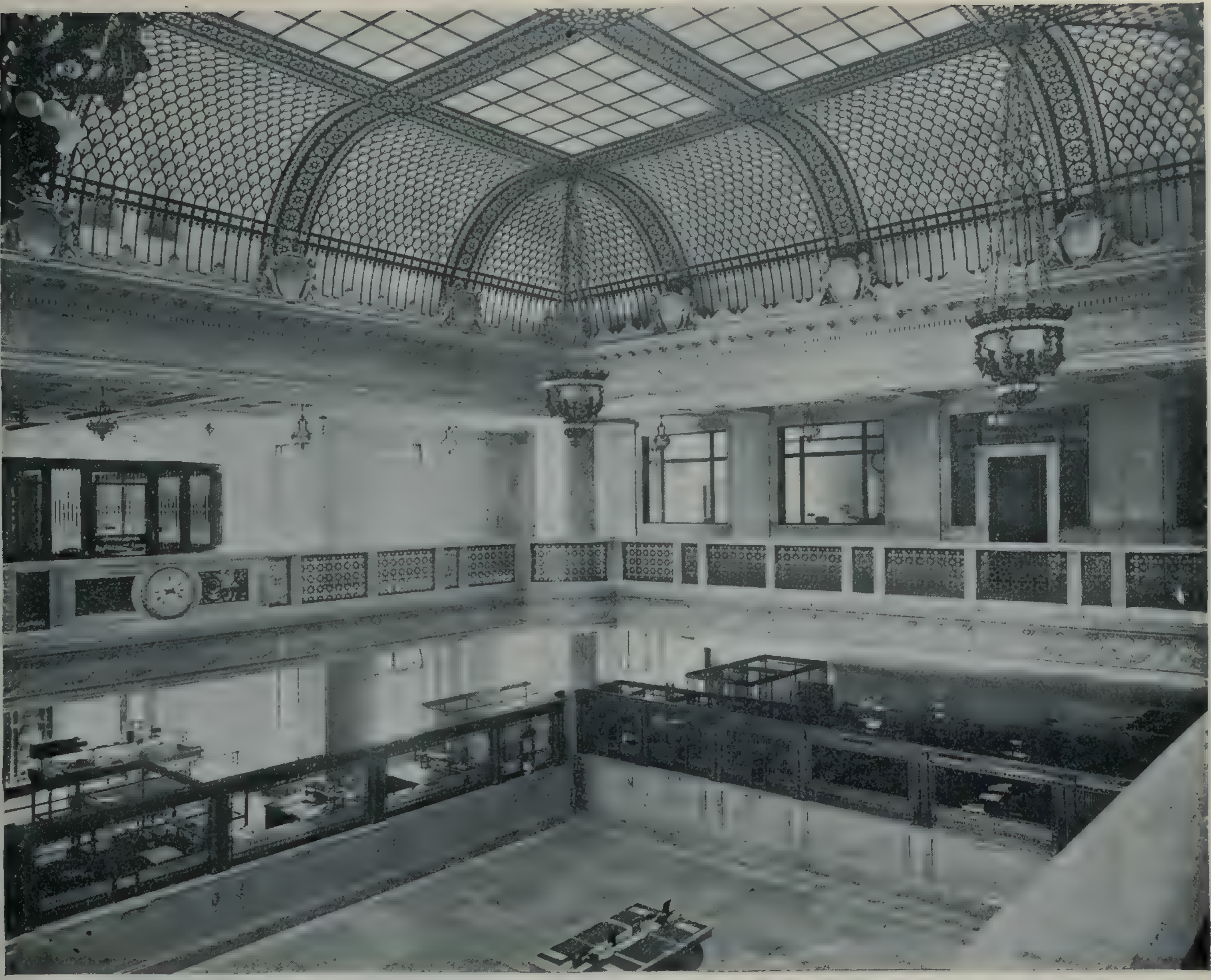


Fig. 3—Main banking room.

monumental vestibule finished entirely in Ceneri marble. The entrance from Bay street as well as the main entrance have vaulted ceilings of the same material. On either side of the vestibule is a beautiful six-light standard as shown in Fig. 1. The standards are made of bronze, the ornamentation on the stems being entirely hand-wrought.

Main Banking Hall

The rotunda, or public business hall of the bank, is the most striking feature of the interior. It is a spacious apartment with the counters arranged around three sides. There is not a column nor structure of any description to intercept the vision or give a sense of restriction; on the other hand, there is the feeling of surprise that such extent has been obtained. It rises to a height of three storeys and terminates in a magnificent dome of glass and cast bronze, unsurpassed for its beauty, probably, by any on the continent. The ornamental bronze of the dome, together with the ornamental iron and bronze of the gallery railing, elevator enclosures and stair rails, was manufactured by the Architectural Bronze & Iron Works, of the Canadian Allis-Chalmers, Limited, Toronto. The skill with which the work was executed and its erection effected, proved a source of great satisfaction to the architects in charge. The dome is glazed with muffled cathedral glass. The field is a pale amber cathedral, bent to meet the requirements. This material was especially made and imported for the color. The outline is a white plain cathedral glass and the effect of the whole is harmonizing and pleasing. The office doors are glazed with imperial plate prism glass, that is the pressed pattern glass on one side with a plate glass finish on the other, giving the doors a clean-cut appearance and almost jewel-like brilliancy. The ornamental glass for the doors and dome was supplied and installed by the Toronto Plate Glass Importing Company, Limited. A portion of this main banking hall and the bronze work of the dome are shown in Fig. 3. An abundance of softened light is admitted through the ample window spaces fronting on King and Bay streets and through the glass of the dome. The general work of the interior is finished in Botticino marble, a monotone of which one never tires and the appearance of which imparts an idea of strength and security. The counters are of Verdello marble with handsome bronze railings executed by the Gorham Company, New York.

The second storey surrounding the rotunda is a balcony or mezzanine floor. The monumental stairs leading to this are of Ceneri marble, with a cast bronze rail. The ceiling around the gallery is of Botticino marble.

The rotunda floor is of Hauteville marble with borders of several Italian colored marbles. All working spaces are provided with nonpareil cork tiling, furnished and installed by David E. Kennedy, Inc., of New York and Montreal. The cork tiling in addition to being sanitary and practically non-inflammable through being laid on a concrete bed, is noiseless and comfortable to stand or walk on. It is of natural wood color and quite agreeable to the eye.

A striking portion of the ornamentation of the rotunda is the four 60-light electroliers, probably the most beautiful ever installed in any public building in Canada. The lighting is semi-indirect. In these fixtures the centre bowl is of alabaster especially carved and imported from Italy for this work. The metal parts are of bronze, hand-chased and finished in gold. Some idea of their magnificence may be obtained from their dimensions. The alabaster bowl has a diameter of 3 ft. 6 in., the metal crown supporting the bowl is 5 ft. in diameter while the height from the bottom of the fixture to the crown is 15 ft. 6 in.

Mezzanine Floor

On the mezzanine floor are situated the cash and securities department, assembly and visitors' room, the bankers' library and correspondence department. What may be termed the third floor will be occupied by the president, general manager and inspectors. The board room and lunch room for the staff will also be found here. The fourth floor has been leased for office purposes. This floor rises on three sides above the exterior finish of the glass dome of the rotunda, serving to protect it and yet is not carried to such a height as to interfere in any way with the lighting. The interior of the various rooms above the ground floor is finished in Circassian walnut and panelled from floor to ceiling. The floor is of teak, a somewhat new feature in Canadian work. The mantles in these rooms are monumental in appearance and composed of various marbles handsomely sculptured.

The lighting fixtures of the mezzanine and the various officers' rooms are of an ornamental character and carefully designed by the architects to be in keeping with the general interior tone. The mezzanine is lighted by eighteen 6-light ceiling fixtures finished in gold. The bowl is of alabaster and was also especially imported. Fig. 5. In the rooms set apart for the officials of the bank, wood fixtures are used. These are hand carved and the finish is applied in gold leaf. The high lights are brought out by means of a polished finish with the receding details in a dull gold. By the combination of shades thus effected, the beauty of the fixture is greatly enhanced. Fig. 6. The lighting of the assembly room is accomplished by four 5-light bronze fixtures finished in Vernis gilt. Every part of these is cast and hand tooled. Fig. 7. The lighting fixtures were supplied and installed by the Murray-Kay Company, of Toronto.

The furniture of these rooms is among the finest if not the finest to be found in any public building in Canada. It is all of Renaissance style. The wood used is genuine French walnut, except in the president and general manager's waiting room, where the furniture is of quarter-cut Austrian oak. In the assembly room is a magnificent pedestal table fourteen feet long made of French walnut and richly carved by hand. There is also a smaller pedestal table and eighteen carved chairs upholstered and covered in pig skin leather. This upholstery is carried out in the visitors' room and board room. In the former the French walnut tables are provided with tops of Skyros marble. In the president and general manager's waiting rooms are comfortable arm-chairs with hand carved frames and a large carved settee, all made of Austrian oak. The furniture received the careful attention of the architects in order to maintain the unity of the interior appointments and was supplied by Murray-Kay Company, Limited.

Lighting

The question of securing proper lighting is always one of great importance and never more so than in an institution of this character. The windows for the King and Bay street elevations of the basement, ground, mezzanine and first floors and for the court windows opening into the banking rooms, were especially designed and made for this building by Messrs. Henry Hope & Sons, Birmingham, Eng., through their Canadian offices, Toronto. The large windows in the banking room are 6 ft. 9 in. wide and 21 ft. high and have a large ornamental cast bronze panel of design which is a work of art in itself. In order to obtain the required strength and at the same time provide the maximum amount of light, it was necessary to design especially heavy gun-metal sections, larger and heavier than has been used, it is said, in any part of the world, the metal being made according to the same specifications as those adopted by the British Admiralty. The casements are fitted with the highest quality of ornamental bronze hardware, the whole being finished in

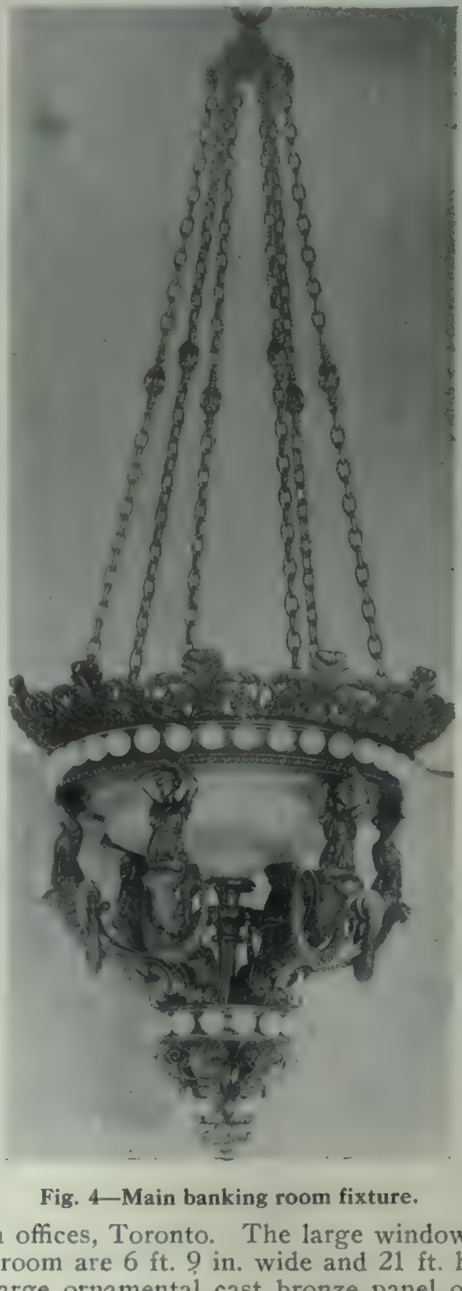


Fig. 4—Main banking room fixture.

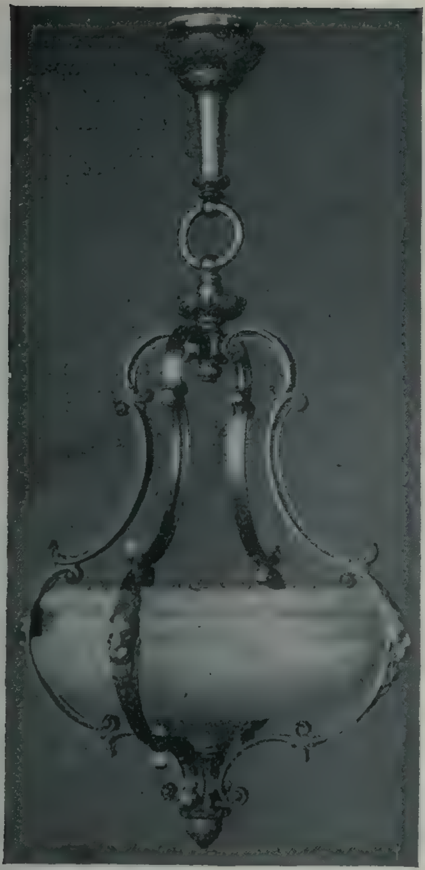


Fig. 5—Balcony.

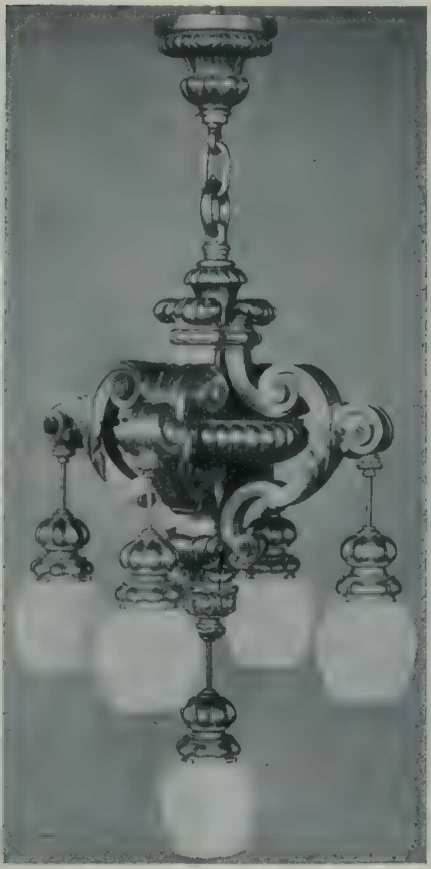


Fig. 6—Private offices.

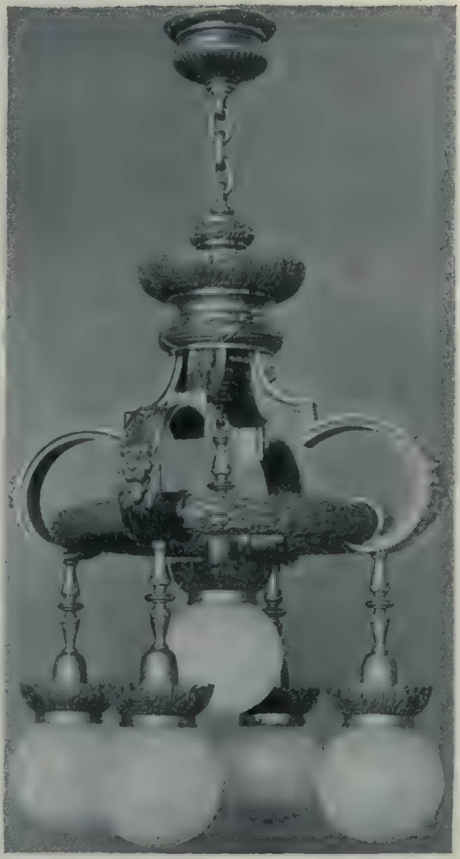


Fig. 7—Assembly room.

beautiful chocolate bronze color and they are recognized as among the finest windows of their kind ever produced.

The frames for the windows of the office suites were manufactured and installed by the A. B. Ormsby Company, Limited, Toronto. The frames here are of the double hung type with metal drawn on wood under heavy pressure and conforming to a most exacting standard of good workmanship. The various skylights in connection with the building were manufactured and installed by the same company and are what is known as the Ormsby Underwriters skylight. The glazing bars are constructed with a heavy core, giving a maximum of strength. We may add that the same company also provided the copper clad doors for the rear entrance and roof houses and also the roofing work.

Master Key System

The finishing hardware of the interior comprises a number of rather attractive features. This was especially designed by P. &. F. Corbin, New Brittain, Conn., and supplied through Freek, Clark & Company, Toronto. The master key system has been very carefully worked out and the locks are master keyed and grandmaster keyed to meet the special conditions of a banking institution. The coupon booth doors are so arranged as to guarantee a customer absolute privacy while checking monetary transactions. The lock on the outside of the door indicates when the booth is occupied and can be unlocked only by a person in authority who has a key which passes these locks. The occupant however can open the door at all times from the inside without necessitating the use of a key.

EQUIPMENT

The power house with its switchboard and auxiliary equipment, boiler room, engines, air cooling and purifying apparatus, is found in the sub-basement. This little plant, Fig. 8, because of its compactness, convenience of arrangement and success in operation, is an excellent example of what skill and foresight can accomplish. The walls and floor of the power house are of white enamelled brick, and the floor space covers an area of 1,800 square feet. To guard against any possible contingency arising from the failure of a power supply on the part of the local distributing company, a steam driven direct current generator plant has been installed with a capacity of 200 kw. There are four generators in the equipment made up of two 75 units and two 25 units, each connected with its own engine. The generators were supplied by the Canadian General Electric Company, and the engines are Robb manufacture.

Boilers and Engines

The boilers in connection with the plant were constructed and installed by the McKenzie Furnace Company, New York. Each is provided with a Dutch oven, in which the coal is coked before being admitted to the firebox. By this process all danger of the smoke nuisance is eliminated. In order to keep the coal from burning during the process of coking a continuous flow of water is maintained around the ovens. All gases produced during the process are forced over the firebox and aid in the work of combustion.

The engine equipment consists of two 9 in. by 10 in. horizontal slide valve engines direct connected to the 25 kw. generators at 310 r.p.m.; also two 13 in. by 14 in. horizontal slide valve engines direct connected to two 75 kw. generators at 275 r.p.m.

The steam valves of these engines are the straight line type scraped through and balanced against steam pressure by a heavy plate held away from the valve-seats by distance strips 2/1,000 in. thicker than the valve, thereby allowing it to move more freely. Double port openings in the valve allow the steam to enter the cylinder and exhaust quickly.

The pistons are made as light as possible to prevent wear to the cylinder, and so that the piston may break before the cylinder or head in case of confined water.

The engines are equipped with the Robb-Armstrong Sweet governor, giving a throttling effect on light load and reducing range of temperature in the cylinder; also as the load becomes greater the initial pressure approaches full pressure in steam pipe, giving a steam distribution well adapted to economy in variable loads. The shaft bearings consist of interchangeable removable shells which may be adjusted while the engine is running.

The oiling system consists of positively driven pump attached to the crank pin which draws oil from the base and distributes it through the pipes to the bearings. The regulation of these engines is 1 per cent. from light to full load.

Additional Electrical Equipment

The switchboard, which was supplied by the Northern Electric & Manufacturing Company, is completely equipped. To the left are two Weston volt meters. On the main part of the board are eight ammeters, also of Weston type. At each end to the right and left of the ammeters is a Duncan recording watt meter. At the centre of the board an Esterline recording volt meter has been installed. The circuit breakers are I. T. E. type. A small motor generator set is also to be found in the generator room, 50 amperes 20 volts, used chiefly for storage battery work. This is controlled by a battery board which works in conjunction with the motor generator and batteries through eight branch switches, one motor switch, one generator switch and two charge and discharge switches. This board carries three ammeters, one volt meter, pilot lights, etc.

The battery consists of sixteen 20 ampere hour cells. These are used chiefly for telephones, call bells and annunciators. The building contains 52 telephones, which will be under the control of the bank's own switchboard in a specially planned telephone switchboard room. This central room will also be used as a centre for the automatic air pressure messenger system which has been installed throughout the building. The electrical equipment also includes a system of electric clocks, which will be under the control of one master clock. This means that if the master clock is correct so are all the others in the building. There will be seventeen in all, including the master clock, which is located in the clerks' lunch room on the second floor. Two of these clocks present a particularly fine appearance and stand in the balcony of the main public banking room. They have 16 in. marble dials.

Elevators

The elevator equipment consists of three passenger elevators, one freight elevator, two dumb waiters and the necessary pumping plant. Near the King street entrance is situated an hydraulic plunger elevator which plies between the ground floor and the second floor. It has a capacity of 2,000 lbs. and a speed of 250 feet per minute with a load of 1,200 lbs. A second hydraulic plunger passenger elevator is situated near the Bay street entrance and runs from the basement to the top floor. This elevator has the somewhat greater capacity of 2,200 lbs. with a speed of 300 feet per minute for a load of 1,200 lbs. This latter elevator runs from the basement to the top floor. An automatic push button elevator maintains communication between the main and first floors near the vault. It has a capacity of 1,500 lbs. with a speed of 150 feet per minute for a load of 1,500 lbs. The hydraulic freight elevator travels from the street level to the sub-basement. One of the dumb waiters is used for service work and the other serves as a booklift. Both are of the automatic type and can be used at any floor. They are actuated by 7½ h.p. electric motor. The hydraulic elevator pumping plant consists of two Worthington duplex tandem steam pumps 12 in. by 10½ by 10 in. situated in the sub-basement. Water is pumped into a pressure tank at 150 lbs., from which the elevators are operated. In the sub-basement is also placed the discharge tank. The elevator equipment was installed by the Otis Fensom Elevator Company.

Heating and Ventilation

The heating system is a combination of hot air and steam heat, the latter being employed in the top floor. In connection with the Webster system of circulation which has been installed there are two vacuum pumps, one driven by a Bruce Peebles' motor and one steam driven. By these the condensations from the radiators and "Vent" heaters are drawn away and delivered into an air separating tank. From this the water drains into the feed water heater. The radiators are heated by exhaust steam.

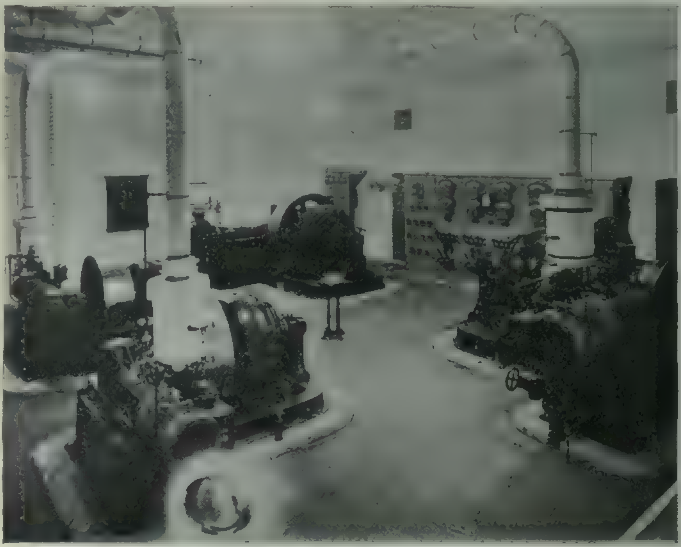


Fig. 8—Steam electric plant.

The hot air system of heating and ventilation is a most interesting feature in connection with the equipment. It consists of supply and exhaust fans and ducts with heating and washing apparatus. The fans are motor driven. The lavatories have a separate system of ventilation. Each room is provided with a thermostat by which it is possible to regulate the temperature to any desired degree.

Water Filtration

In order to provide pure water for the institution a filtration plant has been installed. The water upon entering the building passes through a filter which is so arranged that it may be readily cleansed. From here the water passes into a sterilizer where the water is heated and sterilized. It is then cooled and by means of a pump, circulation is kept up throughout the building.

Pneumatic Tubes

The pneumatic tube system very materially facilitates business. There are 23 stations situated throughout the building. The compressed air for this service is provided by a Connersville horizontal rotary blower, which has a capacity of 13 cubic feet of air per revolution and is driven by a 10 h.p. 400 r.p.m. motor. A vacuum cleaner system is connected with every room in the building. A 7½ h.p. motor provides the energy and it is so arranged that the motor can be started or can be stopped by switches situated at various points throughout the building.

The galvanized duct work for ventilation and heating and for the installations requiring duct work was erected by A. Matthews, Limited, Toronto.

Incinerator

A rather unique feature in connection with the equipment is the incinerator for the periodical destruction of retired currency. This work must be done with the absolute assurance that none of the old bills can escape and that the process of reduction will be complete. The incinerator plant is situated in the incinerator room in the basement. In appearance it resembles a steel clad vault or safe, with massive safe doors and smoke pipe from the top. When the outside steel door is opened a second cast iron heavily baffled door is encountered, which, on being opened, discloses the retort or reduction chamber. This chamber is 2½ ft. square by 2½ ft. high and is completely lined with highly refractory fire clay blocks and terminates in a perforated arch through which small openings allow the products of combustion to pass into a second baffled chamber, and finally to a third chamber before escaping. The burner is designed to produce and retain 2,800 deg. of heat which is sufficient to melt iron. The fuel and heat producing medium is gas with a large proportion of air supplied by an electric motor and blower apparatus. These are regulated by a series of adjustable valves admitting the amount of gas and air necessary for the operation. On a test the incinerator reduced $500,000 of old notes at one burning in fifty minutes. The quantity of bills thus represented completely filled the retort and gave approximately 9½ cubic feet of paper in solid. This incinerator was installed by the Toronto Furnace & Crematory Company.

No bank equipment would be complete without a system of vaults. In the basement are to be found a series of safety silver deposit vaults. The vaults for the banking purposes are found on the first and second and third floors, two vaults on each floor. These have probably the heaviest tonnage of any on the continent, having an aggregate weight of approximately 400 tons. They are of brick construction lined with 3 in. steel and provided with doors having a thickness of 2 ft. and furnished with double time locks. Further protection is given by the installation of a watchman's detective service and fire equipment.

All doorways in the basement and sub-basement are protected by kalemeined copper doors. They are said to be of the highest class kalemeined work manufactured in Canada. The outstanding feature is that they are not marred bv exposed nails as is the case in many ordinary kalemeined doors. These were furnished by Messrs. McFarlane, Douglas & Company, of Ottawa, through Messrs. Douglas Milligan, Limited, Montreal and Toronto.

The general contractors for the work of construction were Messrs. Norcross Bros.

Reinforced Concrete Arches

By V. J. Elmont, A.M. Can. Soc. C.E.

As an example of the extent to which reinforced concrete may be used in farm buildings is given below a description of a stable building made almost entirely of that material. The building is 73 ft. 8 in. by 47 ft. 6 in. As no columns were allowed on the interior of the building and as it was an absolute necessity that the floor should be able to carry a live load of 70 lbs. per square foot, the usual method of construction was not available. The beam and slab structure used generally under these circumtsances would have been too expensive and the outside walls would have to be carried to a great height in order to obtain sufficient clearance for the beams.

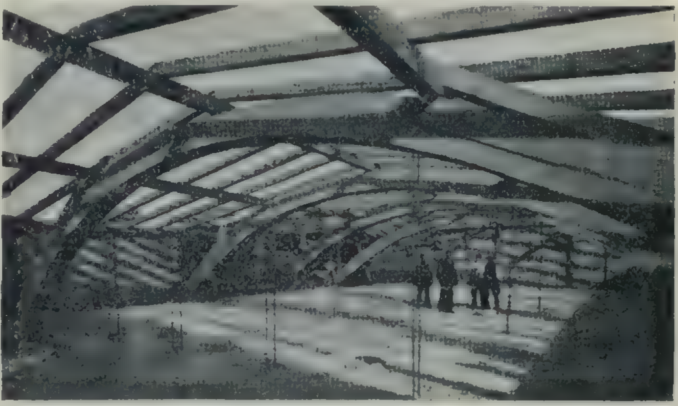


Fig. 1—Arches in position.

The structure actually built was much more economical. Over the building was arranged 4 arch girders (Figs. 1 and 2) resting on reinforced concrete columns in the outside wall. The arch girders at the crown have a depth of 16 in. and 20 in. at the springing line.

The ceiling is suspended to the arches by means of plain round bars having a diameter of 14 mm.; there are 12 bars over each arch.

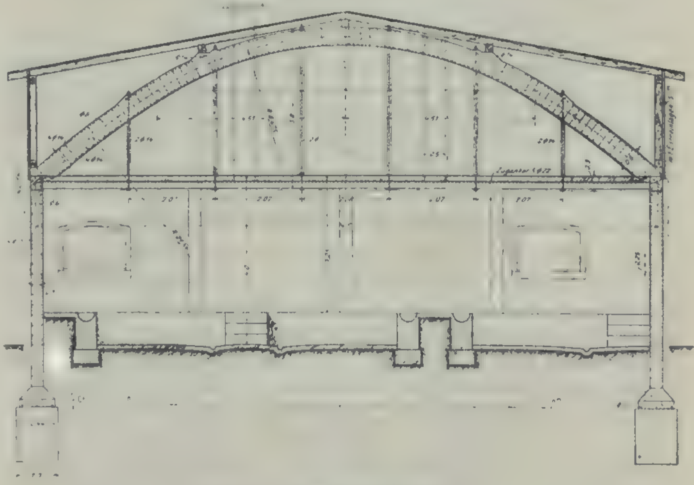


Fig. 2—Cross section.

The statical computation for the arch girders was made as for arches with two hinges, as the arches are simply supported on the columns and only connected with the ceiling through the tie rods embedded in it.

The maximum compression stress in the concrete is 550 lbs. per square foot and the tensile strength of the steel 14,300 lbs. per square foot.

Animal Growths in Water Pipes

Prevalent in Unfiltered Water — Influence of Temperature — Effects Upon Water—Rapidity of Growth—Methods of Removal

The retardation of the flow through water mains arising from incrustations of bacteria has frequently been discussed. Animal growths which sometimes appear in mains where unfiltered surface water is being carried have not been so fully treated. These animal growths not only cause trouble through retarding the flow but frequently give rise to unpleasant taste and odor. Mr. Samuel C. Chapman, water engineer of Torquay, Eng., recently discussed these formations before the Institution of Water Engineers at Wakefield. We publish this interesting article as it is reported in The Surveyor.

Much has been written in recent years concerning the incrustation of water pipes, and the retardation of flow due to the action of Cladothrix and kindred organisms, but comparatively little has been said, in English circles at least, of those animal growths which sometimes appear, and whose presence has been the source of considerable anxiety to those responsible for the administration of the undertaking in whose mains the creatures have ensconced themselves. That so little has been written on the subject is probably due to the fact that in the majority of works the whole of the water sent to the consumer is filtered, and the state of the pipes conveying water to the filters is not a matter of great concern, provided their efficiency remains unimpaired. Further, the difficulty rarely, if ever, arises in connection with supplies drawn from underground sources, so that the question of animal growths is limited practically to those undertakings whose supplies are drawn from rivers or from upland surface sources.

In the early days, before filtration was so universal or had reached its present state of efficiency, it was not an uncommon thing to hear of almost every description of fauna inhabiting the distributing mains, especially in cases where the supply was drawn direct from rivers and streams. Among the older records mention is often made of eels or other kinds of fish, and mussels, to say nothing of sponges and pipe moss, or Polyzoa.

Prevalence in Unfiltered Water

The history of the cholera outbreak at Hamburg is so well known that more than a passing reference thereto is unnecessary. The close and exhaustive investigations which followed that terrible visitation revealed the fact that the Elbe water, which was unfiltered, carried with it into the city's distributing mains sufficient nourishment to sustain the most prolific species of animal life. Besides sponges and Polyzoa, which furred up the pipes to a considerable extent, there were found snails and water-lice in hundreds at every examination, while mussels, eels, sticklebacks, and even flounders made their homes in the water mains. Dr. Kraepelin tells us that he found over fifty genera of animals in the pipes. Since the introduction of filters, however, the numerous inhabitants of the pipes have died off, and at the present time there are no animal growths of any description in the Hamburg distributing mains.

It is hardly necessary to remark that no one at the present time ever expects to hear of such highly developed animals as fish or eels in a town's distributing mains, yet in many works where filtration has not been adopted the lower growths are to be found in the pipes, and in some instances to such an extent as to cause much trouble and anxiety to those responsible for the administration of the supply. In the United States especially has this been the case, and Whipple has stated in reference to such growths as sponge and Polyzoa: "They are found in the pipes of New York City, Brooklyn, Boston, in many small places in New England, and in fact in most of the cities of New England where surface waters are used without filtration." There are, no doubt, many instances in this country where animal growths exist in pipes and conduits, which, by reason of their moss-like formation, have been wrongly ascribed to the vegetable kingdom.

Where water is drawn from rivers or impounding reservoirs without filtration, small free-swimming creatures are often drawn into the pipes, and so find their way into service reservoirs, and thence into the distributing mains. At certain seasons of the year their numbers may be very considerable, and the changes of temperature in the water in impounding reservoirs causes them to transfer their feeding grounds to such levels as may be within the area of influence of the draw-off pipes, and vast numbers may be carried into the mains thereby. The quantity of such life in a reservoir depends largely, or it may be said entirely, upon the available food supply therein, and in the new works, where food is more abundant, the number of these animals would be proportionately large.

A Remarkable Instance

The author had under his observation a short time ago a remarkable instance of the presence of these organisms in their myriads. The supply was drawn from a storage reservoir which had been in use for about five years, and before entering the trunk mains the water was passed through a battery of mechanical filters. These, under ordinary conditions, required cleansing every seven days. It was found necessary to wash them out more and more frequently, and at last the interval between successive washings was reduced to four days.

The manhole of one of the filters having been removed, it was found that the rapid clogging up was due to the presence of Daphnia, which covered the surface of the filter to a depth of ½ in. or more. To ascertain whether the whole reservoir was alive with these creatures, samples of water were taken at various depths (the reservoir was 50 ft. deep), and it was found that they were assembled in the greatest numbers at a depth between 15 ft. and 20 ft. from the surface. The water being then drawn off at another level, the filters were at once relieved of the extra work they had been called upon to bear.

The open surfaces of water, whether in service reservoirs, clear-water tanks, or in channels, lend themselves to the introduction of free-swimming animals into water mains. As is well known, many winged insects lay their eggs at the margins of open-water surfaces, and when these hatch out the larvae spend one part of their existence as free-swimming animals before reaching a further stage in their development. The larvae sometimes find their way into the pipes, and some may even reach the consumers, and although their presence may be easily accounted for, and it may be proved conclusively that the water has been properly filtered, the man in the street will still be of the the opinion that there is something amiss with the supply.

Insect Larvae

The larvae of the Dipterous insect are frequently found in mains carrying water from surface sources, and the author has observed them frequently among specimens of sponges and Polyzoa taken from mains and aqueducts in various parts of the country. Water-snails and water-lice, too, are to be found associated in the same manner with Polyzoa in various forms become lodged in pipes they at once attract large numbers of creatures which either prey upon them or shelter among their tangled masses.

Some years ago the author witnessed a rise of flies from the surface of a reservoir at Plymouth (the water was unfiltered). The caretaker reported that the screens at the outlet, which had an area of about 150 sq. ft., were blocked, and the reservoir was overflowing, a most unusual circumstance. A close examination revealed the fact that winged insects were rising in myriads to the surface, and while so doing many were drawn against the screens and killed. The dead bodies of these flies were jammed into a solid mass of considerable thickness against the surface of the screens. Above the structure of the reservoir were swallows innumerable, which found an easy living on this occasion at least. Without these screens considerable annoyance would have been occasioned to many consumers by the influx of these insects into the town's water supply.

Fortunately, many of these free-swimming organisms do not, as a rule, make the pipes their permanent abode, and they may be regarded simply as occasional and unwilling passengers on their journey to ends unknown, and, furthermore, they often become broken up to such an extent that little remains which can de detected without the aid of the microscope. There are, however, organisms which find the inside of pipes a most congenial place in which to take up their residence, and among these pipe-moss or Polyzoa and sponges are worthy of special notice. The first of these has been found in a variety of forms in many water undertakings in this country and on the Continent, while, as previously stated, they are found in nearly every unfiltered surface supply in the New England States of America. Sponges are also common in surface waters, and are found under almost the same conditions as the Polyzoa.

The question naturally arises as to whether and in what respect these growths are injurious to a water supply, and it may be said at once that they are not pathogenic. Dr. Kraepelin has informed the author with regard to Polyzoa, etc., that: "These organisms in pipes are not at all injurious, but, on the contrary, they consume the debris, and thus make the water purer."

Whipple is guarded in his remarks upon this question. In "The Microscopy of Drinking Water" (p. 168) he says: "In a certain sense they tend to improve the quality of the water by reducing the number of floating microscopic organisms; but they themselves must in time decay, and anyone whose nose has ever had an experience with decomposing sponge will appreciate the fact that better places for these organisms may be found than the distribution system of our water supplies. It should be stated, however, that in all probability very large quantities would be required to produce tastes or odours that would be noticed in the water."

Difficulties Caused

One of the chief objections to these growths lies in the fact that they produce mechanical difficulties which are exceedingly detrimental to any water undertaking: thus at Hamburg, sponges, Polyzoa, and other organisms were found covering the interior of the pipes to a considerable thickness, and to such an extent that the capacity of the pipes was seriously interfered with. At Antwerp, Dr. Kemna some years ago discovered a growth of Polyzoa in a 24-in. main conveying unfiltered water, which reduced the clear diameter of the pipes to 16 in.

Whipple, writing to the author in regard to the growths of Polyzoa in water mains, says: "In regard to the sizes of pipes that have been choked with pipe-moss, I do not know that I have ever seen a pipe actually clogged that was larger than 2 in., but I have seen 4-in. pipes that were nearly full, and it is not at all uncommon to find growths from 1 in. to 2 in. thick in 8-in., 12-in., and 24-in. pipes."

In many cases the surface of the growths resembles thick rough matting, while in others they are surrounded by a collection of mud and slime. Sponges are most irregular in their growth, sometimes forming a thick, smooth surface, while other forms may protrude long finger-like projections into the water.

The author examined a 12-in. pipe some time ago which was coated with sponge to a thickness of nearly ½ in. This was found to have a very rough surface. The growth had covered up the rust nodules that were on the surface, and had used these irregularities evidently to their own advantage by sending therefrom projections into the water area for the better acquirement of food. The result was a surface of the worst possible type for obtaining an efficient flow of water. There is little doubt that these growths not only reduce the sectional area of a pipe to a considerable extent, but the rough surface which they form adds another factor which again materially reduces the flow. It is held by some that these organisms (Polyzoa especially) tend towards the production of rust nodules, that they become firmly attached to the pipe coating, and when they die down or become torn away from their positions the coating is damaged, and in some places entirely detached from the metal, leaving the surface exposed.

However, although the effects of these organisms so far mentioned have been chiefly prejudicial to the water authority, the consumer has just as much cause to resent their presence. The natural death of the Polyzoa, as well as those conditions which sometimes bring about their wholesale destruction, liberate into the mains large masses of tangled, moss-like growths, which become broken up and carried into every part of the system, following generally the direction of greatest demand. It thus follows that the most important supplies are those which first feel the inconvenience of their presence. The house services are first blocked at the ball valves, and metered supplies follow. Unfortunately the trouble is not of a single day, but may continue for a long period.

In Torquay, among many instances, the following may be quoted: On one occasion eleven houses in one row were without water from this cause on the same day; in another case an important metered supply was blocked upon four successive days; while on another occasion an electric lighting station within the area of supply was nearly forced to close down at the time of maximum load because the meter was blocked.

Last year, at New Canaan, Conn., U.S.A., a growth of Polyzoa which had become established in the pipes died off, and while in some instances the heating apparatus in houses became blocked and burst, the choking of the house services was almost general. The author has also heard of a case where a water famine was caused entirely by Polyzoa (Paludicella) blocking up the house services. This happened in our own country a few years ago.

Rapid Growth

Some idea of the rapidity with which these growths can spread may be obtained from the study of their production. The author has had experience with the Polyzoon, the Plumatella, Emarginata, Muscosa, which was found in the Torquay mains before the introduction of filtration. In September, 1910, it was discovered for the first time at Newton Abbot; within a year it was found in every part of the district of supply, and only those who have had experience of such a visitation can realize what that means. This particular growth has two means of reproduction—first, by the production of free-swimming larvae; and, secondly, by statoblasts, or winter eggs. A single egg develops inside one of the parent tubes, and in due time produces a free-swimming larva. After the production of larvae the parent organisms then produce the statoblasts. These are in two forms, the sessile and the floating statoblasts. The first germinates at the foot of the parent tube, so that when the latter dies down there is a new Polyzoon ready to perpetuate the growth upon the old position. The floating statoblasts are developed in great numbers in the upper portion of the tubes. These statoblasts are oval in form, and are surrounded by an equatorial band, and between this band and the statoblast body there are developed small air cells. When the parent dies down these float away, and are carried wherever the water travels, thus spreading their kind over very considerable areas. It will be at once seen how these can be scattered over a waterworks system at a very rapid rate.

The Important Question

The main question for water engineers is: What means can be adopted to remove these creatures from the pipes?

Many attempts have been made, and with partial success. The only safe and satisfactory method is starvation—that is to say, to filter out the Plankton which forms their food—and they must then die off, and the trouble be ended once and for all.

It may be asked whether it is possible adequately to treat water in bulk in storage reservoirs so that these growths may be eradicated at the sources of supply, and the author therefore quotes the following from a communication he received from Dr. Krapelin in reference to the Hamburg mains: "No means of prevention has been tried at Hamburg; it would, indeed, have been quite impossible without poisoning the inhabitants of Hamburg at the same time. . . . The destruction of this growth can only be brought about by the withdrawal of nourishment—that is, by careful filtration of the water."

Dr. Kemna, at Antwerp, had only a short length of main to deal with, and it was possible to isolate this and to turn live steam into it, with the result that the creatures were cooked. Water was afterwards turned in and the dead growth flushed out.

In the case which occurred at New Canaan, Conn., U. S. A., referred to earlier in the paper, the death of the organisms was brought about by chance, and in an interesting manner. By some accident the bottom valve from the storage reservoir was opened, and the water therefrom was used for a week or two. This water, being devoid of oxygen, caused the death of the organisms in the pipes, which afterwards gradually came away from the mains.

In several instances flushing under heavy pressure has been resorted to, with only partial success, owing to the fact that if a solitary statoblast or a sponge larva remains the whole trouble may recur.

The available evidence all tends to show that filtration is the only complete remedy for the trouble caused by these growths, and, referring to the Polyzoa, etc., in New England waterworks, Whipple states definitely that "Where water is filtered, or where ground waters are used, they do not occur." Unfortunately, however, surface water supplies are at any time liable to a sudden development of these animal growths, as is shown by the following facts: In Torquay the supply has been drawn from the same sources since 1859, and up till September, 1910, no single trace of Polyzoa had ever been seen. Suddenly, within a period of twelve months, the growth spread to every part of the area of supply. There are three storage reservoirs from which the supply is drawn. The highest has an elevation of 820 ft. above ordnance datum, and holds 194,000,000 gallons, the second holds 103,000,000 gallons, and has a top-water level of 783.6 above ordnance datum, the third reservoir holds 171,000,000 gallons, with the overflow at 769 above ordnance datum. This last has only been in use five years, while the others have been in operation for a long time. Curiously enough, the growth was greatest in the area supplied from the highest reservoir, and never before the date given was any trace of it seen. That the growth is fairly well established in the reservoirs is determined by the presence of numerous statoblasts on the surface of the filters. The only suggestion which can be made as to their introduction is that they were carried either by wild fowl or with fish obtained for stocking the reservoirs.

Construction of Factory Buildings

THE following brief summary of an article on Factory Construction, by Mr. J. Herbert Pearson, M.S.A., of London, Eng., should prove interesting to architects and builders.

The writer holds the view that a building used for factory purposes should be looked upon as a labour-saving appliance, and in planning, the building should be so arranged that all the different processes of manufacture can be carried out in sequence, in order to effect economy in labour and to reduce the cost of administration.

The present requirements, and those of the immediate future, will determine the size of the factory, but the possibility of extension should also be considered and provisions made which will allow of this being done later with utmost economy and minimum inconvenience.

Site and Design

Some of the chief considerations are: (1) Suitable area and shape capable of efficient development for present and future requirements; (2) A position ensuring a plentiful supply of labour ; (3) Adequate transport facilities; (4) Ample water supply; (5) Efficient drainage; (6) Cheap distribution of gas or electricity for power or lighting purposes; (7) Reasonable local rates; (8) Sufficiency of housing accommodation for work people.

The design will depend on the class of building, the materials used in construction and the requirements of the local authorities, but the elevation, as far as possible, should define the purpose for which the building is used. A very ornate elevation, in most instances, is unsuitable, but effect can be obtained by good proportion and careful selection of materials. A well designed building is always an advertisement for a manufacturer.

There are many matters of detail which require the collaboration of architect and engineer, but the former should have experience in factory design and be familiar with engineering practice. Without this knowledge he cannot so well interpret the views of the engineer, and difficulties and misunderstandings may arise.

Comfort and Convenience of Employees

After considering trade requirements and accommodation for machinery and plant, attention must be given to matters arising out of the Factory Act respecting the comfort and convenience of employees. Where both men and women are employed, separate closet and lavatory accommodation is required, and for certain trades an ample hot water supply for the lavatories is necessary in addition to cold supply. Cloak rooms and, in some cases, mess rooms must be provided and also offices for the staff. The factory must be well lighted, ventilated, and warmed, and the area of cubical contents conform with the requirements of the Public Health Act, which stipulates 250 cubic feet of air for each person employed during the day and 400 cubic feet during overtime hours.

Building Laws

The numerous requirements of the local authorities must receive special attention, as they materially affect factory design. In London, these matters are mostly under the control of the London County Council, but the building laws in other districts are on similar lines.

The use of thinner walls gives increased floor space and effects some saving in cost, but makes it imperative to construct a steel skeleton, or frame, designed to sustain safely and independently the whole dead load, and the superimposed load, bearing upon such framework.

The London County Council also have power to make regulations, subject to the sanction of the Local Government Board, for building in reinforced concrete. Its use for floors is advantageous, but for walls, which for economy must be thin, it is somewhat difficult to keep out dampness and there may be trouble with condensation. The merit of ferro-concrete consists in its economy of construction, monolithic character and fire-resisting qualities.

Means of Escape in Case of Fire

Factories must be provided with adequate means of escape in case of fire, and the decision, in London, rests with the London County Council. Internal staircases providing means of escape must be of stone or hardwood, and have fire-resisting enclosures with exit doors made to open outwards and to clear the landings. External escape staircases are usually of steel.

Now that petrol is so much in use, the local authority, which in London is the Public Control Department of the County Council, requires an application for a license to store petrol, and impose certain restrictions. In garages and other places where there may be petrol leakage, specially built brick separating chambers must be included in the drainage system to prevent any petrol discharging into the sewer. The Council have recently obtained powers for controlling the construction of Petroleum Oil Depots, which include premises where large quantities of petroleum are stored.

Fire Risk

By the judicious use of fire-resisting materials the danger from fire may be minimized and, further, if the architect in his design follows the requirements of the fire offices with respect to the construction of party wall doors, skylights, and other matters in which they are interested from a fire protection point of view, a substantial reduction in premium may be secured.

Apart from the construction of the building, it is desirable to provide some means of fire protection by fitting fire hydrants with hoses in convenient positions, providing chemical fire extinguishers; and, in some cases, by installing automatic fire sprinklers.

Heating and Ventilation

In cold weather, it may be necessary to warm the factory by artificial means to maintain a temperature of about 55 degrees Fahrenheit. Exhaust steam, when available, may be used efficiently for this purpose, but in most cases an installation of circulating pipes and radiators heated by hot water from a central boiler is suitable. Owing to recent improvements in hot water apparatus, it is not essential to have the boiler in the lowest relative position, as is the case with the ordinary low pressure gravity system. For occasional use, gas-heated radiators are more suited.

Natural means of ventilation by open windows and extract ventilators are not always sufficient, and it may be necessary to provide fans for bringing in the fresh air, or for extracting the foul air.

Acquisition of Existing Buildings

When acquiring business premises, by purchase or by taking a lease at rack (or inclusive) rent, the manufacturer is apt to be unduly influenced by a low quotation and convenience of plan, which are so essential both in obtaining business and in reducing the working costs.

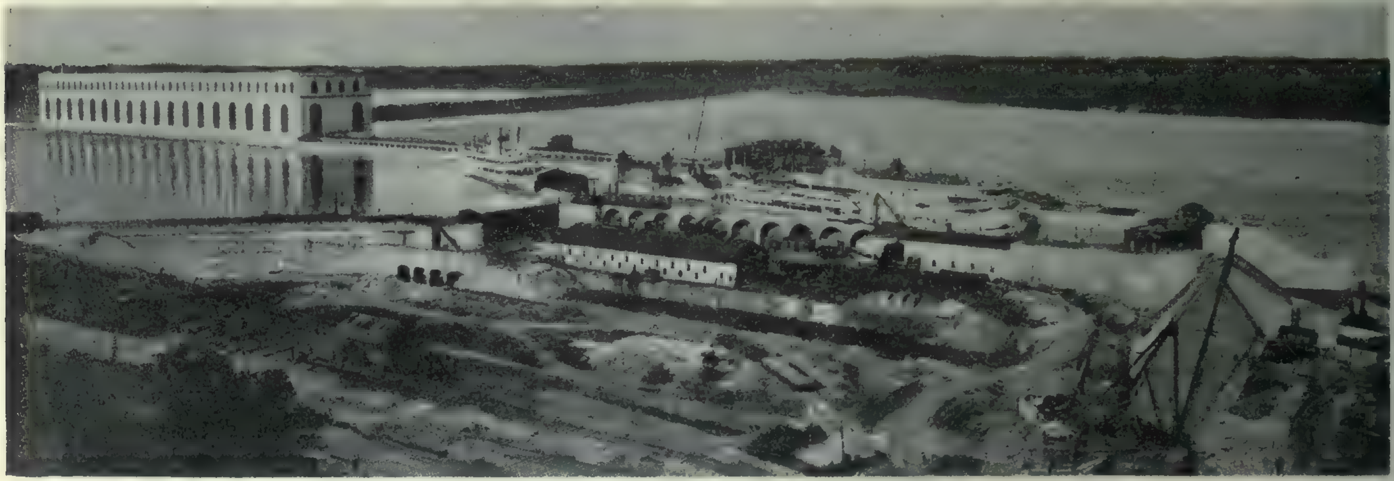
The many considerations in selecting a property make it necessary for the prospective tenant, in the first instance, to instruct an architect to make a survey of any likely premises and to report upon their stability, their structural condition and cost of conversion to suit the particular trade. If, the property is worth favourable consideration, then the architect should express an opinion as to its value and give an approximate estimate of the sum required to repair the buildings and to make the necessary alterations. Where the freehold of the property cannot be obtained, the lease should be for a sufficient term of years to justify the cost of the alterations and repairs. In either case the price to be paid for a property must be considered in conjunction with the subsequent cost of alterations, repairs, and upkeep of the premises.

Important Drydock Construction*

General Description—Method of Building Walls—Emptying and Filling the Lock — The Gates — Power House

Vertically operated floating gates are employed at Keokuk, Ia., on the new lock and drydock which the Mississippi River Power Company is building for the U. S. Government to replace the three locks and 9 miles of canal submerged by the construction of the dam and power plant. On May 8 water was turned through the fifteen 10,000 h.p. wheels, and since July 1 electrical energy has been transmitted regularly to St. Louis. The lock is complete and the first boat passed through it on June 12. The drydock site is being filled and will probably be complete by September 1.

The lock, drydock and lock grounds are located on the Iowa side of the river. As the existing dock occupied space under the new drydock, it was possible to maintain traffic during the construction of the new lock. Features included in the works, which will be turned over to the U. S. Government, are a lock, 110 ft. wide by 400 ft. long, with a lift of 40 ft.; a drydock 150 x 463 ft. in plan, a power plant of 400 h.p. capacity for operating the gates located in the wall connecting the lower end of the main power house and the upper end of the lock, an intake and discharge system controlled at inlet and outlet by four air-operated cylindrical gates, swinging steel miter gates at the lower end of the lock, interchangeable floating gates of a novel design for the upper lock gate, the guard gate and the drydock and an elaborate central system of control of the compressed air by which all of the machinery is driven. Below the mitering gate is a needle dam by which the tail-water may be excluded to permit laying dry the floor of the lock and the culvert system.



View of the works at Keokuk, with the new lock and drydock on the right-hand side

Foundations for the various structures were excavated from the limestone ledge, which is so nearly level at El. 480 that little or no trimming was necessary. The lock floor is not covered with concrete except to fill in around the culvert pipes.

The original cofferdam inclosed practically all of this work with the exception of a portion around the lower end of the old lock, through which traffic was not interrupted until the new lock was ready to operate.

Lock Walls

Walls of the gravity type, built of 1:3:5 concrete, form the sides of the lock. They are 33 ft. wide at the bottom and 8 ft. wide at the top below the 20-ft. esplanade, supported on inset arches, which also give stiffness to the walls. At the lower end the walls are 40 ft. wide and have vertical faces, the extra weight being required to withstand the thrust of the mitering gates. At the upper end the walls are 30 ft. wide and have vertical faces. Between the guard gate and the upper gate the width between walls is enlarged by 5 1-3 ft. This will permit removing the upper gate, as it may be swung on its vertical center opposite the recess sufficiently to clear the seat of the emergency gate.

Construction of the lock proceeded from the lower end, where there was the greatest bulk of the concrete. Wooden form sheets, or panels, made up of 2-in. lagging and 4 x 4 in. studs were held in place by rods embedded in the concrete and by wiring across to the forms on the opposite side of the wall.

Mixed concrete was brought to the site from the mixing plants at the upper end of the power house over industrial tracks in 1½-yd. buckets and then hoisted to place by stiffleg derricks mounted on three improvised railroad trucks. When the height of the wall became too great for handling material from below the derricks were mounted on top of the portion of the wall already completed.

Filling and Emptying System

For filling the locks with water and later discharging it a gridiron of eight 6-ft. culverts extends transversely across the lock from a steel header laid under the river toe of the east wall. Each culvert has seven 3-ft. nozzles. The header is 13 ft. in diameter at the inlet end and diminishes in size as each lateral is taken off. Water enters through four pneumatically operated cylinder valves, 7 ft. in diameter, housed in separate concrete inlet chambers, 19 ft. 8 in. x 10 ft. 6 in. in plan. The centers of the valves are 9 ft. from the back face, giving a clearance of 5 ft. 4 in. Stop-log grooves are provided to permit inspection and repair of the valves.

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*From the Engineering Record.

Each piston is connected to an air cylinder which is supported on the top of the lock by a concrete arch over the chamber. The bonnet, or hood, over the piston rests on two distancers, or pedestals, which in turn rest on a flared inlet casting over the vertical 6½-ft. intake conduit leading to the steel header line. Developed, the clear opening for the passage of water through each valve is 2 ft. 8 in. high by 20 ft. long.

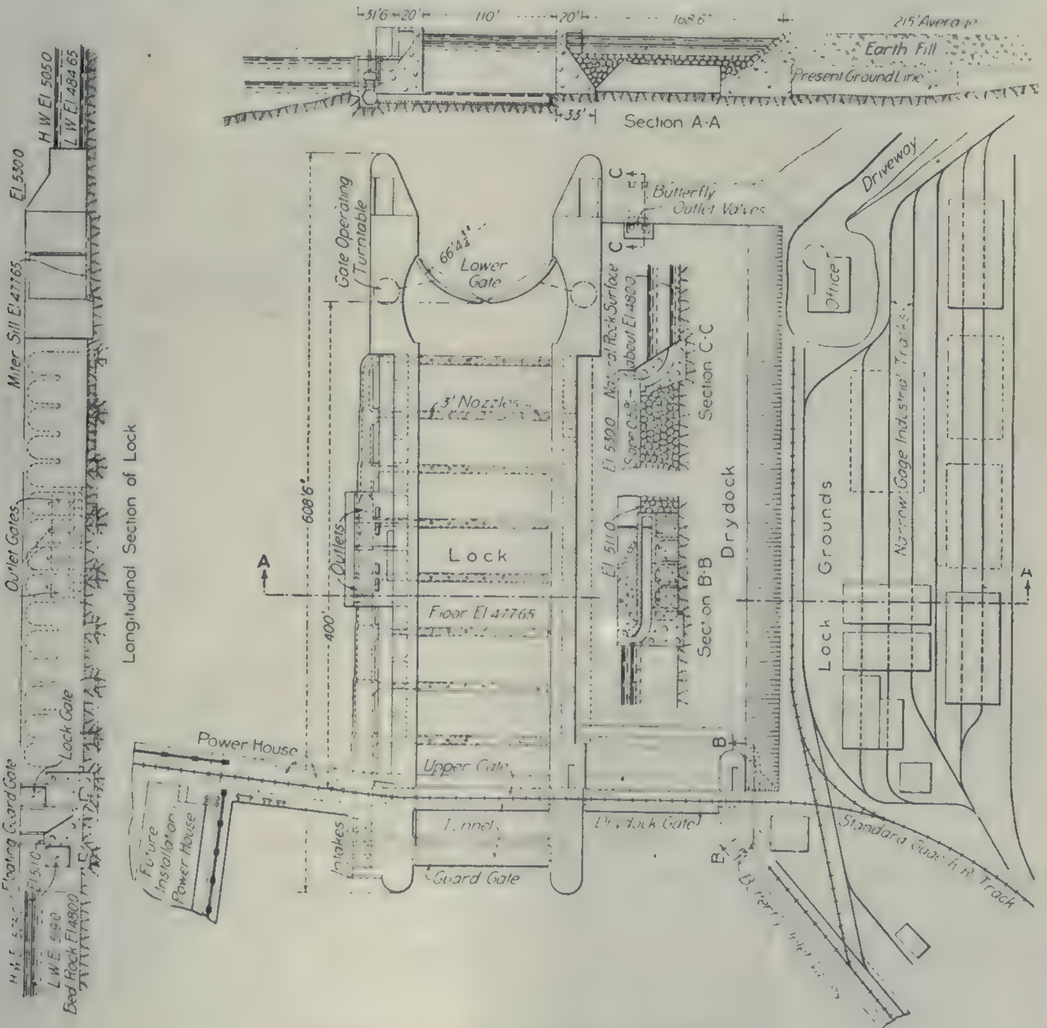
Discharge from the lock takes place through the culvert system to four cylindrical valves, of the same size and type as those at the intake, located in separate discharge chambers near the center of the lock on the outside of the river wall. The valves are set on top of flared nozzels, resting directly on the header, which is 10 ft. 11 in. in diameter at this point. Over the bonnets of the valves are concrete struts, 8 ft. deep and 12 ft. wide, designed to withstand the upward thrust due to the hydrostatic pressure. The operating mechanism is supported on an arched concrete platform over the chambers similar in construction to that at the intake. It is 23 ft. below the top of the back wall and 2 ft. above high tailwater.

Between the normal water level points the lock holds 1,500,000 cu. ft. of water and requires about fifteen minutes to fill. The culvert system is designed to provide a uniform delivery of water throughout the entire area of the lock chamber when filling and an evenly distributed suction when emptying. During the first half of the total time consumed in emptying the lock chambers the water drains down until the difference in head between the level in the lock chamber and the river is about 15 in. The mitering gates and their operating machinery were designed to overcome the usual allowance for wind pressure, and also the pressure due to a difference of 15 in. in water levels. In other words, these gates may be, and actually are being opened against a 15-in. head, thus cutting down materially the discharge period.

Floating Gates

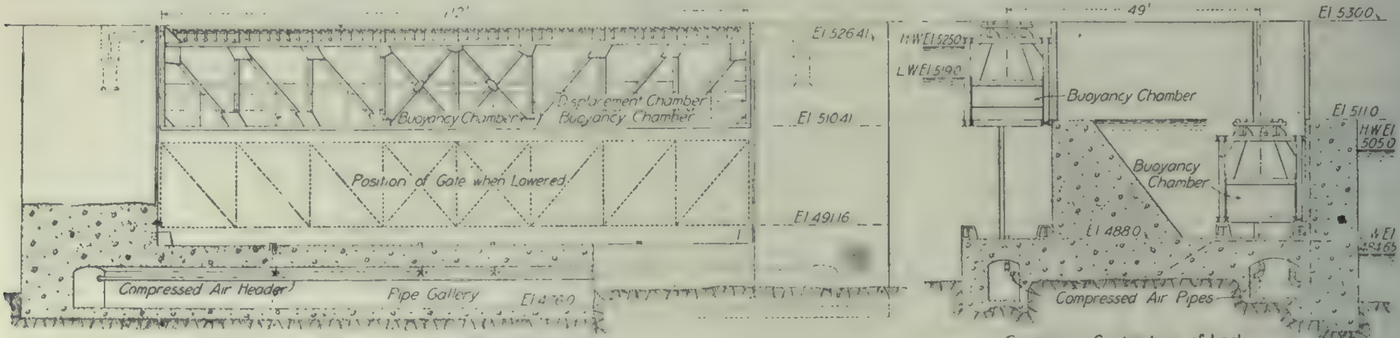
Choice of vertically operated disappearing floating gates was made possible because of the depth of the pool above the lock. There are 31 ft. of water below the sill and a minimum of 8 ft. above it. At high water there are 14 ft. over the sill, above which the skin plate on the back face of the gate forming the water barrier rises 16 ft. Some of the reasons for adopting this type of gate are: First, the structure could be used as a railroad bridge; second, it reduces the length of lock walls over that necessary for mitering gates; third, there is no outward end thrust—in consequence the walls can be made lighter; and fourth, in case repairs are necessary the three gates are interchangeable and any one can be raised and floated out of its recess to the drydock, or to replace either of the other two gates without removing any part, or without assistance other than towlines and barges lashed alongside to prevent turning turtle.

Each gate has an inverted steel box open on the bottom, located centrally, and two closed displacement



Plan of cross-section of lock and drydock.

compartments, one at each end. Structurally the gate consists of two vertical trusses, 112 ft. long, spaced on 15-ft. centers, and connected in the plane of the top chords by a horizontal truss and in the plane of the bottom chords by lateral bracing, all in the form of an eight-panel Pratt truss-deck railroad bridge. The downstream truss is, in fact, a plate girder and its web is heavily reinforced to sustain the hydrostatic pressure, thus forming the waterproof barrier of the gate.



Elevation Looking Down Stream

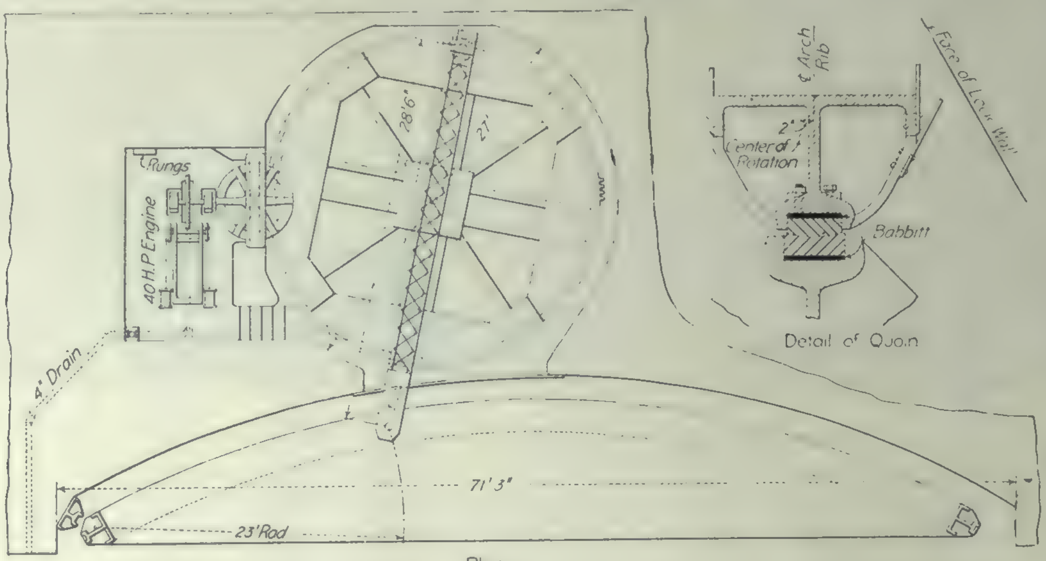
Section on Center Line of Lock

Details of floating gate showing location of tunnels, air piping, latches and seats.

The resulting pressure along the top chord of this truss is sustained and carried to the lock walls by the horizontal truss of the top of the gate. The bottom chord and the end frames of this girder are fitted with oak contacts which take bearing upon and transmit the pressure to cast-iron sills bedded in the masonry sill and walls of the lock.

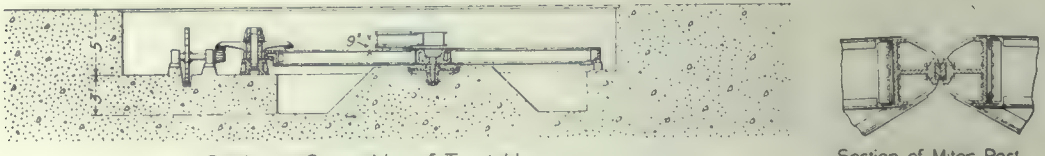
Displacement Chamber

The flotation of each gate is by means of two displacement chambers of 4,550 cu. ft. volume and the open bottom buoyancy chamber. The 6,200 cu. ft. volume of displacement in the buoyancy chamber is under the control of the operator, located in a central control house, whereby each gate may be opened or closed—that is, lowered or raised at will. Compressed air is conducted from the lock power house through the pipe galleries to two points under each gate.



Detail of Quoin

Plan



Section at Center Line of Turntable

Section of Miter Post

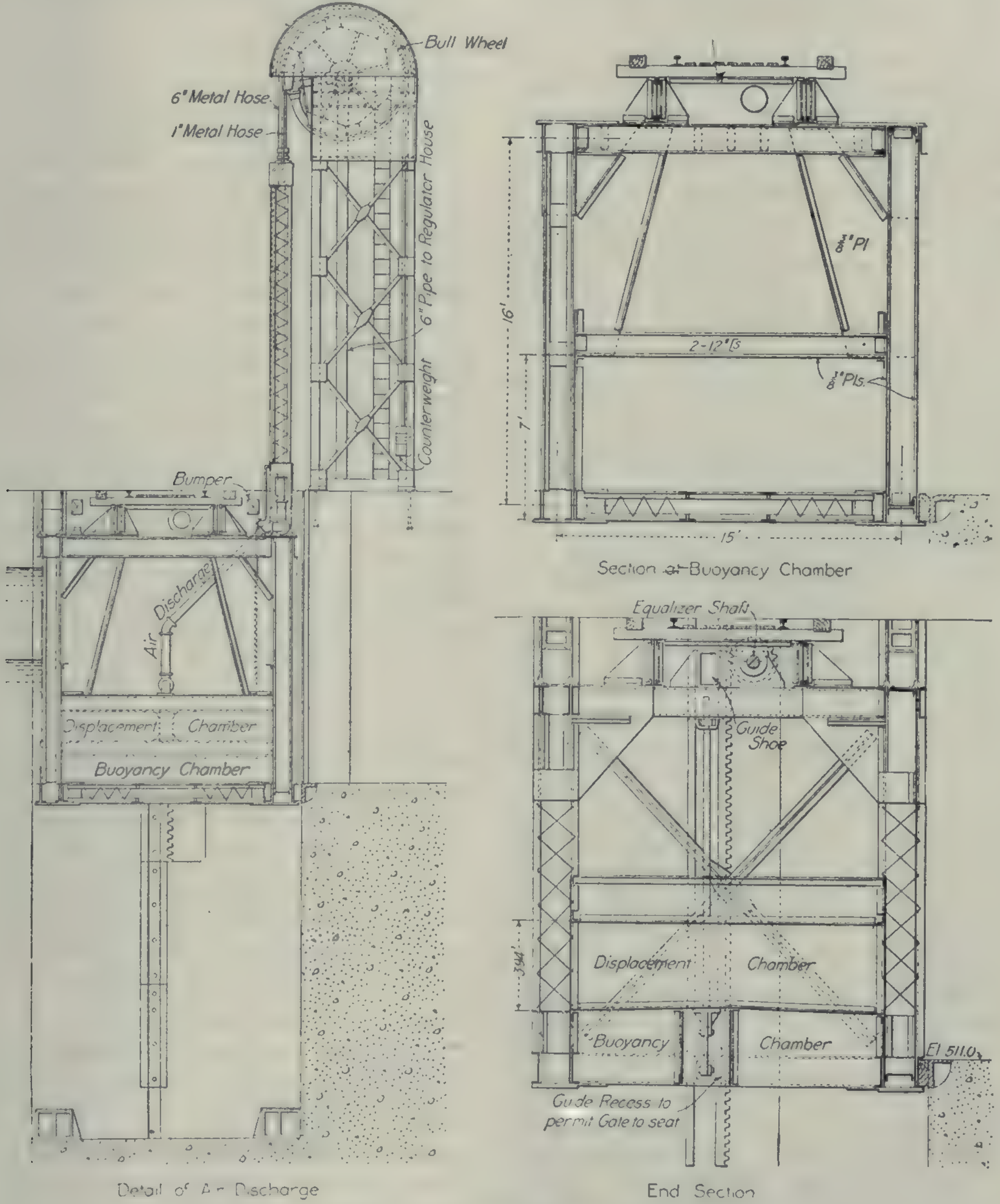
Details of metering gate and its operating mechanism.

The oak bearings along the bottom and ends of the gate are not in contact with the masonry or the reaction castings at any time except when the gate is in a closed position. Each gate is confined to position and to transverse alignment by guide runners sliding in vertical cast-iron guides bedded in the lock walls at each end of the gate. These guides have toothed racks which engage a pinion at each end of the gate, and, as each spur wheel is keyed fast to a shaft which extends from end to end, the simultaneous movement of every part of the gate and its longitudinal alignment are assured.

Each gate is locked in the closed position by four heavy latches, operated pneumatically by a single air cylinder for each pair.

Each gate is proportioned to sustain the hydrostatic pressure due to water at El. 525 on the upstream side with no water pressure acting against the downstream side. The top truss will contain 2,100 lb. per lineal foot uniformly distributed load. This represents the portion of hydrostatic pressure accumulating along the top flange of the downstream girder, which is the same as the bottom chord of the horizontal truss. For the vertical trusses acting as a bridge the dead load is the entire weight of the structure in air, applied equally to the top and bottom chords, when the bridge is supported on the latches. The live load assumed is a continuous train of Cooper's Class E-40 locomotives, with the bridge supported on its latches in air.

Ballast was fixed in the closed chambers to float each gate on an even keel and level longitudinally. The calculated displacement necessary to float the gate when submerged is 6,000 cu. ft. Of this volume there are 4,550 cu. ft. in the displacement chambers, and the remainder is provided by the buoyancy chamber by a depth of 3.87 ft., in which the air pressure varies from 7.4 to 13.6 lb. per square inch, according to the location of the gate between the water surface and the extreme low position.



Section at Buoyancy Chamber

Detail of Air Discharge

End Section

Floating gate with air discharge and gate-alignment devices.

Air for the buoyancy chamber, under 100-lb. pressure, is compressed in the power house and piped through the tunnels under the gates. Two 4-in. risers pierce the roof of the tunnels and discharge into the water through which the air bubbles up under the gate and is trapped.

Discharge of air from the buoyancy chamber is from one point near the center through a 6-in. main carried to the end of the gate and upward through a latticed end-post extension leading to a 6-in. metal hose wound on a bullwheel 8 ft. in diameter. Seven-eighths of a turn of the wheel equals the travel of the gate. The inner end of the hose is connected to the hollow shaft on which the wheel turns. The outer end of the shaft connects with a 6-in. pipe leading to an opening in the lock wall by way of the operator's house, where control is effected.

In a similar manner, the bullwheel carries a 1-in. pipe to supply compressed air to the closed chambers for the purpose of removing any leakage through suitably arranged sumps and check valves.

Before lowering the gate air is first let into the buoyancy chamber to raise the gate so that the latches may be removed. There is a permissible upward movement of 9 in. when four bumpers with rubber cushions are encountered. The outlet valve on the air line passing over the bullwheel is then opened and the gate sinks, slowly and under perfect control, to open position. In this downward movement additional air is admitted after the gate is submerged to compensate for the elastic displacement in the open bottom compartment. This gate travels through 19 ft. vertically, and while its movement is kept slow for safety, the change from open to closed position, and vice versa, is accomplished in remarkably quick time.

The Mitering Gates

At the lower end of the lock are steel mitering gates, 48 ft. high center to center of extreme arch ribs, 66 ft. 4¾ in. long, center to center of contacts, and 10 ft. 8½ in. in extreme thickness. A displacement chamber at the lower central portion of each leaf supports a large part of its dead weight.

Each gate leaf consists of thirteen arched ribs framed together from top to bottom of the leaf by girders forming the quoin and miter posts and by nine lines of intermediate framing. The quoin and miter posts are further reinforced and pressure from the arch ribs is distributed by cast-steel castings in a continuous line from top to bottom. This frame is covered on its convex side by steel plates. The curved shell of the leaf thus formed is reinforced by heavy steel X-bracing on its concave side, designed to sustain the entire dead weight of the leaf and to prevent warping of the leaf under any circumstances, with particular reference to the power applied eccentrically at the top to open the gate against a 15-in. maximum head of water.

Five conditions of loading were assumed. Case 1 is for the dead load of the gate leaf when hung on its hinges in air. In case 2 the dead load is considered when the leaf is hung on its hinges in maximum high water, thus giving the maximum uplift from the buoyancy chamber. Case 3 is with the gates closed and subjected to sufficient power applied at the top to open them against a 15-in. head at low stage. Case 4 is with the gates closed and subjected to static water pressure, when the lock chamber is filled to El. 525 and tailwater is excluded from contact with the gate, also with contact on the miter post, but not on the miter sill. Case 5 is the same as case 4, with the exception that contact is considered on both miter sill and miter post.

Operation of the mitering gates is by machinery similar to that in use at Panama, except that the motive power is compressed air. The 25-ft. turntable and the strut attached to the gate leaf about one-third of the distance from the bearing are shown in one of the illustrations. The reduction in gearing from the 40 h.p. reversible air-driven engine to the wheel is 1 to 700. One-half turn of the turntable opens or closes the gate, so that gear teeth are provided for only a little more than one-half the circumference. The connecting rod, or operating strut, is provided with a double acting spring to absorb shock from the engine or that due to the meeting of any obstruction of the gate when sustaining water pressure. One-inch movement each way from normal is controlled by this spring. Due to the angles and leverage, this is equivalent to a 4-in. travel at the mitering face, so that an 8-in. block of wood could be caught between the mitering faces and do no damage.

Over the miter post on one leaf is a pneumatic miter forcing machine which seizes a post on the opposite leaf in a pair of giant jaws and lines the faces against each other.

The turntable is equipped with an electrical contact so wired that successive positions of the gate are indicated by electric lights on the control board in the operator's house at the far end of the lock. Five inches beyond the dead center a four-way limit cock, the handle of which is guided by a cam on the wheel, reverses the engine by means of an air cylinder controlling the reverse lever. The wheel will continue to oscillate back and forth 5 in. each side of the dead center until the operator shuts off the main air supply. At this point the gate movement is so small that the miter-forcing machine can operate with the turntable stopped anywhere inside of the 5-in. limit.

Setting the cast-iron reaction blocks in concrete was accomplished by erecting a temporary structural-steel post in exact position, bolting the blocks to this post and then placing the concrete.

Anchorages at the top of the quoin post comprise two sets of double 2 x 8-in. eye-bars. One is shown in the drawing in elevation and the other is at right angles to this.

All steelwork for both floating and mitering gates was fabricated by the Chicago Bridge & Iron Works.

Fitting the Miter Sill

Not until the gate had been completed and swung into closed position was the 12 x 12-in. oak miter sill fitted. First, the oak piece was slipped over the horizontal bolt connections, leaving 3 in. for fitting against the back and bottom surfaces. Second, wooden struts were applied against the gate with a force equal to 150 tons uniformly distributed over the bottom of each leaf. Third, the oak pieces were forced tight against the cast-steel contact castings and held there by wooden wedges until the concrete deposited around the sill had set. Fourth, vertical bolt holes were bored through the sill and drilled into the concrete, fox bolts were placed and the nuts screwed tight. For renewals the vertical bolts are to be cut off and new holes drilled.

To make sure that the holding-down bolts grip the bed rock after the concrete forming the sill had set, the 2-in gas pipes around the bolts were not grouted until the bolts had been subjected to an initial stress of 15,000 lb., accomplished by a 150-lb. pull at the end of 3½-ft. wrench.

Lock Power House

Located in the wall connecting the upper end of the lock and the lower end of the power house are two 200 h.p. S. Morgan Smith single-runner Francis turbines, which are belt-connected to Ingersoll-Rand 13 x 16-in. air compressors, and are controlled by Lombard governors. Each unit alone has sufficient capacity to operate the lock and drydock machinery and drive the equipment housed on the lock grounds. From the engine room stairways lead to tunnels carrying the air piping and electric cables under the lock and drydock gates.

Built last is the 150 x 463-ft. drydock, as it is located over the former lock, Government headquarters and reservation. The site is now being filled in to conform to the general drawing. On the river side is the lock wall, while on the downstream side a concrete gravity wall extends from the lower end of the lock to the embankment of the lock grounds and on the upper side is an extension of the concrete gravity sea wall along on top of this latter wall leads over the gates for the drydock and lock to the power house. Two hand-operated butterfly valves, 6 ft. in diameter at the upstream end and a similar set at the downstream end are provided for filling and emptying the drydock.

On the drydock grounds the U. S. Government will erect a paint house, machinery and blacksmith shops, carpenter shop, sawmill and storehouse—all connected by industrial tracks as well as by standard-gage switches to the railroad. Power to operate the machinery located in these buildings, at the lock and at the drydock is to be compressed air.

Tests of Waterproofing in Cement*

By Cloyd M. Chapman, Engineer in Charge, Westinghouse, Church, Kerr & Co., New York

SO much that is contradictory has been said and written concerning various methods of producing concrete which is waterproof, and so much has been claimed by the vendors of various compounds which have been offered to the public as a positive solution of all waterproofing problems, that it is not surprising that not one cement user in ten has any definite or fixed opinion as to how to meet the problem of producing a waterproof concrete. There seem to be as many opinions on the subject as there are men willing to express their opinions. And the many methods which have been used differ greatly from each other. They are not all bad, for some of them have been very successfully applied. They are not all good, for many failures have occurred. Every little while a new preparation is offered or a new method is advocated. There seems to be no strong tendency toward any one method of producing a waterproof concrete. Perhaps the reason for this continued uncertainty and diversity of opinion among cement users may be found in the very fact that many of the multitude of methods advocated have, in certain instances, proven successful and each success makes converts to the method used. In many cases where special compounds have been added to a good, well proportioned concrete made of properly graded materials, there is little doubt that the result would have been satisfactory if the special compound had been entirely omitted. In other cases where the concrete is made of materials not wholly adapted to the purpose, an addition of a suitable filler or special compound would have produced the desired waterproof qualities.

To throw more light upon the effectiveness of the various methods of waterproofing concrete, a great many tests have been made by numerous investigators. The methods used by these experimenters have ranged from absorption tests to high pressure tests necessitating more or less elaborate apparatus.

The absorption or non-pressure tests are made by preparing specimens of any predetermined size and shape of the concrete waterproofed by the particular methods under investigation. After the desired age is attained these specimens are either immersed in water completely, or immersed almost completely, or placed in shallow water so that the bottom only of the specimen is wet; or the specimen may be made cup shaped so that the water may be placed in the depression in the specimen, or a container for the water may be attached to the surface of the specimen. The two last mentioned forms of tests have been extensively used in the laboratory of Westinghouse, Church, Kerr & Co.

In all of these forms of tests the results are expressed in terms of the amount of water absorbed, or the rate of absorption.

In the pressure tests the specimen is either so made that the water pressure may be applied to the interior of the test piece, or it is so made that it may be inserted in the apparatus in such a manner that the water pressure may be applied to a certain area on one face of the test piece. In this form of test the results are expressed in terms of the amount of water passing through the specimen or the rate of flow through it.

Both of the above classes of tests are very valuable if carried out in such a manner that the results may reasonably be expected to compare with results which may be obtained in practical work. To this end it is desirable that certain precautions be observed in preparing specimens and conducting tests so that the results shall not be misleading or deceiving.

It is the purpose of this paper to call attention to some of the features of tests of this class which should receive particular attention and to emphasize more strongly certain precautions, failure to observe which may cause some of these tests to give very deceptive data. These precautions apply particularly to tests made for the purpose of determining what method shall be used on a particular piece of work in the field. Some of them do not apply to tests designed only to compare the relative efficiency of various methods without regard to any particular work at hand.

Precautions

First: The selection of the materials to be used in making up the test pieces. These should be selected from those available at the site of the work which is to be done. This is particularly true of the fine and coarse aggregates. It has more than once happened that tests made with suitable aggregates have shown a particular method to give a waterproof concrete but the same treatment failed when the aggregates available in the field were used. If, therefore, it is desired to determine by test how to produce a waterproof concrete for a particular job, the materials available at the job should be used in making up the test pieces. It is also important in connection with the selection of aggregates that there be secured a sufficient quantity of the materials to be used to conduct the entire line of tests contemplated so that there need be no change in the materials used.

Second: The proportioning of the materials. This should be done with a view to determining the proportions to be used later on the work. The proportions to be used on the job should be used in the tests. There is little use in testing only a 1:2:4 concrete for watertightness and then use 1:2½:5 on the job.

Third: The mixing of the materials. This should duplicate as nearly as possible the mixing to be used on the work. Many a well-mixed concrete has proven waterproof which would have failed utterly if carelessly mixed. There is liable to be a tendency to very thoroughly mixing on the job.

Fourth: The consistency of the mixture. This should be carefully considered because of its influence upon the results. A consistency should be chosen which it is practical to use on the job under the circumstances prevailing there. For instance, it is useless to test a concrete of so thick a consistency that it would have to be spaded into the forms, if, on the job, the concrete is to be spouted from the elevator and therefore necessarily of a much thinner consistency than was used in the test.

Fifth: The moulding of the test specimen. This process should imitate as nearly as possible the filling of the forms as it will be done on the job. To make a test piece by putting into the mould a small quantity of concrete at a time and constantly tamping during the filling process would probably produce a deceiving result.

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*The Cement Era

Sixth: The finishing of the surface to be tested. This is one of the most important points in the preparation of test specimens. The condition in which that surface which is to be subjected to water is left, has a very great influence upon the results obtained. For instance, it is quite possible by means of a little troweling to produce a skin or surface coating of nearly neat cement. This will produce a dense surface much more impermeable than the body of the concrete and show results far superior to an untroweled specimen of the same concrete. It is recommended that specimens be so prepared that the surface exposed to test truly represents the body of the concrete. This may be accompanied by removing the surface of the specimen after the concrete has hardened by means of a wire brush or by chipping or breaking off the surface before test.

In the case of absorption tests, this may be done with a stiff wire brush when the specimen is about 24 hours old. In the case of the pressure tests, only that portion from which the water passes out of the specimen needs to be removed. This may be accomplished by making the test piece with additional material added to the surfaces to be tested so that this additional concrete may be broken off after the specimen has hardened and before the test is performed. Unless some such precaution is taken, tests of this character are liable to show the efficiency of the surface of the specimen in resisting the water pressure rather than the value of the mass of the concrete in performing the same function.

One suitable form for a specimen for pressure tests is in the form of a central disc of suitable diameter and thickness. The outside surface and the outer portion of the two faces of this disc are moulded smooth and regular so as to fit the receptacle or holder into which it must be placed in order to apply the water pressure to a definite and restricted area of its surface. From the central portion of the two faces of this disc project truncated cones whose smaller diameter is just equal to the diameter of the circle which is to receive the water pressure. After the specimen has hardened and is ready for test, the two truncated cones are broken off with a blow of a hammer, leaving a disc.

By this method there is exposed to the water pressure a freshly broken surface of concrete which has not been subjected to troweling or other influences tending to alter the natural condition or distribution of the constituents of the concrete. This freshly broken surface is not only presented to the water on the side to which the pressure is applied, but is also provided on the opposite side where the water leaves the specimen. The test, therefore, is made on a certain thickness of concrete taken from the interior of the specimen and the results are not influenced by the method of finishing these two surfaces.

There are, of course, cases in which it is the surface permeability that it is desired to test, and in such cases this form of specimen is unsuitable. But in all cases in which the watertightness of the concrete mass is to be determined the above type of specimen is much to be preferred.

There are also variations of this form of test piece which will accomplish the same result. Any method which removes the finished surface from the area to be tested is to be preferred to one which does not remove that surface.

Even in such cases as those in which the specimen is moulded on a surface of glass or other smooth material and no troweling is done, there is a concentration of cement and fine aggregates next to the surface which must affect the results obtained if this richer layer or skin is not removed before test.

Seventh: The curing or ageing of the specimen. This matter should also be decided with a view to conditions which will prevail in the field when the real work is done. If it is impracticable on the job to keep the concrete constantly wet for a considerable period, then the test specimens should not be stored in water. If the only wetting the work in the field is to receive is the water contained in the concrete when it is placed, then the test pieces should receive no additional water after moulding. On the other hand, they should not be allowed to dry out any faster than would the work in the field, as they would doubtless do owing to their comparatively small size if kept indoors in a laboratory and no precautions taken to regulate the drying process.

The specimens have now reached the stage when they are ready for whatever tests are to be applied to them and the methods used in performing these tests are so varied that the limited scope of this paper will not permit an extended discussion of them. Those with which the writer is familiar appear to be open to little, if any, criticism. One of the most important features is that the conditions adopted shall remain constant throughout the test.

If the test is an absorption or a non-pressure test, the immersion or partial immersion should be under uniform conditions and for definite lengths of time in clean water. If the test is a pressure test, the pressure should be kept constant, the water clean, and the method of measuring the water passing through the concrete accurate. As the area subjected to pressure is usually small, and the amount of water passing in correspondingly small, in some cases where the measurement of the water is made by collecting the drippings from the underside of the test piece the element of evaporation may greatly affect the results. A form of apparatus in which the amount of water passing into the specimen is determined eliminates this error.

In this form of apparatus the specimen is clamped and sealed to a metal cap which is provided with a projecting, vertical graduated glass tube. The cap and the tube are filled with water, and air pressure is then applied to the top of the tube in any desired amount.

Time Element

Another matter in connection with tests of waterproofings for concrete which seems to have had but little attention paid to it, is the effect of time and the elements upon efficiency of the waterproofing materials. In practically all of the numerous tests of waterproofings made in the past seven or eight years in the laboratory of Westinghouse, Church, Kerr & Company, it has been the custom to expose the test pieces to the action of the weather on the roof of their office building, after first testing them, and then testing again after six or twelve months' exposure. The results of these tests after prolonged exposure show that few, if any, of the materials which are applied to the surface of concrete to waterproof it after it is made, will retain even a fair proportion of their efficiency. In the case of those methods by means of which the entire mass of the concrete is designed to be waterproof, there is shown sometimes a steady improvement after exposure and sometimes a marked decline. In some cases the life of the treatment is very short and the failure after a few months' exposure almost complete.

Personal Mention

Mr. C. J. Gibson, architect, Toronto, has moved from the James Building to the Webster Building at 53 Yonge street.

Messrs. R. K. Shepard and D. D. Calvin, architects, have opened offices at 43 Scott street, Toronto, under the name of Shepard & Calvin.

Mr. J. W. Siddall, architect, Toronto, has moved his offices from the Janes Building to room 250, Confederation Life Building.

The Toronto office of the International Engineering Works, Limited, has been placed under the managership of Mr. E. F. Bradley.

Messrs. Bond and Smith, architects, are now located in their new quarters in the Imperial Optical Company building, 13 Wilton Avenue, Toronto.

The Metals Chemical Company, Welland, Ont., ore smelters and refiners, has recently appointed Mr. K. S. Maclachlan, B.A.Sc., to the position of superintendent.

Investigations into Toronto street railway traffic conditions are being conducted by Mr. Bion J. Arnold, of Chicago. Mr. Arnold is assisted by Mr. G. W. Moyes, of Toronto.

The City of Edmonton, Alta., has called into consultation concerning the site of the proposed filtration plant, Mr. Willis Chipman, of the firm of Chipman & Power, Toronto.

Arthur H. Blanchard, M. Can. Soc. C. E., Professor of Highway Engineering in Columbia University, has been retained as Consulting Highway Engineer by the Department of Efficiency and Economy of the State of New York.

Mr. Adolphe Levesque, a well-known ecclesiastical architect, died in Montreal, aged 86. Mr. Levesque designed a very large number of Roman Catholic churches and schools, and was also consulting architect for the Dominion Parliament Buildings, Ottawa.

Prevost Hubbard, in Charge of the Division of Roads and Pavements of the Institute of Industrial Research, Washington, and Lecturer in Engineering Chemistry in Columbia University, has been retained as Consulting Highway Chemist by the Department of Efficiency and Economy of the State of New York.

Mainly Constructional

The News in Brief—From Coast to Coast

Kitsilano, B.C., is to have a new institutional Methodist Church erected at a cost of $200,000.

The new government elevator, to cost $1,250,000, is being rapidly constructed by the contractors at Port Arthur,

The total expenditure of the Montreal roads department last year was $3,018,000 of which the sum of $1,755,304 was for public works. One-half of this amount was for street pavements.

The Waterloo Cement Machinery Corporation, 117 Vinton Street, Waterloo, Iowa, have opened an office at 127 Coristine Building, Montreal. Mr. G. O. McDonell is in charge.

The Montreal Council have served notice on the Montreal Water & Power Company that at the expiry of six months' time they will enter Court proceedings to acquire the company's plant in St. Henry Ward. The Company object to the acquisition of their property piecemeal, and will fight the case.

The work of erecting the superstructure of the Atlantic Sugar Refineries, Limited, building, St. John, N.B., has begun. The plant is to be erected at a cost of one million dollars. It is expected that the steel for the first building will be in place by the end of August.

The city of Saskatoon, Sask., and the provincial Government of Saskatchewan are jointly interested in construction of a bridge at 25th Street, Saskatoon. Details as to the tenders and concrete work are being arranged. The cost will approximate $500,000.

The Allis-Chalmers Manufacturing Company through the Canadian Allis-Chalmers, Limited, Toronto, has just issued a neat little bulletin describing the Allis-Chalmers friction clutch couplings and pulleys. The booklet is very neat in design and contains a number of illustrative cuts and much information succinctly told. The bulletin is No. 4032.

Nearly 200 men are now engaged on the work of increasing the site of the terminal facilities of the C. P. R. at Moose Jaw, Sask., on which more than $100,000 is to be spent. In connection with the improvements, the trackage is being increased approximately fifteen miles. The double-track line from Swift Current into Moose Jaw is also nearing completion.

The Pennsylvania Railway has undertaken the gigantic task of eliminating 13,000 level crossings found on their system. The estimated cost of this scheme is $600,000,000. The company proposes to divide the work over a period of fifty years, reconstructing 200 crossings each year. The saving over the fifty years in accident expense and repair bills will go a long way toward paying the capital cost of the changes.

Twenty-five thousand men are now at work on the steel which will bind British Columbia and the western provinces with the Atlantic outlets on the east when the Canadian Northern Transcontinental line is completed next spring. Of this number nine thousand are working on the line east of Port Arthur and sixteen thousand on the line in Western Canada.

The Quebec Board of Trade has forwarded a memorial to the Minister of Public Works advocating the establishment of a modern steel shipbuilding plant at Levis in connection with the new drydock to be built by Messrs. M. P. and J. T. Davis. The memorial points out that in order to ensure the proper working of the dock it will be necessary to maintain a staff of competent shipbuilders and ship repairers and that these men must have constant work.

The Dominion Dredging Company, of Ottawa, is arranging to start work on section one of the new Welland Canal within the course of a few weeks. The contract papers are now being executed. The company is well equipped with a fleet of dredges of large capacity. The equipment will be taken up to the Welland Canal from the Quebec yards of the company at once and the work started with a view to early completion.

One of the new clauses in the city of Hamilton building by-law makes it compulsory for every room to have a window at least ten per cent. of the area of the floor space opening inside. Every private house is also required to have a backyard of depth corresponding to the height of the house, so as to provide air space necessary. An effort is made also in the measure to provide adequate fire protection, and to compel ample light and ventilation in every building hereafter erected in the city.

The Toronto and Canadian Lands Company, of London, England, has purchased 100 acres of land between stops 23 and 25 on the Kingston Road, near Toronto, and will erect from twenty to twenty-five workingmen's homes. Three houses have been started on this land already, and the new owners expect to have over a score completed by the close of this fall. The houses to be put up will cost from $2,500 to $3,000 and will be built in any architectural style desired by the purchasers.

Word has also been received from the provincial government at Regina that everything is in readiness for the commencement of operations on the new court house and land titles office for Humbolt, Sask. The plans have been finally approved and it is intimated that building operations will commence right away so that the buildings may be completed this year. The entire premises will be included in one building and the estimated cost is about $150,000.

The C. P. R. has been notified of the completion of the new freight building at the Fort William steamship drydock. The new building is a double-deck structure, nearly a thousand feet long. The upper storey is for the reception of freight by rail and the lower for freight unloaded from vessels and to be loaded on cars. For the unloading of rail freight there is a trestle along the rear of the building of sufficient height to bring the cars to the proper level, Along this side are 19 doors, spaced for freight car openings.

Skilled workmen temporarily employed by the public works department of the city of Montreal are to be paid an increase of 5 per cent. First-class street pavers will receive 48 cents an hour; second-class, 42 cents; third-class, 37 cents, and fourth-class 32 cents. First-class block pavers are increased to 48 cents, and the second class man to 42 cents. Cement finishers are to be paid 42 and 37 cents an hour, while the different classes of foremen are to be paid, 42, 39, 37, 32 and 27 cents, and superintendents of permanent works 48 cents.

A force of about 200 men is now employed on the Sooke Lake development project. The various gangs are busy clearing the site of the proposed works at the south end of Sooke Lake, and on the spot where will be constructed the big 130,000,000 gallon reservoir at Humpback. Men are also engaged at erecting temporary trestles, installing the plant recently secured from the liquidator of the Westholme Lumber Company, and making ready for the active prosecution of the work. The amount already expended on this scheme is nearly $1,000,000.

Mr. E. G. M. Cape, of Montreal, has lately secured three of the largest contracts in Eastern Canada. He is building the Atlantic sugar refinery at St. John, N.B., at a cost of about a million dollars, while he has just secured the contract for a new factory for the Imperial Wire & Cable Company, Montreal. This will be one of the finest factories in Canada. Mr. Cape has also commenced operations on the steel plant of Armstrong-Whitworth & Company, Longueuil, P.Q. The first building is to be 500 feet by 150 feet and 25 feet high, and of iron and cement.

The contract for the main building of the new Toronto Barracks at Long Branch will be awarded in a few days, and it is expected that work will be well under way by September. The buildings to be erected under the first contract include the main barracks for the men, the stable, the officers' mess, the dining hall and the recreation building. Accommodation is planned for 1,200 officers and men, the idea of the department being to eventually move the London and Kingston permanent corps to Toronto, in the interests both of economy and efficiency. The new barracks at Toronto will cost when completed over one million dollars.

There is a possibility that the provincial authorities will be asked to assume control of the Burrard Inlet Tunnel and Bridge Company, and to build the proposed bridge over the Second Narrows as a provincial enterprise. The revised estimated costs of the structure furnished by Sir John Wolfe Barry and his associates, who have prepared plans for the bridge, place the expense at $2,450,000 with an additional $100,000 for contingencies. The stock subscribed at present aggregates $1,500,000, leaving a difference of more than $1,000,000, The revised plans and report from the company's engineers in England show that the cost of the bridge, with the changes necessitated by the difference in the height and grades, the substitution of steel throughout instead of timber and piles—points strongly urged by Sir John Wolfe Barry—will mean a greater cost than originally expected. The preliminary estimates placed the cost of the bridge at $2,303,000 exclusive of approaches and other extra charges.

A New Canadian Plant

The B. F. Sturtevant Company of Canada, Limited, has arranged for the establishment of a plant at Galt, Ont., and from this plant will handle the Canadian business, together with the export to England and Australia and other countries. The company will start work immediately as the property acquired is of such a nature that they can begin manufacture at once, as well as the assembling of parts manufactured by the B. F. Sturtevant Company of Boston. Provision is being made for an increase in the plant as business develops. Salesmen are already located to cover Montreal, Toronto and Vancouver sections and offices will be established in each of the principal cities of Canada. The manufacturing, engineering and sales will be handled by men trained by the B. F. Sturtevant Company, of Boston, and the general policy of that company in manufacturing high-grade material will be carried out. Some of the more important apparatus which will be manufactured are fans and blowers, planing mill exhausters, propeller fans, heating and ventilating apparatus, fuel economisers, mechanical draft, steam turbines, vertical engines, generating sets and stokers.

Addition to Power Plant

The position occupied by the Canadian General Electric Company, Limited, in the design and construction of hydroelectric power machinery is well shown in the contract recently awarded by the West Kootenay Power and Light Company, of Rossland, B.C. In order to increase the capacity of its plant the latter company decided upon the addition of a 7,500 k.v.a. water wheel driven generator. The Canadian General Electric Company, Limited, will build the generator, while the contract for the water wheel was placed with the subsidiary Canadian Allis-Chalmers Ltd. This water wheel will have a capacity of 9,000 h.p. at 180 r.p.m. under a head of 70 feet. The contract therefore will be carried out practically by one firm who are thoroughly familiar with the design and construction of both the electric and hydraulic portions and with the conditions necessary for their successful operation as one unit.

It is understood that the increase in the generating capacity of the West Kootenay Power and Light Company has been undertaken in anticipation of the electrical requirements of the Canadian Pacific Railway which intends to electrify the line between Rossland and Castlegar. The contract for the electrification of this section of the railway was also awarded a short time ago to the Canadian General Electric Company, Limited.

A bridge 769 ft. in length is, says the Railway News, to be built over the Pazundaung Gorge on the extension of the Burma Railways. The work is being undertaken in order to link up the riverside districts of Rangoon. The structure will comprise three fixed spans of 165 ft. each, a rolling lift span to give 100 ft. clear opening for water traffic, and an approach span of 120 ft.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Cayuga, Ont.
Tenders received by Clerk, T. A. Snider, K.C., until August 16th for 26½ miles of stone macadam road. Plans at office of engineers, Jackson & Kyd, Dunnville.

Guelph, Ont.
Storm sewers contemplated by City Council. Secretary, T. J. Moore. City Engineer, M. Ferguson. Plans drawn.

Milestone, Sask.
Concrete reservoir for C. P. R. Div. Engineer, T. Martin, Moose Jaw. Engineer in charge, W. T. Daniels, resident engineer, Regina. Tenders received by W. T. Daniels till August 31 for supply of labor, material, etc., for erection of a reservoir for water supply 40,000 cu. yds. Plans, specifications, etc., at either engineer's office.

McKillop Twp., Ont.
Tenders received by Clerk, M. Murdie, Winthrop, Ont., until Aug. 13th for extension of the Holland and Dodd drains into Hullett Twp.

Melville, Sask.
Sewerage system planned by Town Council. Mayor, C. L. Franks. Sec.-Treas., F. H. Clarkson. For disposal works and septic tanks. Engineer not yet appointed.

Ottawa, Ont.
Pavements and walks, cost $250,000 contemplated. Mayor, J. A. Ellis. Engineer-in-charge, Archibald Currie. Concrete sidewalks, asphalt, rocmac, tarvia X and B, passed by Board of Control.

Tenders will be called this week for asphalt pavements on Rochester, Somerset to Ellen, and on Centre, Bank to Craig. Cost $40,000. Mayor, J. A. Ellis. Engineer, Archibald Currie, City Engineer.

Richmond, Que.
Town Council has applied to the Provincial Government for loan of $39,780 to be used to macadamize Main St., Craig and Spooner roads. Mayor, A. Brock.

Sandwich, Ont.
Paving, cost $5,000, planned by Town Council. Mayor, Ed. Donnelly. Tenders received by Clerk, E. N. North, from Aug. 5th to 15th, 1,000 sq. yds. of concrete pavement.

Toronto, Ont.
Paving, etc., cost $92,000, planned by Board of Control. Mayor, H. C. Hocken, City Hall. Road improvement, etc., in the Exhibition grounds.

Pavement, cost $6,000, in connection with Street Railway track on Louisa St. Extension, planned by Board of Control. Mayor, H. C. Hocken, City Hall.

Sewers, planned by Board of Control. Mayor, H. C. Hocken, City Hall. Tenders received until Aug. 19th. Plans at office of Commissioners of Work. Midway sewer system outlet via Hiawatha Ave., Gerrard St. and Morley Ave. Division No. 2 West Toronto. Woodville Ave., Balsam Ave., Queen to Kingston Road. East Toronto Section A outlet.

West Zorra Twp., Ont.
Tenders received by Clerk, Allan Murray, Embro, until Aug 12th, for drains and catch basins.

Winnipeg, Man.
Tenders received by Chairman Board of control till August 7 for concrete pavements on lanes between Ruskin Row and Wellington Cres., Park Rd. and Kingsway, Grosvenor and Yale avenues, Stafford and Harrow streets, Dorchester and McMillan avenues, Amelia and Guelph streets. Specifications at office of Engineer, H. N. Ruttan, 223 James avenue. Secretary Board of Control, M. Peterson.

Sewer planned by Board of Control. Sec., M. Peterson, in Winnipeg Ave, from Flint to Campion St. Specifications at office of Engineer. Tenders received by Chairman Board of Control till Aug. 6. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Ottawa, Ont.
Pavements. Mayor, J. A. Ellis. Engineer, Archibald Currie, City Hall. Roadway engineer, L. McL. Hunter. Approximately 9,000 yds. asphalt, including curb and gutter, etc., awarded to Ottawa Construction Co., Central Chambers. 3,500 yds. asphalt on Spadina and Clarence awarded to city, to be done by day labor.

Sandwich, Ont.
Paving, cost $26,000. Mayor, Ed. Donnolly. Engineer, Owen McKay, Walkerville, Ont. Town Clerk, E. R. North. General contractor, Thos. Chick, Windsor. 16,000 sq. yds. of concrete pavement.

Welland, Ont.
Concrete walks planned by Plymouth Cordage Co. General contractors, Somerville & Reid, Welland. 10,425 sq. yds.

Winnipeg, Man.
The Dominion Construction Co., 290 Selkirk ave., general contractors for sewer in Lansdowne from west line of Lot 14, Block 6, Pl. 1262 to McGregor street. M. Peterson, secretary Board of Control. Engineer, H. N. Ruttan, 223 James ave.

Reservoir, cost $12,700, for Manitoba Agriculture College, St. Vital. General contractors, Des Moines Bridge & Iron Works, Des Moines, Iowa.

Railroads, Bridges and Wharves

Brantford, Ont.
Tenders received by Ald. S. Suddaby, until Aug. 7th for construction of sluiceway dam and building, concrete pier and abutment. Cost $4,000. Specifications at office of Engineer. City Engineer, T. Harry Jones.

Galt, Ont.
Concrete dam contemplated by the Town Council. Clerk, Jos. McCartney. Plans will be prepared.

Haney, B.C.
Canadian Pacific Railway Company has been authorized to construct spur for Abernethy & Lougheed Ltd., in Lot 398, Sec. 12, Twp. 12, N.W.D., Haney, B.C.

Hope, B.C.
Railway for the Kettle Valley Rly. Co. President and general manager, J. J. Warren, Penticton, B.C. Tenders called for line from Coquahalla Summit to Hope, on the Fraser River, a distance of 60 miles.

Little Current, Ont.
Dredging, for Dom. Govt. Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until Aug. 12th, 4 p.m. Specifications, etc., at Dept., Ottawa.

Meadowvale, Ont.
Canadian Pacific Railway Company has been authorized to construct bridge No. 292 over Toronto Suburban Railway near Meadowvale, Orangeville Sub-Div.

Montreal, Que.
Viaduct, cost $5,000,000, contemplated by G. T. R., City to pay share of cost. Matter to be decided upon in a month or six weeks.

Widening aqueduct, for Board of Commissioners. Sec., L. N. Senecal. Cook Construction Co., Sudbury, Ont., may be communicated with, c/o Canadian Railway & Contractors Supply Co., 248 St. James St., Montreal, and will open an office in New McGill Bldg., about Aug. 1st.

Underground conduits, on Bleury and Park Ave., and St. Catherine, Guy to Atwater, planned by Board of Commissioners. Sec., L. N. Senecal. Architects, Elec. Service Commission, New Birks Bldg., 10 St. Catherine St. Engineer-in-charge, Dr. Herdt, McGill University. Plans approved.

New Hamburg, Ont.
Bridge, for Co. of Waterloo. Engineers, Bowman & Connor, Toronto and Berlin. Tenders close Aug. 8th. (1) 35 ft. concrete at Hawkesville; (2) retaining wall at New Hamburg; (3) extra steel joists on concrete floor for the 120 x 18 ft. bridge at New Hamburg. Plans with Engineers and S. Cassel, New Hamburg, J. G. Hurst, Connestogo, Ont.

New Lowell, Ont.
Station for G. T. Rly. Company's architect has prepared plans. Approved by Municipal Council.

Province of Quebec.
Bridge, cost $9,500, over Nation River, for Municipal Councils of Parish and Village of St. Andre Avellin. Secretary-treasurer Parish, E. G. Belisle. Secretary-treasurer Village, L. Bourjeois. Plans, etc., at office of sec.-treas. One

span, 105 x 17, concrete, steel and 4-in. red pine. Tenders called.

Rainy River, Ont.
Dredging for Dom. Govt. Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until Aug. 12th, 4 p.m. Specifications, etc., at office of Secretary, Ottawa.

Sandwich, Ont.
Concrete dock, cost $7,000, River front, planned by Town Council. Mayor, Ed. Donnelly. Tenders received by Clerk, E. N. North, from August 5th to 15th. Old dock will be repaired, new concrete top and sides.

Trenton, Ont.
Canal. Tenders received by Secretary, Dom. Govt., Dept. Railways & Canals, L. K. Jones, Ottawa, Ont., until August 25th for Port Severn Section, Severn Division Trent Canal. Plans at office Chief Engineer, Dept., Ottawa. Engineer in charge, Welland Ship Canal, St. Catharines. Dist. Engineer Midland & Post Master, Orillia.

Toronto, Ont.
Harbor improvements. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Aug. 25th. Work includes sea wall, 17,295 ft. long, steel piles and timber; breakwater 18,600 ft. long; ship channel, 16,705 ft.; retaining wall 6,894 ft.; dredging 24 ft. deep. Plans at office of J. G. Sing, Toronto; H. J. Lamb, Windsor, J. U. Michaud, Montreal.

Winnipeg, Man.
City has applied to Minister of Public Works, Ottawa, for permission to replace a Howe truss span in its tramway bridge over the Winnipeg River, near Lac du Bonnet, Prov. of Man., by a steel span girder. Plans, specifications, etc., at Dept. of Public Works, Ottawa, and at the Land Titles Office, at Winnipeg, No. 313. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Cape Tormentine, N.B.
Car ferry terminal, cost $571,590. Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractor, Albert Mackie, Standard Bank Bldg., Toronto. Stone, Sackville Freestone Co., Sackville, N.B. About 110,000 tons stone required.

Carleton Point, P.E.I.
Car Ferry terminal, cost $950,000, Dom. Govt., Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, Roger Miller & Sons, Lumsden Bldg., Toronto.

Middleton, N.S.
Two concrete culverts for C. P. R. (Dom. Atlantic Rly., Div. Kentville, N.S.). General contractors, Power & Brewer, St. John.

Ottawa, Ont.
Dredging planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, F. A. Fowler, Little Branch, N.B., for dredging Little Black River.

Prov. of Quebec
Bridge, cost $4,450, over La Loutre River, for Municipal Council of Ste. Euphemie. Sec.-Treas., Donat Proulx. Engineer, L. A. Vallee, Que. General contractors, La Cie G. Blais. Ltd., Montmagny.

Bridge, cost $17,500, over Duchene River, for Municipal Council of St. Jean Deschaillons. Sec.-Treas., J. A. Jacques. Engineer, L. A. Vallee, Que. General contractors, Barabe & Jacques, Deschaillons.

Bridge, cost $4,975, over Deep River, for Municipal Council of Ste. Philomene. Sec.-Treas., L. U. Blanchet. Engineer, L. A. Vallee, Quebec, Que. General contractors, Barabe & Jacques, Deschaillons.

Bridge, cost $17,000, over Yamaska River, for Municipal Council of St. Pie. Sec.-Treas., G. D. Morin, M.P. Engineer, L. A. Vallee, Quebec, Que. General contractor, Jean Ducharme, St. Cesaire. One span, 200 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $4,750, over Fourche du Pin River, for Municipal Council of Ste. Cajeton d'Armagh. Sec.-Treas., C. Boivin. Engineer, L. A. Vallee, Quebec, Que. General contractor, Elzoa Duchesneau, Ste. Cajeton d'Armagh.

Saskatoon, Sask.
Traffic bridge, cost $398,000, over Saskatchewan River, from University grounds, planned by City Council. Clerk, Andrew Leslie. Chairman Board of Highway Commissioners, A. J. McPherson. General contractors, R. J. Lecky & Co., Regina.

Public Buildings, Churches Schools, etc.

Brampton, Ont.
Clock tower. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Aug. 18th. Plans at Dept., also Post Office, Brampton. Clock tower for public building.

Charlottetown, P.E.I.
Sanitarium contemplated by Provincial Govt., Dept. of Public Works. Premier, J. A. Mathieson. Architect, Mr. Scopes. Site has been selected about 1½ miles from North Wiltshire Station. Building to start as soon as plans are completed. To accommodate 24 patients.

Frelighsburg, Que.
Academy planned for R. C. Denomination. Plans, etc., with Rev. O. Peloquin, who will receive tenders until Aug. 19th, for construction of academy.

Glace Bay, N.S.
General hospital. Tenders received by Chairman Building Committee, Norman McKenzie, up to August 12th. Plans and specifications at offices of J. T. Martell. Secretary and architect. Cement and brick construction.

Halifax, N.S.
College extension, cost $75,000, Windsor, for R. C. Corporation. Archbishop, Rev. E. McCarthy, Dresden Row. Architect, H. E. Gates, 88 Hollis street. Four storeys. Plans in progress.

Harwich Twp., Ont.
School, cost $4,000, planned for School Section No. 10. Further information from George Riseborough, Blenheim.

Melville, Sask.
School, cost $20,000, planned for Melville School Dist. Sec.-Treas., A. Burgman. Two storeys. Tenders will be called as soon as debentures are sold.

Moncton, N.B.
Church and school building, Dunn Bridge, for First Moncton Baptist Church. Sec. of trustees, W. H. Estano. Architect, C. B. Chappell, Charlottetown, P.E.I. Plans may be seen at office of W. C. Barnes, architect, Wyse Bldg., or at office of C. B. Chappell, architect, Charlottetown, P.E.I. Stone or brick construction. Tenders received by Sec., till Aug. 12th.

Montreal, Que.
Theatre, St. Catherine, for W. F. Stair, Stair Bldg., Toronto, c/o Thos. J. Duggan, 210 St. James St., Montreal. Mr. Duggan is handling negotiations in Montreal.

School, cost $55,000, Longueuil (St. Charles) for R. C. School Commissioners. Architect, Alf. Prefontaine. New tenders to be called after Aug. 4th. Three stys., 60 x 80, cement foundation, reinforced concrete, Plastic and Laprai brick construction.

School, Notre Dame de Grace, for R. C. School Commissioners of Notre Dame de Grace. Architect, G. A. Monette, Toronto Bank Chambers, 260 St. James W. Concrete foundation, steel and brick construction. Plans in progress.

Children's school, cost $45,000, for Children's Memorial Hospital, c/o Dr. A. MacKenzie Forbes, Sec., Cedar Ave. Architects, Brown & Vallance, 12 Canada Life Bldg., are preparing plans.

School, cost $80,000, Maisonneuve, for R. C. School Commissioners. Architect, C. A. Reves, 58 St. James. General contractor, A. Choquette, 170 Bourbonniere, will receive tenders shortly for all trades. Contracts will be settled about Aug. 6th.

Moose Jaw, Sask.
Tenders called by Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa, for erection of terminal elevator at Moose Jaw. Plans, specifications, etc., at Dept., Ottawa, and at offices of Board of Grain Commissioners, Fort William, Ont.

North Vancouver, B.C.
Drill hall planned by Dom. Govt. Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa. Plans, specifications, at offices of Dist. No. 11, Victoria, B.C.; City Clerk, N. Vancouver, and Director of Engineer Services, headquarters Ottawa. Tenders received by Director of Contracts Dept., Ottawa, till noon Aug. 11th.

Police station and court house, cost $30,000, will be erected on 2nd Street east of Lonsdale Ave. Clerk, Austin Brown. Sketch plans have been prepared.

Ottawa, Ont.
Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Aug. 11th, for stone and iron fence for Rideau Hall. Plans, etc., at office of Secretary.

Church, cost $15,000 to $25,000, Sunnyside, planned for Presbyterian Church of Ottawa South, Ottawa. Architect, J. Albert Ewart, 193 Sparks St. Tenders will be called in a week or so. Concrete and stone foundation, stone facing, brick construction.

Fire hall, cost $100,000, Albert, contemplated. Mayor, J. A. Ellis. Architect not chosen.

Post office, West End. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Works Department, preparing plans.

Church, cost $150,000, Second and Lyon, planned for Glebe Methodist Church, c/o A. S. Wickware, 7 Powell Ave. Architect, C. J. Burritt, 193 Sparks St. It is expected that tenders will be called within three weeks.

Club house, cost $23,000, Ottawa River, contemplated for Ottawa Canoe Association, per Sec., Sussex St. Plans will be prepared.

Quebec, Que.
Church for the Congregation of St. Mathew's, Rev. F. G. Scott, Simard St. Committee, Dr. Jas. Laurie, St. Foye, Que. M. A. J. Teakle, St. John Street, Architect, Ralph N. Gram, Boston, Mass. This church to be erected in rememberance of General Wolfe. Plans in progress.

Church, cost $45,000, planned for Rev. Fathers, Limoilou Fransciscoin. Architect, Jos. P. Ouellet, St. Famille St. Interior fittings, C. E. Morissette. Marble columns, plate glass, gold paint.

Catholic church, St. Joseph, for Parish of St. Roch, 158 St. Joseph. Architect, E. M. Talbot, 14 St. Joseph. Plans being prepared.

Roseisle, Man.
School, cost $4,000, planned. Sec.-Treas., W. D. B. Voyd. Architect, E. D. Tutle, 701 McArthur Bldg., Winnipeg. Tenders will be called about Aug. 12th. One storey and basement, concrete foundation, frame construction.

Regina, Sask.
City Stables, cost $15,000, Albert St. Architect, R. W. Allen, City Engineer's office, has plans prepared. Two stys., frame and stone construction, galvanized iron roofing.

Officers' Home, cost $10,000, contemplated for the Salvation Army. Interested, Ensign Weir, S. A. Citadel, Broad street, and Major McLean, Divisional officer, Winnipeg. Two storeys, brick foundation and construction, electric lighting.

Garage loading station, cost $10,000, planned by City Council. Architect, R. W. Allen, City Engineer's office. Clerk, A. W. Pool. Two storeys, concrete foundation, reinforced concrete and brick construction, galvanized iron roofing.

Saskatoon, Sask.
Tenders called by Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa. For erection of terminal elevator at Saskatoon. Plans, specifications, etc., at Dept., Ottawa, and at offices of Board of Grain Commissioners, Fort William, Ont.

Sunnidale Twp., Ont.
School planned for School Sec. No. 8. Architect, Jno. Wilson, Collingwood. Tenders received by Sec., P. S. Fleming, Stayner, Ont., until Aug. 11th.

Toronto, Ont.
Club addition, cost $6,500, planned for University Club, 82 King W. Architects, Sheppard & Colvin, 43 Scott St. 2½-stys., 24 x 40, brick and steel construction, brick foundation. Tenders called.

Market building, St. Patrick, for Board of Control. Mayor, H. C. Hocken. Tenders received until Aug. 12th. Plans, etc., at office of City Architect.

Vancouver, B.C.
Post office building, cost $100,000, Mt. Pleasant, planned by Dom. Govt. Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, A. Campbel Hope, Empire Bldg., has been commissioned to prepare plans and wishes to receive samples and prices of Canadian made building materials. Building to be entirely fireproof.

Victoria, B.C.
Tenders received by A. Johnston, Deputy Minister of Marine and Fisheries, until August 25th for construction of a wooden fog alarm building at Discovery Island, Huro Strait, B.C. Plans, specifications, etc., at this Dept., Ottawa and Victoria, and Post Offices at New Westminster, Vancouver, Nanaimo and Alberni.

Walkerton, Ont.
Heating for library. Tenders received by Secretary, W. B. Thompson, until August 15th. Plans at office of Secretary and from architect, Geo. Gray, Harriston.

Winnipeg, Man.
Orphanage for Esther Robinson, Jewish Orphanage of Winnipeg. Sec.-Treas., R. S. Robinson, 171 James St. E. Will apply to Govt. for charter. It is proposed to erect buildings on the cottage plan.

Church, cost $50,000, Cathedral Ave., for St. Johns Presbyterian Church. Pastor, Rev. J. P. Jones, Bannerman Ave. Architect, R. L. Smith, 417 Somerset Bldg. Plans, specifications, etc., office of Architect, who received tenders till July 31st for excavating and drains. Tenders for other trades will be called later.

Wolfville, N.S.
Library and museum, cost $30,000, planned for Acadia University. President, Dr. Geo. B. Cullen. Architect, A. R. Cobb, Halifax, N.S. Free stone construction.

Yarmouth, N.S.
Drill hall, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Town Council have purchased site. Building will be started next spring. Supervisor, Col. Mowbray, of Halifax. 60 x 100, stone construction.

CONTRACTS AWARDED

Berlin, Ont.
Fire hall, cost $18,000, Edward Street. Mayor, W. R. Kuler. Architect, C. Knechtel. General contractor, J. Baetz, Mill St. Excavating done.

Municipal barns, cost $6,000, Wilmot St., planned. Mayor, W. R. Kuler. Architect, C. Cowan. Carpenter, H. Dunker, 46 Shanley Street.

Edmonton, Alta.
School, cost $160,000, Hudson Bay Reserve. Secretary, Mr. Brady. Architect, G. E. Turner, Mortlake Block. General contractors, Brown & Hargreaves. Two storeys, 108 x 210, concrete foundation, brick construction.

Hampton, N.B.
Post office. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, H. H. Mott, 13 Germain St., St. John, N.B. General contractors, British American Construction Co., Ltd., c/o manager, P. I. Ligan, Prince William St., St. John. Reinforced concrete, Trussed Concrete Steel Co., Halifax, N.S. Manager, Harvey Thorn.

Lachine, Que.
Public building, cost $20,200. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Adolphe Gauthier, Lachine.

McNab, Ont.
Parish hall, cost $3,500, for Trustees of St. Johns Church. Architect, A. E. Nicholson, 46 Queen St., St. Catharines. General contractor, M. Mullen. One storey, 27 x 45, concrete foundation, brick construction. Foundations in.

Melville, Sask.
Church, cost $8,000, for German Evangelical Association. Architect, E. R. Munole. General contractor, A. B. Cunningham. One storey, 60 x 85. Foundations in.

Moving picture theatre, cost $8,000, for Besler Bros. Architects, E. R. Mund & Co. General contractor, A. L. Zeigler. One storey. Excavating started.

Magog, Que.
Bank building, Main street, for Canadian Bank of Commerce, head office, Toronto. Builder, G. N. Thompson, Magog. Iron and steel, MacKinnon, Holmes & Co., Sherbrooke. Other work being done by day labor under supervision of builder. Foundations in.

Montreal, Que.
Moving Picture Theatre, cost $15,000, St. Catherine and Bleury, for Peerless Amusement Co., St. Catherine and Bleury. Architects and general contractors, White Construction & Realty Co., Coronation Bldg. 38 ft. high, concrete and brick foundation, concrete block construction.

Repairs to school, cost $10,000, 120 Fullum, for R. C. School Commissioners, c/o U. Lafontaine Com. Academy, 85 St. Catherine W.. Architect, L. R. Montbriand, 20 St. Andre. General contractor, H. Demers, 47 Labelle.

Grenadier guard armoury, Esplanade, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, MacVicar & Heriot, 104 Union Ave. General contractors, carpenters, concrete, plastering and painting, D. G. Loomis & Sons, St. Patrick. Steel and metal lockers and electric not let. Roofing, Campbell, Gilday Co., Ltd., 563 St. Paul St. Heating and plumbing, Hickey & Aubut, 93 Dominion St. Two storeys, 169 x 126.

Addition to school, cost $25,000, Laval Ave. Commissioner Scolaire, St. Jean Baptiste. Architect, J. A. Godin, 269 St. Denis St. General contractor, P. J. Charlebois, 1234 St. Hubert. Brick, Brunet & Nadeau, 1347 Van Horne. Heating and plumbing, J. & C. Brunet & Co., 223 St. Lawrence. General contractor does of work.

Signal house, cost $5,750, Argyle Ave., for Canadian Pacific Rly. Builders, D. G. Loomis & Sons, St. Patrick St. Three storeys, 30 x 18, brick construction. Foundations started.

Post office fittings, St. Lambert. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The J. T. Schell Co., Alexandria, Ont.

Children's hospital, cost $35,000, for Children's Memorial, c/o of Dr. A. MacKenzie Forbes, Sec., Cedar Ave. Architects, Brown & Vallance, 12 Canada Life Bldg. General contractor, W. V. Brennan, 6 Lincoln Ave., Verdun. Tenders for other trades received shortly by Architect. Three storeys, 40 x 50, concrete and stone foundation, brick construction. Excavating started.

School, cost $196,000, Longue Pointe (Lavaltre). R. C. School Commissioners, c/o U. Lafontaine, 85 St. Catherine W. Architect, Z. Trudel, 238 St. Andre. General contractor, carpenter and painting, H. Demers, 47 Labelle. Mason, O. Corbeil, 1173 City Hall Ave. Brick, Jos. Monette, 12 St. Louis Sq. Plastering, F. X. Charbonneau, 668 Sherbrooke E.

Postal station "H," cost $200,000, Bishop and St. Catherine W. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Cox & Amos, 78 Crescent St. General contractor, C. E. Deakie, New Sommer Bldg. Granite, Argenteuil Granite Co., 42 Craig W.

School addition, cost $17,000, Drolet, for School Commissioners of St. Jean Baptist Ward. Architect, J. A. Godin, 269 St. Denis St. General contractor, P. J. Charlebois, 1234 St. Hubert. Brick, Brunet & Nadeau, 1347 Van Horne. Carpenter, steel, roofing, plastering and painting, General contractor. Heating, plumbing, J. & C. Brunet & Co., 223 St. Lawrence.

St. Cyprians church, cost $10,000, Maisonneuve, c/o Mr. Mount, 4278 St. Catherine W. or Rev. Wm. Robinson, 430 Pio IX. Architects and general contractors, Westmount Plumbing & Heating Co., 4278 St. Catherine W. Basement to be built at once and roofed over, church to be built about a year later. 14 ft. basement, 47 x 104, cement and brick foundation. Excavating started.

North Battleford, Sask.

Drill hall, cost $28,500. Dom. Govt. Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa. General contractors, Piggott & Healey, Picton, Ont.

Orono, Ont.

Armoury, cost $12,000, for Dom. Govt. Dept. of Militia & Defence. General contractor, W. A. Thom. Work to start at once. To be completed March 1st, 1914.

Port Arthur, Ont.

Armouries, cost $200,000, Park and Secord, for Dom. Govt., Ottawa. General contractors, Canadian Stewart Co., Port Arthur. Foundations in.

Quebec, Que.

Transportation building, cost $25,000, for Exhibition Com., City Hall. Architect, A. Pinsonnault, City Hall. General contractors, mason and carpenter, Mr. Magloire Cauchon, 307 Richardson. Iron and Steel, Eastern Canadian Steel & Iron Co., St. Malo. Roofing, A. Falardeau. Painting, J. M. Tardivel. Structural steel and brick construction.

Church, cost $13,000, for French Presbyterian Congregation. Architect, T. R. Peacock, 76 de Salaberry. General contractors, L. H. Peters Co., 10 St. Angele. Brick, Citadel Brick & Paving Block Co., Auditorium Bldg. To be completed about February, 1914. Devonshire brick construction, stone trimmings.

Interior fittings, postal station "B." Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The J. T. Schell Co., Alexandria, Ont.

Poultry building, cost $3,000, for Exhibition Board. Architect, J. L. Pinsonneault, City Hall. General contractor and carpenter, Ed. Paquet, 18 Couillard. Roofing, Nap Durand, 445 St. Francois St. One storey, 100 x 50, galvanized iron roofing.

Regina, Sask.

Assembly hall, cost $20,000, Broad, for Salvation Army. General contractor, A. W. Bain. Two storeys, concrete foundation, stone and brick construction.

Jewish synagogue, cost $45,000, Ottawa St. President, S. Pearlman, 10th Ave. and Broad St. General contractors, Mellville & Dowell. 30 x 50, brick foundation, stone construction.

Simcoe, Ont.

Armoury, cost $30,000. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Robert E. Gunton, Simcoe.

St. Felicien, Que.

Church, cost $123,000, Lake St. John, for R. C. Church Congregation. Architect, Jos. P. Ouellet, 28 Ste. Famille St. General contractor, Edmond Tremblay, St. Anne de Chicoutimi, Que. 212 x 75, embossed stone construction.

St. John, N.B.

Club house, Wellington Row, for Elks Club, c/o H. J. Fleming, 130 Pond Street. Architect, F. Neil Brodie, 42 Princess. Steel, Fleming & Sons, 130 Pond street. Painting, Jas. Pullen, 16 Horsefield St.

Toronto, Ont.

School, Lansdowne School, for Board of Education. Sec., W. C. Wilkinson. Electric wiring, Fred Armstrong & Co., Queen W., $1,210.

Westboro, Ont.

Church, cost $11,000, for Presbyterian Congregation. Pastor, Rev. W. H. Craim. Architect, J. P. MacLaren, 104 Sparks St., Ottawa. Carpenters, Low & Raitt, 148 Percy St., Ottawa. Heating and plumbing not yet let.

Waterloo, Que.

Bank building for Canadian Bank of Commerce, head office, Toronto. Builder, G. N. Thompson, Waterloo. Work being done by day labor under supervision of builder. Excavating started.

Winnipeg, Man.

Church, cost $10,000, Westminster and Furby streets, for the Unitarians. Architect, John D. Atcheson, Trusts & Loan Bldg. General contractors, Grey & Davidson, Portage and Arlington street. Architect is receiving tenders for roofing, heating, plumbing and electrical work.

School, St. Vital, for Rural Municipality of St. Vital. Sec.-Treas., John Edmond, Grand Vital. Architects, Hooper & Davis, Confederation Life Bldg., Winnipeg. General contractors, Modern Construction Co., Sterling Bank Bldg, Winnipeg. Two storeys, 40 x 60.

Business Buildings and Industial Plants

Chicoutimi, Que.

Store and residence, cost $3,000, Bogin, for Treffle Harvey. 40 x 35, stone foundation, iron and steel roofing. Plans drawn.

Jasper Park, B.C.

Hotel contemplated for G. T. P. Rly. Hotel manager, F. W. Bergman, Ottawa, Ont. Plans to be prepared shortly.

Montreal, Que.

Automobile factory, Laurier and De Gaspe, for The Ford Automobile Co. of Canada, Walkerville, Ont. Four stys., 31,315 sq. ft., concrete foundation, steel frame and brick construction. As much glass to be used as possible. Plans in progress.

Stores and flats, cost $50,000, for Thos. Coggins, 319 St. Antoine St. Architect, C. A. Mitchell, 58 Beaver Hall Hill. Tenders received by Architect. Three stys. and basement, 80 x 100, pressed brick construction, concrete foundation.

Mount Robson, B.C.

Hotel for G. T. P. Rly. Hotel manager, F. W. Bergman, Ottawa, Ont. Plans to be prepared shortly.

Niagara Falls, Ont.

Store and flats, cost $4,000, Queen, for Roland Reed, Queen St. Two storeys, 21 x 50, cement foundation, brick construction. Plans in progress.

Ottawa, Ont.

Warehouse, cost $30,000, Bohelier, for H. L. Florence, Sussex St. Architect, A. L. Weeks, Sparks St. Two storeys, concrete foundation, solid brick construction. Plans in progress.

Factory, Bannermour, for Dusbane Mfg. Co., Sussex St. Site has been purchased and plans are in progress. Two storeys, 120 x 60, concrete foundation, solid brick construction.

Stores, etc., cost $6,000, Besserer, for H. J. Borbridge, 88 Rideau St. Concrete and stone foundation, solid brick construction. Plans in progress.

Prince Rupert, B.C.

Hotel, contemplated for G. T. P. Rly. Hotel manager, F. W. Bergman, Ottawa, Ont. Plans to be prepared shortly.

St. George, N.B.

Bank building, contemplated by Bank of Nova Scotia. Supervisor, Chas. Easson, St. John, N.B. Plans will be prepared.

Shawinigan Falls, Que.

Extension to paper mill, for The Belgo-Canadian Pulp & Paper Co., Ltd. Engineer, Owners. Plans and specifications being prepared by Owners for building and machinery. Machinery contracts will not likely be let until end of 1913 as sulphite mill will not be in operation before Aug., 1914, and extension to paper mill about Dec., 1914.

Welland, Ont.

Factory, planned for The Electric Steel & Metals Co., Ltd., Welland. Ratepayers voted on by-law for fixed assessment.

Winnipeg, Man.

Paper mill for The Austin Paper Mfg. Co., Ltd. President, R. D. Waugh. 28 Stradbrooke Place. Company capitalized at $150,000. Will erect plant to manufacture paper from flax straw.

CONTRACTS AWARDED

Amherst, N.S.

Drug store, cost $5,000, Victoria, for Douglas Bros. Architect, J. L. Allan. General contractor, J. N. Fage. Three storeys, 50 x 30.

Factory, cost $35,000, Foundry, for Amherst Pianos Ltd. Architect, J. N. Fage. Painting, W. A. Allan. Three storeys, 60 x 50.

Berlin, Ont.

Shoe factory, Michael St., for C. A. Ahrens. Architect, C. Cowan, 200 Victoria St. Mason, J. Baetz, Mill St. Carpenter, H. Dunker, 46 Shanley St. Two storeys, 45 x 70. Foundations in.

Collingwood, Ont.

Warehouse and grain elevator, for T. Long & Bros., Ltd., Hurontario St. Architect, Jno. Wilson, Hurontario St. Concrete work, Jno. Lackton. Brick work, A. Courts. Carpenter, N. A. Campbell. Plumbing, McFadgen & McQuade. Painting, A. Pomphrey. Electric work, refrigerator machinery, cork-board insulators for cold storage, not yet awarded.

Edmonton, Alta.
Garage, cost $18,000, Government House site. Dom. Govt. Dept. of Public Works. Work done by day labor. Two-storeys, 35 x 72, cement foundation, brick construction. Foundations started.

Fort William, Ont.
Business block, cost $7,000, S. May St., for F. S. Jones, S. May St. Architects and builders, Russell Bros. Two storeys, 25 x 60, brick construction, cement foundation.

Montreal, Que.
Stove foundry, etc., St. Laurent, for Canada Stove & Furniture Co., Ltd., St. Catherine and Delorimier Sts., Montreal. Architect, W. A. Mahoney, Guelph, Ont. General contractors, The James Shearer Co., Ltd., 225 St. Patrick. General contractors will call tenders later for roofing, painting and glazing.

Two stores and flats, cost $15,000, Outremont (Durocher and Lajoie). Mr. Jos. Lebeau, 100 Parc Lafontaine. Architect, Z. Trudel, 238 St. Andre. General contractor, plastering and carpenter, A. Frenette, 212 Fabre St. Steel, Dom. Bridge Co., Lachine. Roofing, heating, plumbing and electrical, Jos. Belisle & Frere, 808 Papineau. Foundations in.

Offices, etc., cost $450,000, for Imperial Wire & Cable Co., 241 Guy St. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractor, E. G. M. Cape, New Birks Bldg. Steel, Dom. Bridge Co., Lachine.

Alterations to newspaper office, cost $8,000, 75 St. James St., for Le Canada, 75 St. James St. General contractor, H. Demers, 47 Labelle. General contractor doing all work.

Two stores and residence, cost $15,000, Westmount (366 Victoria Ave.). Architect and builder, D. J. Finlayson, 366 Victoria Ave. Mason, J. W. Wilson, 40 Lincoln. Carpenter, A. A. Sharp, 27 Hillside. Owner does all other work. Two storeys and basement, 40 x 55, cement foundation, brick construction.

Restaurant, cost $43,500, Peel St., for Childs Co., 200 5th Ave., New York. Architect, J. C. Westervelt, 110 West 34th St., New York, N.Y. Supervisoring architect, D. J. Spence, 46 Beaver Hall Hill, Montreal. General contractors, mason and carpenter, Owners, c/o Mr. Swanson, 142 Peel St. Tile, Alex. Reed Co., New York, N.Y. Architectural iron, Can. Arch. Iron Works, 74 St. Dominique. Roofing and ventilating, Geo. W. Reed & Co., 37 St. Antoine. Plastering, Geo. Knott & Co., Chestnut Ave. Gas, heating and plumbing, Westmount Plumbing & Heating Co., 4278, St. Catherine W. Electric, Coolyer & Brock, 131 St. Alexander. Interior fittings, W. D. Lewis Co., New York, N.Y. Marble and painting not let. Three storeys, 42 x 114, steel construction.

Ottawa, Ont.
Storehouse, cost $15,000, Cooper, for Ottawa Dairy Co., Somerset St. Architect, J. Albert Ewart, 193 Sparks St., Ottawa. General contractor, F. McCullough, 181 Waller. Carpenter, J. Wallace, c/o General Contractor.

Business block, cost $100,000, Albert, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Mason, T. C. James, 140 Flora. Carpenter, Alex. Christie, Elgin St. Painting, W. J. Carson, 293 Laurier Ave. Electrical, H. B. Parks, 205 Laurier Ave. Plastering, plumbing and heating not let yet. Steel Dom. Bridge Co., Sparks St.

Port Arthur, Ont.
Laundry, cost $21,000, Van Norman, for Armstead & Co. Architect, Carl Wirth, Fort William. General contractor, R. Smith, Prince Arthur Hotel. Two storeys, 50 x 165.

Addition to store, cost $25,000, Cumberland, for I. L. Matthews & Co. Architect, Fred Urry, 237 Arthur St. General contractors, Cox & Jones. One storey addition, 65 x 110, red clay brick construction.

Garage, cost $20,000, for Central Garage Co., 234 Park St. General contractor and mason, Geo. H. Otto, 206 Arthur St. Two storeys, 50 x 100, cement foundation, red clay brick construction.

Regina, Sask.
Office building, cost $10,000, 6th Ave. Owner and general contractor, W. H. Joyce. Two storeys, brick construction. Foundations in.

St. Catharines, Ont.
Flax mill, cost $150,000, Lincoln Ave., for Canadian Flax Mills, Ltd., 24 King W. Supt.-in-charge, Austin Campbell, Welland House, St. Catharines. Mason, Newman Bros., St. Paul St. Heating and plumbing, A. Riddell & Son, St. Paul St. Two storeys, 100 x 60, brick construction, felt and gravel roofing, machinery required.

St. Thomas, Ont.
Brass factory, cost $25,000, Wellington, for St. Thomas Brass Co., M. C. R. Yds. Manager, J. B. Potts. General contractor, Albert E. Ponsford, 605 Talbot St. Fenestra Steel Sash, Steel & Radiation, Ltd., Fraser Ave., Toronto.

Tillsonburg, Ont.
Pickle factory, cost $5,000, for Heinz Pickle Co. Builder, Owner. Frame construction.

Toronto, Ont.
Bank building, Queen and Brock Ave., for Standard Bank, Toronto. Architect and builders, Baldwin & Woods, 9 Front E. Concrete, foundation, stone and brick construction.

Boiler house, cost $5,000, Dufferin. Owners and general contractors, A. B. Ormsby & Co., Queen and George. Engineer, Company's Engineer. Two stys., 24 x 40, brick foundation and construction. Excavating started.

Vancouver, B.C.
Factory, 11th Ave., for The Alaska Feather & Down Co., 412 St. Ambroise. President, J. H. Parkhill. General contractor, Fred Sherborne, Metropolitan Bldg. Four storeys, brick and mill construction.

Warehouse, csot $70,000, Homer and Davis Sts. Owner and general contractor, Geo. R. Baker, 835 10th Ave. W. Architects, Sharpe & Thompson, 536 Hastings St. W. Three storeys and basement, 119 x 200. Excavating started.

Wadena, Sask.
Hotel, cost $26,000, for Ike Diner, Yorkton. Architect, Max Blankstein, 450 Dufferin Ave., Winnipeg. General contractors, Alex. Black Lumber Co. Three storeys, 46 x 72.

Winnipeg, Man.
Warehouse, cost $19,000, Winnipeg Ave., for Metallic Roofing Co., Notre Dame Ave. Architects, Jordan & Over, 47 Canada Life Bldg. General contractor, Worswick Bros., Poplar Ave. Two storeys, 58 x 100, brick construction.

Yorkton, Sask.
Office building, for The Dom. Express Co., Ltd. General contractor, C. J. McLeod. Two storeys, brick foundation and construction.

Residences

London, Ont.
Residence, cost $10,000, Richmond St., planned for Geo. H. Belton, cor. Central Ave. and Wellington. 40 x 40, cement foundation, white brick construction. Owner will receive tenders until August 7th.

Sandwich, Ont.
Residence, cost $5,000, for Rev. D. Hind. Tenders received by Architects, G. Jacques & Co., Windsor, from August 5th to 15th. Two storeys, 30 x 30, brick foundation, brick veneer construction.

Toronto, Ont.
Three residences, cost $6,000, for H. Fine, 12 Milan St. Architect, R. A. Abraham, 23 Jordan St. Two storeys, 48 x 44, brick foundation and construction. Owner now open for tenders.

One detached residence, cost $16,000, Warren Road, for J. E. Atkinson, Toronto Daily Star. Architects, Langley & Howland, Confed. Life Bldg. 2½-stys., 46 x 80, stone foundation, stone, reinforced concrete, brick and structural steel construction, slate, galvanized iron. Tenders in. Contracts not yet awarded.

Windsor, Ont.
Bachelor apartments, cost $16,000, Ferry, for F. K. Dresch & Son, 17 Ferry St. Architects, Leybourne & Whitney, Windsor. Three storeys and basement, 34 x 50, brick foundation, brick and structural steel construction. Tenders received by Architect from August 1st until August 15th.

Bungalow, cost $6,000, Ouelette, for Jno. Pageau. Tenders received by Architects, G. Jacques & Co., from August 4th to 15th. 1½ storeys, 30 x 32, brick foundation, stucco and brick veneer construction.

Winnipeg, Man.
Residence, cost $6,000, Elm, for A. Macaw, 803 Trust & Loan Bldg. Architect, c/o Owner. Two storeys, 24 x 32, stone foundation, frame and stucco construction. Plans ready.

Four residences, cost $6,000, Anderson Ave., for Cohen & Meyerwitz, 685 Alfred Ave. Architect, c/o Owner. 1½ stys., 20 x 36, stone foundation, frame construction.

Residence, cost $6,400, Rosedale Ave., for Canadian Syndicate Investments, Somerset Bldg. Architect, c/o Owner. Two storeys, 20 x 26, stone foundation, frame construction.

Residence, cost $5,000, Balfour Ave., for R. C. Mitchell, 312 Florence. Two stys., 26 x 28, cement foundation, frame construction. Plans ready.

CONTRACTS AWARDED

Hamilton, Ont.
Residence, cost $25,000, Queen St., for J. W. Lamoreaux, 26 Canada St. Gen-

(Continued on page 70)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders will be received by the undersigned up to the **15th day of August, 1913**, for the heating of the Walkerton Public Library. Plans and specifications may be seen at the office of the secretary, Walkerton, or at the office of Mr. Geo. Gray, architect, Harriston. The lowest or any tender not necessarily accepted.
W. B. Thompson, Secretary. 32-33

CITY OF MONTREAL

Notice to Contractors

Contract No. 2

Tenders for the Construction of a System of Underground Conduits, ManholesTransformer Chambers, etc.

Sealed tenders in an envelope provided for the purpose, and addressed to the undersigned secretary of the Board of City Commissioners, will be received at the offices of the said Commissioners, City Hall, Montreal, in the Province of Quebec, until twelve o'clock noon, on the 15th day of August, 1912, for the construction of a system of Underground Conduits, Main and Service Manholes, Transformer Chambers, etc., in, upon, and adjoining that portion of St. Catherine Street, between Atwater Ave. and Guy St., in the City of Montreal.

Tenders will be considered for the whole and not for a part only of the above mentioned works. and persons tendering are notified that tenders will not be considered unless made on the printed forms supplied by the Commissioners.

Plans, specifications and forms of tender may be obtained at the office of the Electrical Commission, 1009 New Birks Bldg, any day during office hours, upon payment of a deposit of One Hundred Dollars, which amount will be refunded after the receipt of a bona fide tender and the return of the said plans, specifications and other documents.

Each tender must be signed and sealed by all the parties to the tender, and duly witnessed, and be accompanied by an accepted cheque on a Chartered Bank of the Dominion of Canada, payable at Montreal to the City Treasurer, for a sum of Five Thousand Dollars ($5,000) to be increased (if required) before the contract is signed by the accepted tenderer to an amount equal to ten per cent. (10 p.c.) of the amount of his tender.

The person or firm whose tender is accepted shall, within ten days after the final acceptance thereof, sign the contract, specifications, and other documents required to be signed, and in case of the refusal or failure on the part of the person or firm whose tender is accepted, to complete and execute the contract with the City Commissioners, the said cheque shall be forfeited to the City Commissioners as liquidated damages for such refusal or failure, and all contract rights acquired by the acceptance of the tender shall be forfeited.

The cheque deposited by the person or firm whose tender is accepted will be deposited to the credit of the City of Montreal as security for the due and faithful performance of the contract according to its terms.

The cheque deposited by the person or firm whose tender is rejected will be returned within ten days after the signing of the contract.

The lowest or any tender will not necessarily be accepted.

By order,

L. A. HERDT, Chairman,
The Electrical Commission of the City of Montreal.

L. N. SENECAL, Secretary.
Board of City Commissioners.

Newspapers inserting this advertisement without authority will not be paid for it. 32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Clock Tower, Public Building, Brampton, Ontario," will be received at this office until 4 p.m., on **Monday, August 18, 1913**, for the construction of a Clock Tower to the Public Building at the place mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Brampton, Ontario, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 28, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44785. 32-33

Department of Railways and Canals, Canada

Welland Ship Canal

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Track Ties," will be received at this office until 3 o'clock p.m., on August 14th, 1913, for the furnishing of 41,000 ties.

Specifications and forms of tender can be obtained from the Purchasing Agent, Department of Railways and Canals, Ottawa.

An accepted bank cheque for the sum of $500 made payable to the order of the Minister of Railways and Canals must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 2nd August, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—45891. 32

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, August 19, 1913**, for the construction of the following sewer works:

Midway Sewer System

Outlet via Hiawatha Ave., Gerrard St. and Morley Avenue

Division No. 2, West Toronto

Woodville Avenue

Balsam Avenue, Queen Street to Kingston Rd.

East Toronto, Section A, Outlet

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or, in lieu of said sureties, the Bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, July 26, 1913. 32

Sealed tenders, addressed to the undersigned, and endorsed "Tender for East Pier, Eastern Entrance, Toronto Harbor, Ont.," will be received at this office until 4 p.m. on **Tuesday, Sept. 2, 1913**, for the reconstruction of part of superstructure of East Pier of Eastern Entrance to Toronto Harbor, in the County of York and Province of Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life, Building, Toronto, Ont., and H. J. Lamb, Esq., District Engineer, Windsor, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 1, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43525. 32-33

THE PAS, MANITOBA

Notice to Contractors

Sealed tenders, registered and endorsed on the envelope, "Tender for (tender bidding on)" and addressed to H. H. Elliott, M.D., Sec.-Treas. of the Town of The Pas, Man., will be received up to 6 p.m., **August 20th, 1913**, for the construction of the following works:

Tender A—Construction of Sedimentation Basin.

Tender B—Foundations for Power House.

Gravel 75c f.o.b. The Pas, Man.

Marked cheque for five per cent. (5 p.c.) of the amount of the bid must accompany each tender, or in lieu of the said cheque, the tenderer may furnish the bond of an approved surety company.

Plans, specifications and instructions may be seen at the offices of the Consulting Engineers, Saskatoon, or at the Resident Engineer's office at The Pas, Man., or plans and specifications will be given or forwarded on a deposit of Twenty ($20) Dollars—the deposit cheque to be returned if the plans and specifications are returned with the tender.

H. H. ELLIOTT, M.D., Sec.-Treas.,
The Pas, Man.
MURPHY & UNDERWOOD,
Consulting Engineers,
32-33 Ross Bldg., Saskatoon, Sask.

Department of Railways and Canals, Canada

Trent Canal

Port Severn Section—Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Port Severn Section—Severn Division, Trent Canal," will be received at this office until 2 o'clock p.m., on **Monday, August 25th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after July 26th at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.; at the office of the District Engineer, Public Works Department, Midland, Ont., and at the office of the Postmaster, Orillia, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of **$10,000** made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 29th July, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—45677. 32-33

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, Little Current," will be received until **4.00** p.m., on **Tuesday, August 12 ,1913**, for dredging required at Little Current, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of the tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister o Public Works, for five per cent. (5 per cent.) of the contract price, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 26, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45519. 31-32

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, Magnetawan River," will be received until 4 p.m., Wednesday, 20th August, 1913, for dredging required at Burks Falls, Ont.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, (no cheque to be for less than fifteen hundred dollars), which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. —45752. 32-33

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913**, by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
32-37 Cayuga, Ont.

CITY OF MONTREAL

Notice to Contractors

Contract No. 3

Tenders for the Construction of a System of Underground Conduits, Manholes, Transformer Chambers, etc.

Sealed, tenders in an envelope provided for the purpose and addressed to the undersigned Secretary of the Board of City Commissioners will be received at the offices of the said Commissioners, City Hall, Montreal, in the Province of Quebec, until 12 o'clock noon, on the 15th day of August, 1913, for the construction of a system of Underground conduits, Main and Service Manholes, Transformer Chambers, etc., in, upon, and adjoining that portion of Bleury street and Park avenue between Craig street and Pine ave., in the City of Montreal.

Tenders will be considered for the whole and not for a part only of the above mentioned work, and persons tendering are notified that tenders will not be considered unless made on the printed forms supplied by the Commissioners.

Plans, specifications, and forms of tender may be obtained at the offices of the Electrical Commission, 1009 New Birks Bldg., any day during office hours, upon payment of a deposit of Five Hundred Dollars, which amount will be refunded after the receipt of a bona fide tender and the return of the said plans, specifications and other documents.

Each tender must be signed and sealed by all the parties to the tender, and duly witnessed, and be accompanied by an accepted cheque on a chartered bank of the Dominion of Canada, payable at Montreal to the City Treasurer, for the sum of Ten Thousand Dollars ($10,000) to be increased (if required) before the contract is signed by the accepted tenderer to an amount equal to ten per cent. (10 p.c.) of the amount of this tender.

The person or firm whose tender is accepted shall, within ten days after the final acceptance thereof, sign the contract, specifications, and other documents required to be signed and in case of the refusal or failure on the part of the person or firm whose tender is accepted, to complete and execute the contract with the City Commissioners, the said cheque shall be forfeited to the City Commissioners as liquidated damages for such refusal or failure, and all contract rights acquired by the acceptance of the tender shall be forfeited.

The cheque deposited by the person or firm whose tender is accepted, will be deposited to the credit of the City of Montreal as security for the due and faithful performance of the contract according to its terms.

The cheque deposited by the person or firm whose tender is rejected will be returned within ten days after the signing of the contract.

The lowest or any tender will not necessarily be accepted.

By order, L. A. HERDT, Chairman,
The Electrical Commission of the City of Montreal.
L. N. SENECAL, Secretary,
Board of City Commissioners.

Newspapers inserting this advertisement without authority will not be paid for it. 32

Tenders for a New Market

St. Patrick Square

Bulk tenders only will be received by registered post only, addressed to the undersigned up to noon on **Tuesday, 12th August, 1913**, for the above building.

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering, as prescribed by City By-laws, must be strictly complied with or tenders may not be entertained. Tenderers shall submit with their tender the names of two personal sureties or the bond of a Guarantee Company, approved by the City Treasurer.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman of the Board of Control.
City Hall, Toronto,
July 30th, 1913. 32

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

DERRICKS FOR SALE

One 25-ton Terry & Tench travelling stiff leg derrick.

One 20-ton stiff leg derrick.

One 15-ton stiff leg derrick.

No reasonable offer refused.

National Sand & Material Company, Ltd.
30-31-32 Welland, Ont.

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont. 29-t.f.

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, A1 ... ... $700

Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new $2,500

Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1 ... ... $3,500

Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1 ... ... $2,800

TRACTION ENGINE
Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?
TRY US!

WILLIS SHAW MACHINERY CO.
La Salle Street, Chicago. Ill.

Situations Wanted

Architectural Draughtsman open for engagement. Capable Superintendent, having had large practical experience.

Moderate remuneration to get established. Reliable. Box 849, Contract Record, Toronto. 33

Position Wanted—Engineer, electrical and mechanical, age 26, with extensive workshop experience and University training, desires suitable engagement; more particularly on the sales staff. References. Box 851, Electrical News, Toronto, Ont. 16-17

Position Wanted—Engineer, electrical and mechanical, age 26, with extensive workshop experience and University training, desires suitable engagement, more particularly on the sales staff. References. Box 850, Contract Record, Toronto, Ont. 32-33

Residences

eral contractor, W. H. Yeates, Jr., 24 Leeming St. Roofing, Wm. Findlay, 317 Aberdeen Ave.

Medicine Hat, Alta.

Six residences, cost $3,500 each, Central Park, for Huggins & Porter, Bennet Bldg, Toronto St. Architect and builder, A. Montgomery, 14 Hull Block. Two storeys, 26 x 32 each, frame construction. Foundations in.

Montreal, Que.

Flats, cost $30,000, Park ave., for E. Goldfine & Chananie, 3 Ontario W. Architects, G. Bail and E. Vincent, 102 Stadacona. General contractor and carpenter, G. Bail. Brick, S. Langlois, 394 Forsythe street. Roofing, heating, plumbing, electrical work, Jos. St. Amand, 109 Laurier W. Plastering, H. Tremblay, 1360a Amity. Painting, Brosseau & Laurendeau, c/o gen. contractor.

Alterations and addition to residence, cost $10,000, for Lady Hickson, 20 Ontario Ave. Architects, Nobbs & Hyde, 49 Beaver Hall Hill. General contractors, Bennell Bros., 341 Guy St., doing all the work.

Toronto, Ont.

Det. residence, cost $5,500, Glen Road, for J. S. Vancamp, 109 Langley. Architect and general contractor, R. Perkins, 576 Palmerston ave. Two storeys, 28 x 42, stone foundation, brick and steel construction. Excavating started.

Det. residence, cost $35,000, Clarendon & Russell, for D. K. Ridout, 85 Bay St. Architects, Langley & Howland, Continental Life Bldg. Masonry, Wood & Son, 611 Manning ave. 2½ storeys, 45 x 66, stone foundation, brick, stone, hollow tile and steel construction. Excavation started.

Power Plants, Electricity and Telephones

Brandon, Man.

Telephone exchange, $100,000. Manitoba Government Telephones. Dist. Supt., C. H. Snider. Damage covered by insurance.

Dundas, Ont.

Power house, for Ontario Hydro-electric Commission. Sec., W. W. Pope, Bay and Richmond, Toronto. Engineer, F. A. Gaby, Bay and Richmond, Toronto. General Contractors, Wells & Gray, Confed. Life Bldg., Toronto. Equipment, Can. Westinghouse Co., Hamilton.

Forest, Ont.

Electric power house, cost $6,000, planned by Town Council. Clerk, Richard Karr. Engineer, H. A. McLean, C.E., Sarnia. General contractor, Wm. Ross. Boilers and engines, E. Leonard & Sons, London, $4,385. Electrical work, Can. Westinghouse Co., Hamilton.

London, Ont.

Power house, for Ontario Hydro-electric Commission. Sec., W. W. Pope, Bay and Richmond, Toronto. Engineer, F. A. Gaby, Bay and Richmond, Toronto. General contractors, Hyatt Bros., 94 Egerton. Equipment, Can. Westinghouse Co., Hamilton.

Medicine Hat, Alta.

Telephone exchange building, cost $85,000, 5th Ave. and Ottawa Sts., planned. Tenders received by Deputy Minister, W. J. Harmer, Edmonton, Prov. Govt. Dept. of Railway, Telephones and Telegraphs, for excavation, concrete footings and walls. Specifications at office of Provincial Architect, Edmonton. Three stys., stone and brick construction.

Orillia, Ont.

The Dom. Govt. will build dam and power house at Swift Rapids, also transmission line to supply power to Orillia.

Regina, Sask.

Power house, cost $30,000, Lakeview, planned by City Commissioners. City Commissioner, L. A. Thornton. Supt. of Light and Power, E. W. Bull. Architects, Storey & Van Egmond, Credit Foncier Bldg. 174 x 130, concrete foundation, brick and stone construction.

St. Thomas, Ont.

Power house planned for Ontario Hydro-electric Commission. Sec., W. W. Pope, Bay and Richmond, Toronto. Engineer, F. A. Gaby, Bay and Richmond, Toronto. General contractor, Geo. Ponsford. Equipment, Can. Westinghouse Co., Hamilton.

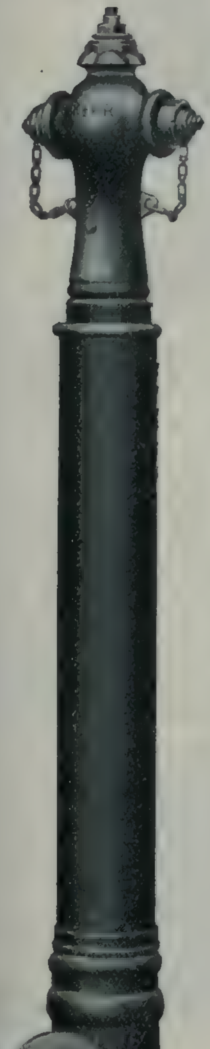
Toronto, Ont.

Dam and power house for Hydro-electric Power Commission. Sec., W. W. Pope, Continental Life Bldg. Engineer, F. A. Gaby, Continental Life Bldg. Stop log winch and Headgate mechanism. Wm. Kennedy & Son, Owen Sound, awarded contract for work, etc., on Wasdell's Falls, on Severn River.

KERR

Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.



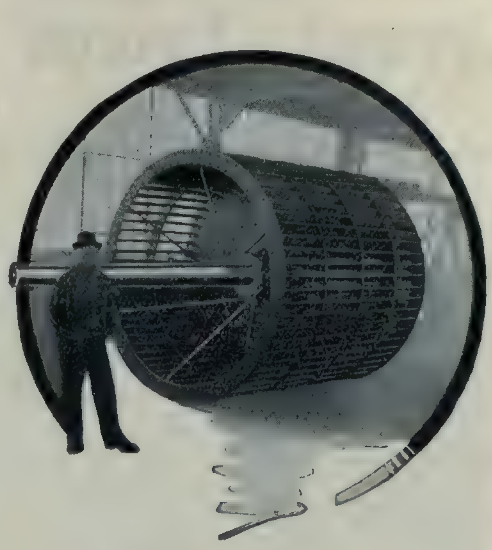
Standard Compression Hydrant

Send us your Specifications and Enquiries.

Prompt attention given.

6″ Hubbed

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.



Fresh Air for 9,000 People Delivered by ONE

"Sirocco"

TRADE MARK.

Ventilating Fan

The illustration shows a double inlet "Sirocco" Fan with a capacity of 270,000 cubic feet of air every 60 seconds at 5″ water gauge.

A "Sirocco" Fan will deliver twice as much air as the ordinary steel plate fan of the same wheel diameter. Save one-half the space and one-third the power.

"Sirocco" Fans and Blowers are made in sizes to deliver from 75 cubic feet per minute to 1,000,000 cubic feet per minute.

Our Engineering Department will gladly co-operate with you in the selection of the proper equipment for YOUR needs.

Let us tender on your next requirements. Bulletin No. 3401 is descriptive of the construction and operation of "Sirocco" Fans. You should have a copy.

CANADIAN SIROCCO COMPANY
LIMITED
WINDSOR, ONTARIO.

Engineering Salesmen

CLARK T. MORSE, 301 McGill Bldg., Montreal
E. C. POWERS, Room 5, 43 Victoria St., Toronto
W. P. EDDY, 214 Donald St., Winnipeg
S. S. Clarke, 605 2nd St. West, Calgary

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	30 00	
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	26 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in, pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4.85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¼ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.50 in car lots; hydrated lime, $9.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $8.50 per 100 lbs.

Boiled Linseed Oil in bbls., 64c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 61c per gallon.

Turpentine, in barrels, 56c per gallon.

Pure Red Lead, dry $6.50 to $7.50 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.
Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

CAST IRON PIPE SHIPPED FROM STOCK

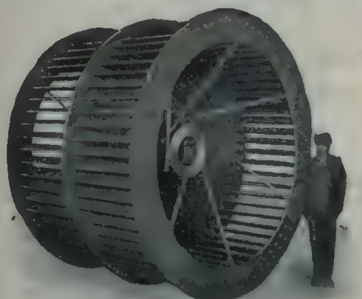
Prompt Shipments are necessary if your lines are to be laid before frost.

We make all sizes, from 3″ to 84″

UNITED STATES CAST IRON PIPE AND FOUNDRY CO.

General Offices:—BURLINGTON, NEW JERSEY

Branch Offices:—PHILADELPHIA, NEW YORK, CHICAGO, SAN FRANCISCO, PORTLAND (Ore.)
BUFFALO, PITTSBURGH, ST. LOUIS, CHATTANOOGA



BLOWERS "Sirocco" FANS

TRADE MARK.

Made In Canada

Low cost of Installation, low cost of Operation, low cost of Maintenance, and High Efficiency are the deciding features of "Sirocco."

Engineering Service

Aside from our own Expert Engineers we have at our command the co-operation of the Engineering Service Department of the American Blower Company, and the results of years' of experience of S. C. Davidson, the inventor, Belfast, Ireland.

A "Sirocco" Fan will deliver more air with less power than the ordinary steel plate fan twice the size.
"Sirocco" Fans and Blowers are used in connection with apparatus for Heating, Ventilating and Cooling, in Industrial, Educational, Office and Public Buildings.
For Forced and Induced Draft under steam boilers on land and at sea.
The world's largest boats use "Sirocco" Fans for Forced Draft and Hull Ventilation.
The British Navy use "Sirocco" exclusively.

Let us tender on your next air handling problem. The services of our Engineering Department are at your command.

You Should Read "Sirocco" Bulletin No. 3401

Describing and illustrating the construction, operation and application of 'Sirocco' Fans and Blowers.

Write for it today.

CANADIAN Sirocco COMPANY

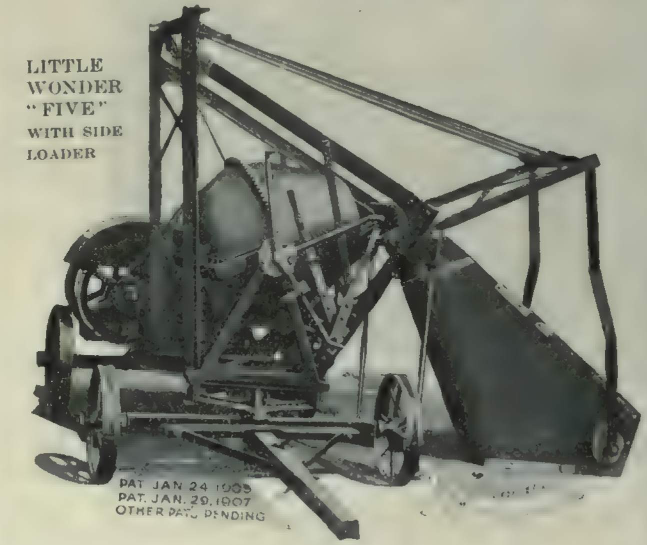
LIMITED

WINDSOR, ONTARIO.

Sales Engineers:

Clark T. Morse, 301 McGill Bldg., Montreal
E. C. Powers, Room 5, 43 Victoria St., Toronto
W. P. Eddy, 214 Donald Street, Winnipeg
S. S. Clarke, 605 Second St. West, Calgary

Wonderful Things



LITTLE WONDER "FIVE" WITH SIDE LOADER

are told about the

WONDER

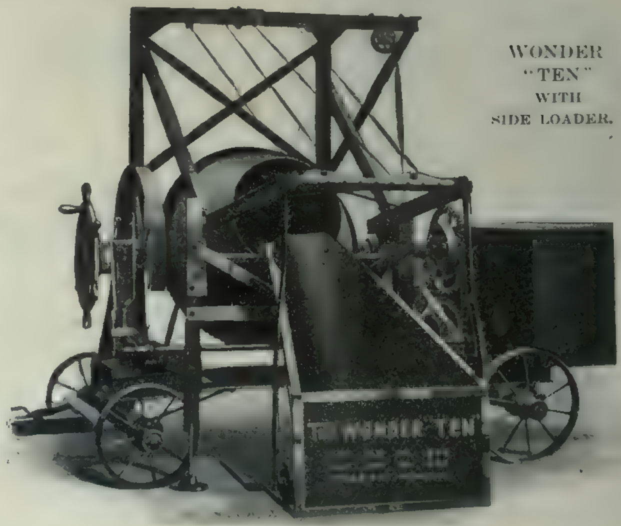
line of Concrete Mixers and the WONDER is they're true. Nobody thinks now-a-days of buying a mixer without first investigating the

LITTLE WONDER "FIVE"

and

The WONDER "TEN"

These mixers place concrete work on a new basis. They make double the money and save time and labor over old methods. They are enthusiastically endorsed by thousands of contractors.



WONDER "TEN" WITH SIDE LOADER.

ABSOLUTELY FREE TRIAL

on your own work is our offer to you. Get the details.

WATERLOO CEMENT MACH'Y CORP'N

117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists and Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

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Street Lighting Poles

Modern Ideas in Street Lighting

Send for Descriptive Bulletin and Prices.

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QUEBEC, P. Q.

American Agencies, Ltd.
Aull Block
CALGARY, ALTA.

Residence W. J. Fleury, Toronto
85 Bedford Road

Residence Cleaning
by
TUEC
Stationary
Air-Cleaning
System

RECOGNIZED AS THE STANDARD OF THOROUGH CLEANING

CANADIAN TUEC DISTRIBUTORS
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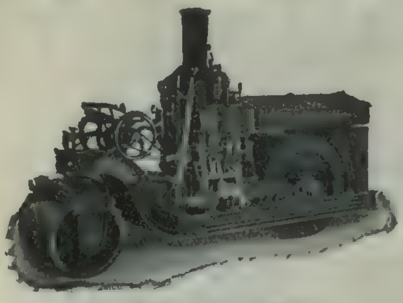
Tuec Co. of Winnipeg—419 Portage Ave., Winnipeg, Man.
Tuec Co. of Calgary—812 First St. West, Calgary, Alta.
Tuec Co. of Montreal—406 New Birks Bldg., Montreal, Que.

Canadian Factory—B. O. T. Building,
159-61 Richmond St. W., Toronto—Jas. J. Martindale.



ERIE MACHINE SHOPS

P. W. DIETLY
Proprietor

Send for our Catalogue of Asphalt Rollers and Mixers.

"Our 20th Century Roller"

1303 PEACH STREET - ERIE, PA.

Vault Doors and Safes

J. & J. Taylor

Toronto Safe Works

Established 1855 **TORONTO**

Branches: Vancouver and Winnipeg

BOILERS

FROM STOCK

We are prepared to furnish at once from stock **Return Tubular Boilers** in most standard sizes from 40″ x 10′ to 72″ x 18′.
These are new, have been inspected and tested and are in the best of condition.
If your size is not in stock we have facilities to put your order through with the least possible delay.

WRITE

The Waterous Engine Works Co. Limited
Brantford, Canada

*Residence of Ralph Peters, Esq., President, Long Island R.R.
Aymar Embury II., Architect, New York.*

Shingles stained with Cabot's Shingle Stains, stucco stained with Cabot's Waterproof Cement Stains, and lined with Cabot's Quilt, for warmth.

CABOT'S CREOSOTE SHINGLE STAINS

The Standard Stains for Shingles, Siding or Trimmings. The first shingle-stain ever made, and quality guaranteed by thirty years' use. Made of the strongest and finest colors, ground in pure linseed oil, and Creosote, "the best wood preservative known," No cheapeners, no adulterations, no kerosene or benzine.

CABOT'S "QUILT"

The warmest lining. Heat-proof. Cold-proof. Sound-proof. Uninflammable, non-decaying, vermin-proof. Insulates cold-storage and ice-houses, and all other buildings. Deadens sound in floors and partitions.

Cabot's Waterproof Cement and Brick Stains

For waterproofing and tinting stucco and similar cement surfaces, and for freshening, restoring and waterproofing bricks.

Cabot's Conservo Wood Preservative

For preserving ties, poles, planking and all other lumber.

Cabot's Plasterbond Damp-proofing

For direct plastering on brick or concrete without studding or lathing. Forms a perfect permanent and impervious bond.

Cabot's Mortar Colors

Strongest, finest and most lasting.
Send for Samples and Prices.

SAMUEL CABOT, Inc., Mfg. Chemists, Boston, Mass.

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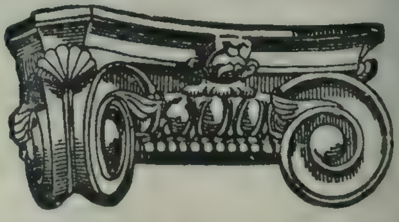

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Alphabetical Index of Advertisers
Page 16

Vol. 27 August 13, 1913 **No. 33**

Eliminating the Irresponsible Bidder

FREQUENTLY considerable trouble is caused and unnecessary expense incurred through the acceptance of the tender of an irresponsible bidder. In his anxiety to obtain the contract, he tenders at a low figure, and with the award of the contract his troubles as well as those of the owner begin. He soon recognizes the fact that his prices are low and skimps the work where possible or uses materials not specified. Even with close inspection it is not always possible to prevent this.

Time is always an important factor in any contract. The contractor of limited means is not infrequently inefficient in executing his contract. He lacks the system and the equipment by which the work can be carried to a speedy conclusion. He finds difficulty in financing and the work drags to the annoyance and loss of all concerned. The contract is abandoned, occasionally a lawsuit follows and somebody else must be called in to finish the work.

A first essential in providing a remedy for this condition is a recognition on the part of the owner, that an article obtained at a low price is not necessarily a cheap one. That even if the owner should desire it, he cannot get something for nothing and that there is an economy in paying a reasonable price and having the work done by responsible persons.

The standing of the individual or firm to whom the contract is to be awarded should be known, and if the owner is not thoroughly satisfied, the award should not be made.

The difficulty may be obviated by inviting firms to tender on a given price of work. In this case the owner should be perfectly frank and let the firms know against whom they are competing and reasons should be given for the acceptance of any tender.

It should always be borne in mind that in tendering on any piece of work there is an expenditure of both time and money. That many firms will not tender on certain contracts in competition with men who are bound to have the work at any hazard, knowing that expense is involved without possibility of return.

This state can be remedied only by a system of tendering necessitating the least possible outlay on the part of those bidding. It seems to us that a general adoption of "The quantity system of estimating" as advocated by Mr. Alexander Wright in the Contract Record of July 23, would go a long way in this direction. By this means the cost of tendering would be minimized and the possible variation in the tender price reduced to the very narrowest limits.

The Geological Congress and Its Economical Significance

TO the citizens of Canada has fallen the honor of entertaining the members of the Twelfth International Geological Congress. No more distinguished body of scientists has graced the shores of this continent than that which held its sessions in the city of Toronto August 7th to August 14th.

The society was organized in the year 1878 and since that time has held triennial or quadrennial meetings in the capitals of the leading countries of Europe and America. The fifth session was held in United States in 1891 and the tenth in Mexico in 1906. The last session was held at Stockholm, Sweden, in 1910. Of the 879 members enrolled 625 were in attendance and fully as many were present at the Toronto conference.

The membership consists of professional geologists and persons occupied in kindred professions. Delegates are members who have received special appointment to represent governments, universities, or scientific societies.

The programme consists of papers and discussions on geological questions and theories. There is also a very practical side to the programme. Prior to the meeting and during its continuance as well as afterwards, visits are conducted to those portions of the country where formations of geological interest are to be found.

The Toronto congress came on the joint invitation of the Dominion and Ontario governments and the Canadian Mining Institute and Royal Society of Canada. Arrangements have been made for the visiting scientists to see practically every part of the Dominion if they wish and become acquainted with the mineral possibilities of this country.

The meetings of the congress have a marked economic significance. The co-operation of various governments and scientific societies has been secured and a standardization of geological nomenclature has been evolved and as a result of this a magnificent geological map of Europe is nearing completion. One part of the work accomplished by the Mexican Congress was a geological map of North America and and the Swedish congress published a great work, "The Iron Ore Resources of the World." The executive committee of the Twelfth Congress has undertaken the publication of three quarto volumes and a folio atlas of about 70 maps in colors descriptive of, "The Coal Resources of the World." Another topic of vital economic importance to be debated at this assembly is, "The influence of depth on the character of metalliferous deposits."

To Canada the gathering of this group of notable scientists, representing in all about forty different nationalities, must have a beneficial influence. Abroad, the knowledge of our mineral wealth will be made known in a way not possible through any other agency. At home, there will be a wider spread knowledge of our mineral possibilities together with a more rational method of development, resulting from increased knowledge.

Employ the Canadian Contractor

COMPLAINT comes from Montreal that United States firms are obtaining the preference in the execution of contracts in that city, and that material from the same country is being used for construction purposes instead of material produced in Canada. This is a matter of considerable importance for both the Canadian manufacturer and contractor.

There are one of two features of the case that must be considered. There are firms operating in Canada under legal charters and employing Canadian labor almost entirely, together with a large amount of material produced in this country. These firms are American only in name.

Again, as one contractor pointed out, occasionally the specifications call for material not manufactured on this side of the line. On most contracts time is a very important element and some of the contractors assert that they are occasionally forced to obtain supplies from American houses.

These statements are doubtless true yet the fact remains, that handing a contract over to a foreign firm in preference to a Canadian firm, or importing foreign material when goods similar in quality and price may be obtained within our own borders, is detrimental to the best interests of the country.

We have no antipathy towards the American contractor but we are concerned in the welfare of Canada and the Canadian contractor and manufacturer. It is well to remember that the prosperity of any branch of labor directly affects the prosperity of all others and that the men of this country, who are engaged in the work of building and manufacture cannot be deprived of their legitimate field of operation without affecting the condition of Canadians generally.

We have every confidence that what has been done by others elsewhere can be done by the Canadian engineer and contractor and he should be given the chance. Going abroad for material which is obtainable here does not increase the possibility of procuring an adequate supply in reasonable time in our own country, but tends to a continuance of restricted conditions by limiting the producers' opportunity for output.

Railway construction upon a comprehensive scale is to be undertaken by the Brazilian Government. The sum of $65,000,000 has been voted for the purpose. The construction will be carried out in accordance with a general plan but most of the work will be done in the southern part, to open up the mining and agricultural areas found there.

Editorial Comment

THE unpleasant taste given to drinking water by the use of bleaching powder may be removed, according to Prof. H. N. Holmes, Richmond, Ind., by treating with sodium sulphite or sodium thiosulphite. About 1.2 pounds of sodium sulphite have been found necessary to kill the taste of one pound of the bleaching powder. At 4c. a pound this increases the cost of the treatment about 125 per cent. The sodium thiosulphite is just as efficient and cheaper for at 1.85c. per pound, the cost of purification is increased only 40 per cent. Only one-half as much is required to remove the taste as in the case of sodium sulphite.

* * *

ENGINEERING work on a large scale and of great importance is to be undertaken in southern Italy. In the mountain region of Calabria the rainfall is irregular but abundant. It is proposed to build four enormous reservoirs and regulate the flow of water down the mountain sides. At the outset a 50,000 horse-power turbine electric plant will be installed which will supply power to the neighboring towns and cities.

* * *

THE development of the oil industry near Tampico, Mexico, has forced the Mexican government to undertake engineering work of considerable importance in the vicinity of that city. The harbour of Tampico is to be improved so as to accommodate ships up to 30 ft. draught. The river Panuco, upon which Tampico is situated, is to be dredged. It is estimated that 100,000,000 cubic metres of sand and silt must be removed from the bottom of the river and that the company will have to handle from 8,000 to 10,000 cubic metres daily, in order to complete the work in the three-year limit stipulated by the Mexican government.

* * *

NORTHERN pine, Norway spruce and larch are the principal timbers in use in Vienna for paving. The mountain larch is the hardest of these varieties and in addition has a small proportion of sapwood. The preservatives employed are creosote and a mixture of creosote and chloride of zinc. Creosote alone is used when the blocks are laid on bridges. The mixture of creosote and chloride of zinc is used for pine and fir on the roadways. Chloride of zinc only is used when the blocks are laid under cover. Wooden strips 4 millimetres thick and 4 centimetres high are placed between the blocks. The joints are filled with sharp sand and the surface is covered with a hot mixture of pitch and coal tar and strewn with fine gravel. The life of the wood pavements is ten years and over for heavy traffic and about twenty years for light traffic.

A patent recently granted by the department at Washington shows a boat equipped with a motor, and so constructed as to drive the propeller shaft of the boat upon the rise and fall of the boat, by the action of the waves.

Rail Failures and Their Causes[*]

Classes of Failures—Description of Each Class —Causes of Failures — Remedies Proposed

By M. H. Wickhorst

RECENT years have been active ones in the matter of investigations of rail failures by the railroads, the rail manufacturers and public bodies, and it is proposed in this paper to consider our present information concerning the nature of the failures and their causes.

From the standpoint of the visible condition of the failed rails most of the rail failures may be divided into three classes, as follows:

1. Crushed and split heads;
2. Broken rails (square and angular breaks);
3. Broken bases (crescent breaks).

In addition to these, there are other failures occurring in smaller numbers, such as "cracked webs" (horizontal longitudinal cracks through the web) and "transverse fissures" (transverse internal cracks in the interior of the head).

Statistics concerning the rail failures occuring in the United States have been published for several years by the American Railway Engineering Association, and in Table I. are given a few figures covering rail failures for the year ending October 31, 1911. The tons are long tons of 2,240 lb. and represent the tons of new rail laid.

TABLE I.—RAIL FAILURES IN 1911.

	Bessemer.	Open-Hearth.	Total.
Tons of rails represented..	10,088,706	2,600,008	12,688,714
Number of rails based on 30-ft. lengths...	27,866,348	6,622,736	34,489,084
Number of failures:			
Broken	8,165	1,786	9,951
Head	17,761	2,260	20,021
Web	2,450	515	2,965
Base	2,898	806	3,704
Total	31,274	5,367	36,641
Failures per 10,000 tons:			
Broken	8.1	6.9	7.9
Head	17.6	8.7	15.8
Web	2.4	2.0	2.4
Base	2.9	3.1	2.9
Total	31.0	20.7	29.0
Percentage of Failures:			
Broken	26	33	27
Head	57	42	55
Web	8	10	8
Base	9	15	10
Total	100	100	100
Number of rails for each failure	891	1,234	941

It will be noticed from this table that the failures in 1911 per 10,000 tons of new rail laid were 31.0 for Bessemer steel, 20.7 for open-hearth steel, and the average of all rails was 29.0.

On the basis of number of rails, there was one failure per 891 Bessemer rails, one failure per 1,234 open-hearth rails, and one failure per 941 rails of both steels. This suggests that open-hearth steel is less liable to failure than Bessemer steel, but on the other hand it is probably true that the open-hearth rails were in general of more recent manufacture and probably also contain more of the newer sections. This table cannot therefore be said to be conclusive in its indications in this respect.

The table shows us that there was one failure per 941 rails, but we seem not to have general information of all the failures occurring during the full period of service of a lot of rails. Assuming, for the purpose of forming some idea of the order of magnitude of the average total failures in a lot of rails, that the average life of rails is 8 years, the total failures per lot of rails would average about one failure per 118 rails or something under one per cent.

While the American Railway Engineering Association statistics above referred to indicate an improvement in the general failure performance from year to year in the last three years that they have been kept, we still hear of occasional lots rolled in recent years that give very poor service. As an example may be mentioned a lot of 2,500 tons of 80-lb. A. S. C. E. Bessemer rails rolled in September, 1909, and placed into track in October, 1909. Up to May, 1912, or in a period of service of 2½ years, there were 510 failures classified by the trackmen as follows:

Crushed head and flow of metal	243
Split head	93
Split web	89
Broken	81
Broken base	4
Total	510

This would be 2,040 failures per 10,000 tons; or figured on the basis of 30-ft. lengths, there would be one failure in each 13.7 rails in 2½ years from the time the rails were put into service. I am advised that since May, 1912, other rails have been removed from track and still others at this writing (March, 1913) are developing a condition that will necessitate their removal. Thus far about seven per cent. of this lot of rails have been removed from service on account of failures, mostly of the head, and it seems probable that finally the number may amount to ten per cent. or more. This type of failure, as will be explained, is to be attributed to the interior condition of the ingot from which the rail was rolled, described as segregation and its accompanying conditions.

Crushed and Split Heads

Head failures are the most numerous and most of these may be described as crushed or split heads. This failure consists of an internal crack in the head running lengthwise of the rail anywhere from a foot or two to several yards in length. The external appearance may show only a crushing of the head; but when broken, the rail will show a crack in the interior of the head running lengthwise of the rail. This kind of failure is confined almost entirely to metal showing considerable internal segregation of carbon, phosphorus and sulphur, attended more or less with laminations and slag seams. Under wheel loads, the top of the head flows sideways and if the interior metal cannot likewise flow sideways due to internal flaws or due to brittle material in the interior, it develops a crack which grows and later forms a split head, the crack generally coming to the surface at the under side of the head at its junction with the web. Frequently the crack extends downward into the web and comes to the surface at the side of the web, and then the trackman is apt to report the failure as a web failure, whereas in reality it was a head failure.

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[*] Before American Society for Testing Materials.

Split heads may thus be said to be due to lack of transverse ductility in the interior of the head, due mostly to segregation.

Broken Rails

The next largest class of rail failures is that called "broken" rails, including square and angular breaks; that is, the rail breaks through the whole section more or less vertically. This type of failure is most predominant in winter, particularly in severely cold weather, and may be termed "winter disease" of rails. The severe winter of 1911 and 1912 brought out a very abundant crop of such failures on the northern roads. An examination of the fractures of such rails shows that the fracture is upward through the section; that is, it starts from the base, and the rails also show longitudinal cracks or seams at the bottom of the base. Mr. H. B. MacFarland, Engineer of Tests, Atchison, Topeka and Santa Fe Railway, has made an interesting report in which he shows that most "broken" rails were accompanied by half-moon base fractures, which observation has also resulted from other investigations. Probably the most prominent feature of the appearance of most "broken" rails, is what may be called the "scalloped" fracture across the bottom of the base; that is, the fracture is not straight across the base but one side is concave or re-entrant with a sharp corner, while the other side is pointed and dovetails into it. The concave side of the fracture generally shows also a seam at the bottom of the base.

Seams in Base of Rail

Rails frequently contain longitudinal surface seams, and in this connection a study of the behavior in the drop test of a rail containing seams in the bottom of the base is important. These base seams vary in depth from a hundredth to a tenth of an inch and occasionally deeper. When tested in the drop test in the usual manner, the rail ordinarily breaks at or near the place where hit by the tup due to exhaustion of the longitudinal ductility of the part in tension. Occasionally, however, when tested with the base in tension—that is, with the base resting on the supports—the fracture occurs near one of the supports. A 100-lb. rail was broken in the drop test with the base in tension, supports 3 ft. apart, when given one blow of a 2,000-lb. tup from a height of 20 ft. The pressure of the rail on the support caused some side spread of the base at this place, which in turn opened up a seam. A piece of the flange broke, and a fracture occurred through the whole section 3½ in. from the support, as a secondary break. The failure of this rail occurred long before the longitudinal ductility was exhausted and may be considered as due to insufficient transverse ductility at the bottom of the base because of the presence of seams.

When tested with the head in tension, the result is of a similar nature if there is a seam in the base at the place where struck by the tup. Here again the blow of the tup caused a side spread of the metal of the base where struck, which in turn opened up a seam causing a failure from the top side, not due to exhaustion of the longitudinal ductility of the head.

Base Failures

About ten per cent. of all rail failures, according to Table I., are base failures, mostly half-moon or crescent-shape pieces broken out of the flange. These occur mostly at ties and appear also to be largely attended with seams in the base. The origin of the failure in this type, as with "broken" rails, thus appears to be the seams in the base and these two types should therefore be classed together as regards cause of failure.

Other Failures

A type of failure that has attracted considerable attention in recent years, is the "transverse fissure" or "oval spot" in the interior of the head. This type was first brought into prominence by a report by Mr. J. E. Howard, of the Bureau of Standards, on a rail ascribed as the cause of a bad wreck on the Lehigh Valley Railroad at Manchester, N.Y., on August 25, 1911. Mr. C. D. Young, Engineer of Tests of the Pennsylvania Railroad, has also presented an interesting report of his investigations of some failures of this type that occurred on the Pennsylvania Railroad. While these reports contain valuable data and good suggestions, the writer feels that a full explanation of the cause of this type of failure has not as yet been worked out, which necessarily must precede effective action for remedying the trouble. This kind of failure is occasionally followed with disastrous results, but fortunately occurs only in small numbers except perhaps under some special conditions.

Another type of failure that constitutes a small percentage of the total failures is the "cracked web," in which the web is cracked through from side to side running lengthwise of the rail; but here again the writer is not aware of a final explanation having been worked out.

Service Conditions as Causes of Failures

Wheel loads have been increasing ever since the beginning of railroads and the tendency seems to be to still further increase them, at any rate as regards the average wheel loads. The heavy wheel loads have been given as the cause of rail failures. While it is true that the loads are heavy, it is also true that failures are confined to what may be called defective rails, and that most rails stand up under the service. The failures classified as crushed and split heads have for some time been recognized as due to defective metal; and although "broken rails" eluded us for a while, as attributable to the material, we may say these also are to be ascribed to defective material although not defective metal.

Bad counterbalance, flat wheels and other abnormal conditions kink good rails and throw them out of line, although, of course, the defective rails are more promptly found by such abnormal conditions. A rail tested in the drop test will ordinarily stand a bend of several inches in a span of three feet. Of course the railroad that persists in bending and kinking its rails will soon have an unrideable track for satisfactory service. It seems to be true that such matters as weight of rail or design of section are of but small importance in the matter of rail failures, but are rather matters more concerning the rideability of track and cost of maintenance.

Remedies

The above part of this paper deals with diagnosis and I think we have now arrived at a point where we may feel considerable confidence that we have the correct diagnosis of the causes of most of the rail failures. About fifty per cent. are ascribable to low transverse ductility of the interior of the head due to segregation (and its attendant conditions) and traceable to the interior condition of the upper part of the ingot. About forty per cent. are ascribable to low transverse ductility at the bottom of the base, due to the presence of longitudinal seams at the bottom of the base, and probably the origin of these seams is to be looked for in the rolling of the steel. This leaves about ten per cent. not yet diagnosed. What remedies will finally be applied I, of course, cannot say, but below are given some thoughts as to the directions in which betterments are to be looked for.

According to Table I., 55 per cent. of the rail failures of 1911 were head failures and 8 per cent. were web failures, and as already indicated most of these may be classified as crushed and split heads, attributable to excessive segregation in the interior of the ingot together with the conditions which ordinarily attend such excessive segregation, such as sponginess and an abnormal softness of the steel at the outer part of the rail section around the segregated region of the rail. Thus, it appears that the remedy for about fifty or perhaps sixty per cent. of rail failures, is to be looked for in a reduction of segregation below the point where it causes a brittleness of the interior metal of the rail. The condition of sponginess is worst at the top end of the rail bar, but the segregation reaches its worst condition at a varying distance from the top end—ordinarily about fifteen per cent. of the weight of the ingot from the top end of the ingot—and varies in degree from harmless segregation to a condition sure to result in bad service of the rail. It seems to be well established that well-deoxidized, quiet-setting steel has not the concentrated segregation found in other steel and is free from sponginess, but the central pipe extends farther downward into the ingot. The main cause for head failures is, however, the excessive segregation, and to avoid this requires a sufficient discard from the top of the ingot, or steel treated with sufficient silicon, titanium or aluminum. It is usual for rail specifications to put a maximum limit of 0.20 per cent. on silicon, but it is necessary to have 0.25 per cent. or more silicon in the steel in order to obtain its full influence in reducing sponginess and segregation. When titanium is used, 0.1 per cent. or more of metallic titanium is probably the proper amount with which to treat the steel. Talbot recommends aluminum used in amounts of 2 oz. per ton or about 0.006 per cent.

It seems that we must come to a well-deoxidized dead-quiet-setting steel, but then we have a deep pipe to deal with when the steel is cast in the usual manner into ordinary open-top iron moulds. There has been recently, and still is, considerable experimental activity toward overcoming this condition and the next few years may see a practicable and economical solution of this problem of pipe, available on a larger working scale. Hadfield recommends a sand top to the mold and special arrangement to keep the top metal liquid till the bottom of the ingot has set. Talbot recommends a pre-rolling or liquid compression, and a number of other means have come to public attention lately. Possibly, also, some improvement may be obtained by closer attention to the details of the present casting process; or, again, satisfactory uses may be found for the upper part of the ingot for other purposes. The conclusion seems to be emerging, however, that for rails, a well-deoxidized, quiet-setting steel must be used, in order to avoid excessive segregation and to obtain rails with a uniform hardness at the wearing surface in the several rails of an ingot. A solution of the ingot problem means the prevention of about half of the failed rails of the country.

As indicated above, about forty per cent. of the rail failures are traceable to a longitudinal seam at the bottom of the base. The seam does not show on the new rail and cannot be discovered by inspection, but shows up when the failed rail is examined. We have very little satisfactory information as to the origin of these seams (although they seem to be produced in the rolling), but the matter is being studied more critically and we hope in the course of time to have more satisfactory knowledge of the subject.

Conclusion

In conclusion, we may say(considering the number of failures) that about fifty per cent. of the rail failure problem consists of obtaining sound metal of fairly even composition, and about forty per cent. consists of so rolling the metal into rails as to avoid seams in the bottom of the base. The earnest activity and the co-operation between all interests to produce improvement in the matter of rail failures, is such that we may well be hopeful of the future. The steel mills have freely offered the facilities of their works to the railroads for experimental work, and I in particular wish to acknowledge the uniformly kindly treatment accorded me in my work at the various mills. As a still further improvement of the general situation, I would urge upon the metallurgists and other officers of the steel mills that they be more forward in publicly presenting the results of their studies and investigations.

Tracing Water Mains

THE difficulty of tracing underground water mains when no exact record has been kept of their position is considerable, and the work of finding them is sometimes too costly and difficult to be practicable. The value of the simple electrical devices which enable the modern water engineer to trace such mains accurately without disturbing the ground is great. It is, for instance, quite an easy matter to connect one of the wires of a battery to a house stopcock and the other to a hydrant or valve on the town main and thereby to induce a current of electricity along the service pipe running between the main and the house. The pipe then becomes a conductor, and when an electric coil is brought within the electric field of this conductor, a current is induced in the coil which will cause a sound in the telephone receiver connected to the coil. This sound will increase or diminish as the coil approaches or recedes from the underground conductor, but will cease when directly over it. Small batteries such as those used in an automobile are used for creating the necessary current. It is needless to dwell upon the obvious advantages of the method.

The use of cement, especially in foundation work, is rapidly increasing in Norway, and during 1912, with high prices demanded by foreign manufacturers, the local industry had a very prosperous year. For the large plans at Slemmestad a great amount of new machinery has been ordered. Until very recently the imported cement was so expensive as to preclude its use, but with the establishment of local plants it has gradually become cheaper. The use of reinforced concrete is also beginning to be general in the large cities of Norway.

Ozone Applied to Water Purification

Ozone as a Purifying Agent—History of its Development—Plants in Operation — Economical Production of Ozone

By Russell Spaulding, State Department of Health, New York

THE growth of cities causes pollution of the water courses by sewage being discharged into the streams, and it has become more and more difficult, not only to get large enough water supplies, but to get pure water supplies. The enormous amount of money expended for metropolitan water systems like those of Boston and New York must inevitably reach a limit, and some method must be devised to purify the courses by the removal of the dirt and the destruction of the pathogenic bacteria.

There have been three methods hitherto suggested. First, filtration, which is efficient but more or less cumbersome and expensive and not always practical. The second method in general use is rapid filtration for dirt and treatment of the water with chemicals, of which the most promising is chloride of lime. The third method which has been suggested is the treatment of water with ozone after rough filtration for coarse dirt.

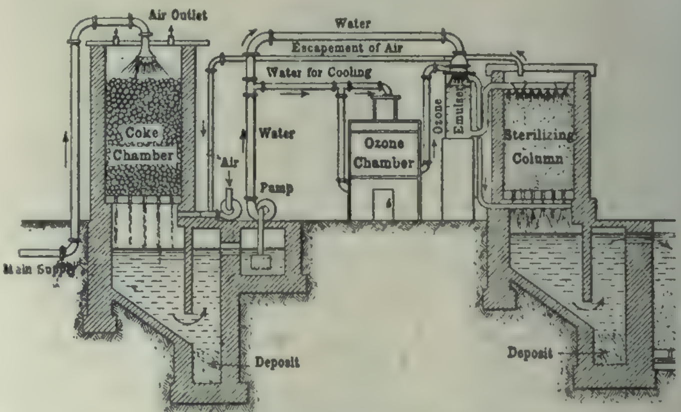
The use of ozone as a purifying agent has received such varied publicity that the history of the discovery and development of the gas needs but brief attention. A Dutch physicist, Van Marum, in 1783, while studying the behavior of gases in the path of electrical discharges, noted that oxygen gave a decided odor. But not until 1840 was this peculiar form of oxygen recognized as a distinct gas. In that year Friedrich Schoenbein, a German chemist and professor at the University of Basel, Switzerland, showed that oxygen after being subjected to electrical stress, possessed peculiar chemical properties. To this gas he gave the name "ozone." The gas remained more or less of a scientific curiosity for a number of years, and the study of its properties seems not to have been attempted for practical ends until Berthelot took it up in 1890. He was followed by a long line of experimenters, most of them Europeans. Only a few of the army of experimenters made definite contributions to the advancement of the art of producing ozone in large quantities on a commercial scale and with a minimum expenditure of power.

Ozone is a form of oxygen in which the atoms of the molecule have a different arrangement from that of ordinary oxygen. It is very unstable and will revert to oxygen in a very short time if left to itself. When, therefore, it is put into water it will speedily assume the condition of oxygen and be quite beyond the possibility of polluting water. Consequently its use is beyond any criticism which may be directed at the chemical treatment which may remain as an impurity. Ozone could not be an impurity in water, for it changes instantaneously. It owes its efficiency in acting on bacteria to the fact that it cannot remain in the condition of ozone, but breaks up and forms free oxygen, which is an extremely powerful oxidizing agent. This oxidization destroys bacteria with incredible rapidity in the purification of water by ozone, which in turn leaves no trace of itself.

The utility of ozone as a bactericide, through its marked oxidizing properties, was pointed out by de Meritens in 1886 and Froelich about 1890. To-day there is little question of the efficacy of ozone as a commercial chemical and sterilization agent but there are questions of practicability, related mostly to the cost of production and utilization, and to the ease of maintenance of generating apparatus. By the improvement and refinement of the generators, the cost of production has become a small part of the cost of any complete process for using ozone for purifying or bleaching. This condition arises largely through the expense of forcing contact between the ozonized air and the material to be treated.

The process about which most interest centers, naturally, is the purification of water. There are elements in the proposition to kill all bacteria and to get rid of organic contamination by introducing "electrified air" that appeal to the popular imagination as no proposal of filter or chemically sterilize water can. It has been demonstrated that ozone is a simple and effective sterilizing agent and leaves no residue in the water repugnant to the public mind as use of chemicals would. Whether or not an ozone plant is the best thing for a given location often simmers down to a question of the costs, and these depend to a very large extent on local conditions, so that results obtained in one place are to be applied with caution to another place and only under the advice of competent engineers.

The earliest attempt to produce and utilize ozone on a commercial scale was that of Baron Tindal at Oudshoorn in Holland, in 1893. Since then great improvements have been made in ozone-generating apparatus, both from the point of view of reliability and of economy. Baron Tindal's first apparatus yielded about 2 grammes of ozone per kilowatt hour, whereas the plants now in use in Europe produce from 40 to 50 grammes per kilowatt hour. Even this efficiency can be improved on, and the United States may soon redeem itself for its slowness in adopting a system already so well developed in Europe by outstripping the old world in the production of economical apparatus.



General arrangement of plant at Nice, France.

Baron Tindal was followed by such men as De Frise, Schneller, Vandersleen, Vosmaer, Otto, Abraham, Marmier, Siemens, Gerard, each contributing to the improvement of apparatus and application. That these efforts have finally placed the use of ozone on an economical commercial basis is shown by the number of plants now in operation in Europe. The Otto and Siemens systems in use in these plants represent the best so far attained in Europe.

Since 1902 plants using ozone for the sterilization of drinking water have been installed in many European cities and in at least three in South America. Among the cities possessing such an equipment may be mentioned Marseilles, Nice, Paris and Toulon in France; Wiesbaden, Leipzig, Hamburg and Munich in Germany; Ravenna, Spezzia and Florence in Italy; St. Petersburg in Russia, and Valparaiso in Chili. In some cases the plants are the property of private manufacturing concerns, but in many cases they have been installed by the municipality.

The Plant at Saint Maur

The plant at Saint Maur is the largest one in France. It was enlarged in 1910 to its present capacity of 24,300,000 gallons per 24 hours and is the outcome of the crude attempts of Tindal in 1895. It has been remodelled many times and to-day embodies the cumulative benefits of the efforts of Tindal, Otto, Marmier, Abraham and Siemens. This plant is situated near Paris on the River Marne. The water pumped from the river is first filtered through sand and then sterilized by means of ozone. This ozone is drawn into the water by Otto aspirators. The water then trickles down through gravel contained in a sterilizing tower, meeting an ascending current of ozone which further sterilizes it. From this tower the sterilized water runs into a large reservoir, from which it is pumped into the city of Paris proper.

Plant at Villefranche

The ozone plant at Villefranche supplies all the towns on the French Riviera from Villefranche to Mentone. The towns supplied are: Villefranche, La Condamine, Eze, Saint Jean, Cabbe-Roquebrune, Monaco, Mentone, La Turbie, Beaulieu, Monte Carlo. The water is taken from the River Vesubie, first filtered and then sterilized by ozone. The plant was put in operation in 1911 and has a capacity of 7,020,000 gallons per 24 hours.

The water of the river Vesbuie was tested after being ozonized with the following results: The filtered water was a grayish-yellow; ozonized water was a transparent blue shade. The chemical composition was in no manner changed. The organic contents of the water were sensibly lessened. Samples of 50 c.c. in emery-stoppered bottles maintained for 8 days at a temperature of 38 deg. C. remained clear and odorless, and no traces of peroxide of hydrogen were found in the ozonized water. No bacilli-coli or pathogenic bacteria were found.

Plant at Nice

Early in 1904 the municipality of Nice, in Southern France, entered into a contract with the French Ozone Company for the erection of an ozone sterilization plant near the reservoir of Bon-Voyage. This plant, with a capacity of 6,480,000 gallons daily, was completed in 1905. The following are some of the requirements made by the city:

1. Capacity of sterilization, regular and continuous, 6,480,000 gallons per 24 hours.

2. Maximum allowance for upkeep $5,000 per annum.

3. The city will furnish free hydraulic power—13,157 kilogrammes on the axis of the turbines.

4. The Ozone Company guarantees that the treated water will not contain any pathogenic bacteria.

5. The maximum harmless bacteria is not to exceed 10 per c.c., exception being made for B. Subtilis.

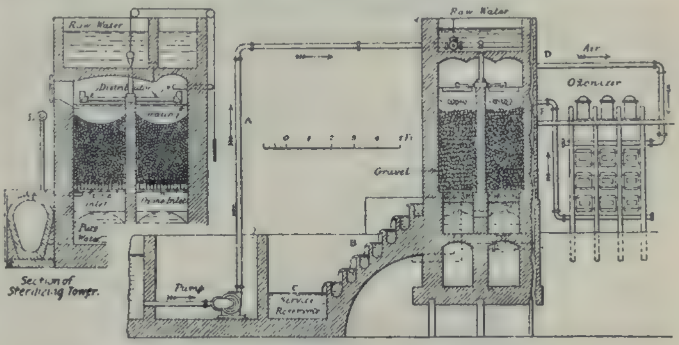
7. The Ozone Company guarantees that the chemical qualities of the water will not be altered except they be improved, that they will not introduce in the water any harmful foreign substance, and that no trace of ozone will remain in the treated water as it emits from the reservoir of Bon-Voyage.

8. The Ozone Company further guarantees the absolute innocuousness of the process.

9. The Ozone Company will be responsible for any abnormal corrosion of the conduits.

10. Price of entire installation to be 240,835 francs—$48,167.

The success of this installation is evidenced by the fact that in 1909 the municipality of Nice ordered installed a second plant at Rimiez with a capacity of 3,780,000 gallons per 24 hours.



Sectional views of plant at Wiesbaden, Germany.

Plant at Paderborn

As a result of the experimental plants installed at Berlin in 1896 and at Martinikenfeld in 1898, it was decided to build an ozone water-purification plant on a large scale, in order to determine whether or not it would prove reliable, efficient and economical in a municipal plant. The town of Paderborn in Germany was chosen for the initial plant. The plant was erected and officially turned over to the municipal authorities in the month of August, 1902.

The plant has a capacity of 500,000 gallons of sterilized water per 24 hours. It has been operating uninterruptedly since 1912, never once failing to perform its duties in an entirely satisfactory manner. Bacteriological examinations are made regularly and at frequent intervals each day. Since the day the plant started, in 1912, these examinations have shown an entire absence of pathogenic bacteria. A duplicate of the Paderborn plant was erected in 1903 to supply the town of Wiesbaden. The plant is located near the River Rhine at Schierstein, and the sterilized water is pumped over to Wiesbaden.

Plant at Saint Petersburg

The city of Saint Petersburg in Russia is dependent on the River Neva for the major portion of its municipal water supply. These waters were contaminated to an alarming extent by typhoid and cholera bacteria. After a thorough investigation of all available means for the purification of water, investigations which extended over a considerable period of time, the authorities of the city of Saint Petersburg decided that the most reliable and effective agent was ozone. Researches made at the Pasteur Institute in Paris were made the final basis of the Russian authorities. Work on the plant was started in 1909 and was completed in

November, 1910. The water after being pumped from the river is first treated with sulphate of alumina as a coagulent; it is then filtered through rapid filters. Careful bacteriological examinations show that both before and after filtration the water contains an abundance of typhoid and cholera bacteria, whereas after ozonization there is invariably a total absence of these and all other pathogenic bacteria.

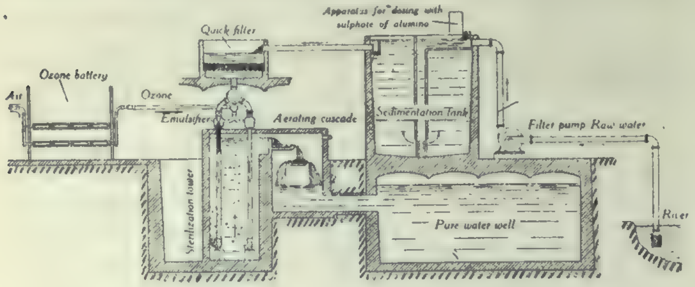
Conclusion

The records of the foregoing ozone purification plants, and their successful operation over an extendtd period of time, have established beyond cavil that ozone as a purifying agent is both efficient and economical, so that an extended discussion on the subject seems superfluous.

It may be well, however, to emphasize the fact that in contradistinction to all other purifying agents, ozone possesses one signal virtue in that it is absolutely non-toxic. Furthermore, it is insoluble in water to any appreciable extent, so that "overdosing" is impossible.

Aside from its wonderful and unfailing bactericidal power, ozone totally removes from water all traces of odor, color and taste due to the decomposition of organic matter. Ozonized water is never flat to the taste—it is not only perfectly hygienic, but satisfies the most delicate palate.

To summarize, ozone destroys in water all that which is harmful or distasteful and in no manner changes the mineral qualities. The successful application of ozone to water purification is dependent upon a number of factors, none of which may be disregarded with impunity. The failures that have occurred have been due solely to faulty design in the electrical or mechanical devices used. Ozone, as such, never has and never can fail to perform its functions properly.



General view of plant at St. Petersburg, Russia.

The first problem that confronted the pioneers in this art was the economical production of ozone. Ozone can be produced, chemically, thermically and electrically. The first two methods were soon discarded in favor of electrical methods, which, however crude at the start, offered the best promise of ultimate success.

The efficiency of production of ozone is even to-day quite remote from the theoretical efficiency. The early efforts produced an efficiency of only 3 grammes of ozone per kilowatt of energy. The present efficiency, prevalent in the European plants described in this report, varies from 40 grammes to 60 grammes of ozone per kilowatt of electrical energy.

In some instances much higher efficiencies have been obtained by supplementary devices, such as refrigerators and dehydration of air to be ozonized, but these devices are not only expensive and cumbersome but they tend to complicate the apparatus as a whole and diminish its dependability. Efficiency in ozone production has increased with the efficiency in electrical apparatus, such as dynamos and transformers, but little progress has been made in increasing the efficiency of the ozone apparatus itself.

Aside from the generators required to supply alternating current and the transformers used to step-up the potential to its required power, the ozone apparatus consists of electrodes of metal separated by an air space, dielectrics, such as glass, being interpolated between electrodes to produce a brush-discharge. This brush-discharge acting on the air disturbs the atomic balance of the oxygen, which is normally di-atomic, in such a manner that more or less of the atoms recombine in an unstable tri-atomic form which is called ozone.

This brush-discharge is accompanied by the phenomena of light, heat and noise, all of which absorb energy, thereby reducing the percentage of energy available for the creation of ozone. The heat generated tends to cause a reversion of ozone into oxygen and furthermore lessens the dielectric resistance of the glass dielectrics, making them liable to puncture by the high tension current—thus putting the apparatus out of commission.

To overcome this difficulty various means have been resorted to, to prevent a rise in temperature, such as refrigerating the air before it reaches the electrodes of discharge, or surrounding the electrodes with some fluid such as oil or water, for the purpose of carrying off the heat as fast as generated. These palliatives, though they make the operation of ozone generators possible, only add to the losses already entailed in the generation of the objectionable heat. The obvious remedy for low efficiency is, therefore, to so arrange the electrical circuit that the major portion of electrical energy supplied to an ozone generator shall be used in the conversion of oxygen into ozone, and that only a small portion shall be lost in a non-productive manner. The non-production of heat should be sought rather than its elimination by cooling means.

To summarize then, the main desiderata in generating ozone are:

1. A supply of alternating electric current at low cost.
2. An efficient transformer to obtain high tension.
3. Ozone electrodes that do not generate enough heat to
   a. Disrupt the dielectrics,
   b. Cause reversion of ozone to oxygen,
   c. Require external means for cooling.
4. Ozone electrodes that will approach the theoretical efficiency much more closely than the various systems now in use.

Such an ozone generator does exist and when offered to the public will revolutionize the art. Pending such time it would be improper to give a full description of it.

The efficiency in the application of ozone to the purification of water is dependent entirely upon mechanical factors. Bacteria are immediately destroyed and converted into CO_2 when brought in contact with ozone. The only failure in ozone water-purification plants that have so far occurred have been due to a failure in breaking up the water in sufficiently fine particles and in properly contacting these small particles with ozone. I speak of failures in the technical sense, that is, failure to produce odorless, tasteless, colorless water, entirely free from pathogenic germs, by means of ozone. Failures might occur from a commercial point of view, because of excessive overhead charges or too high a cost of maintenance due to low efficiency or unreliability of apparatus.

Road Maintenance and Improvement Present and Future[*]

By Harold Collins, Assoc. M. Inst. C.E., Deputy City Engineer, Norwich, Eng.

IN order to emphasise the altered conditions which road engineers now have to meet as compared with those of ten years ago, at that time the number of mechanically propelled vehicles, apart from traction engines, was so small as to be negligible; the Motor Car Registration Act did not come into force until 1904, and the first estimates of the number of vehicles were made by The Car in 1906 and 1907, which paper has continued this practice year by year. Figures are appended for the years 1906, 1907, 1909 and 1912:—

Year	Motor Cars	Motor Cycles	Heavy Motor Vehicles	Total
1906	49,300	48,700	3,200	101,200
1907	65,800	55,000	4,520	125,320
1909	101,169	73,821	6,765	181,755
1912	175,247	132,245	12,627	320,119

The figures after the year 1909 are based on actual returns supplied by the registering authorities of the United Kingdom; these figures do not correctly give the number of vehicles on the road, as a considerable number have been broken up or sold out of the country. The distance travelled by these vehicles on the highways would possibly be 900,000,000 miles annually.

Recently in Norwich a census of traffic was taken on practically all the main roads extending over seven successive days, and the proportion by weight of mechanically propelled vehicles was found to be 30 per cent.; tramcars were not included in the returns.

The wheels of motor vehicles, more especially those of the heavy or commercial type, have been designed without the slightest consideration, except as to width of wheel tread in relation to load, and to a very limited degree as to diameters, for the road surfaces on which they have to run. Failure in adapting wheel proportions and loads to the roads on which they must run has led to much unfair criticism of road engineers. Critics fail to consider but one side of the question. Those critics who trouble to think will probably conclude that railway engineers must adapt their rolling stock to the track on which it must run. Why should not the same consideration be given when the roads of the kingdom are in question? The loads and general conditions on railways have not been suddenly and completely changed in such a manner as the road traffic; it has been of gradual growth, and so the railway engineer has been enabled to keep pace and provide suitable roads. Notwithstanding this, there have been many instances of locomotives being withdrawn owing to their severity on the roads on which they run. Whoever heard of a steam or motor wagon owner doing such a thing? The author has personal knowledge of steam wagons with a loaded rear axle weight of over 10 tons with a wheel diameter of less than 3 ft. 6 in. and tires of 12 in. width.

Experience in Norwich has been that with these excessive axle weights of commercial vehicles it is most difficult to make a road which will stand. Even thoroughly well-paved granite setts fail, the setts in many places being crushed and the concrete bed damaged. The author is of opinion that the regulations for these vehicles require amendment.

Regulation of Wheel Loads

The city engineer of Norwich, in November, 1912, put forward several suggestions to the Joint Committee on Loads on Highway Bridges for the regulation of wheel loads, wherein due consideration was taken into account for diameters of wheels and widths of fires, and to avoid the necessity for circulation a diagram was given. A standard load of 7 cwt. per inch width of tire was assumed for a wheel of 5-ft. diameter, and a maximum load of 5 tons per wheel or 10 tons per axle was allowed, the reason for suggesting this standard being that ordinary carts with wheels of 5-ft. diameter by 4-in. tire, loaded to 28 cwt. per wheel, do not cause unreasonable wear, and the lengths of tire in contact with road on account of yield of road surface, etc., was taken as 1 in. It will be seen that the proposal would allow 5½ cwt. per inch width of tire for wheels 3 ft. in diameter to 8½ cwt. for wheels 7 ft. in diameter; thus the steam wagon referred to previously, instead of having driving wheels of 3 ft. 6 in. diameter by 12 in. wide tires, would require to have wheels 7 ft. diameter by 12 in. width, or 5-ft. diameter wheels by 14 2-7 in. wide. A limit should be fixed to the width of tires on account of the difficulty in uniformly distributing the load across them because of road contours.

These were suggestions, and were not put forward as being arbitrary allowances. Possibly, as the tire increased in width (up to a certain point) it might be found possible to increase the allowable load per inch in width. The suggestions only have reference to vehicles fitted with steel tires; where the vehicles are fitted with soft tires, the length of tire in contact with the road is increased, and the conditions very considerably altered, and the author suggests that for such vehicles the limit of load should be 7 cwt. per superficial inch of tire in contact with the road. That regulations are necessary none can deny if they have examined any country roads which are regularly used by heavy motor vehicles.

These suggestions are general, and do not refer to special cases where exceptionally heavy weights have to be hauled over a road—such as, for instance, between a boiler works and a station or docks, where the road would have to be made specially to suit this purpose, and a speed limit fixed. In those cases where an abnormal load has to be transported over a road not intended for such weights, the persons responsible for the transport must take necessary steps as to the provision of plankways or otherwise to prevent damage. Skid-pans should be properly made, shaped and adjusted so as to prevent cutting into road surface, and the maximum pressure thereon should be limited to ½ cwt. per square inch of surface in contact with the road. All brakes should be so constructed and adjusted as not to prevent revolution of the wheels. The taxation of motor vehicles also requires to be entirely revised, as the steam-driven steel-tired commercial vehicle, which is the most severe on the roads, pays no contribution beyond the registration fee.

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[*] The Surveyor.

Construction With Tar-Macadam

The author's experience of road construction with tar-macadam, using ordinary gasworks tar (not such as the various proprietary materials supplied by firms who have specialised in their construction), is that results are never certain, and he is of the opinion that a very rigid specification requires to be adopted, and the tar supplied should be examined periodically by a chemist who has made a special study of its use in road construction. He is of opinion that examination of tar in the ordinary laboratory of a road engineer is of very little use, the work requiring the knowledge and experience of a specialist. The author is further of the opinion that tar-macadam should be made mechanically with properly designed machinery which will properly measure, mix and heat the constituent parts. He thinks far more uniform results are to be looked for from this method of manufacture than by manual methods.

The proportions of the different-sized materials should be carefully ascertained by experiment, dried (the stone to be dried sufficiently to drive off all moisture, and not heated more than is necessary for this purpose), heated and mixed with tar at the correct temperature. This will make a very dense road when properly consolidated by rolling, and will need no sealing or top coat of small stuff; in fact, it will be better without, as the author's experience is that it is very difficult to keep a thin top coating of small material properly attached to the tar-macadam proper.

Insufficient attention is generally given to mixing the stone in proper proportions for tar-macadam. The aim should be to get the greatest practicable proportion of stone and the smallest of tar (provided there is sufficient). To do this in the most effectual manner it is necessary that the stone be graded into several sizes—say seven—and the grades mixed in such proportions as are found to give the heaviest weight per cube yard. The author thinks that the most perfect result would be obtained by mixing each grade with the tar or other matrix separately, and while still hot mixing into the mass, adding first the next largest to the largest and so on, until the last to be introduced would be the smallest. Up to the present he has heard of no one taking this care, but with proper machinery he sees no practical reason against its being done.

He has recently seen tar-macadam which was made with gasworks tar and iron slag, and laid over six years ago in a busy town near London, and subject to heavy traffic such as motor buses and railway lorries, which is still in perfect condition and appears to have a considerable life; the appearance is similar to that of a tessellated pavement, and a loose stone could not be seen.

Some good results have been obtained in Norwich with the grouting method, in some cases using bitumen, and in others Brodie's Pitchmac; Plascom has also been used. Local flints were used for the bottom coat consolidated to a depth of 3 in. by rolling dry; the bitumen mixture, to which is added sand and cement, is then run in and rolling is repeated. On this is spread a 2-in. layer of 1½-in. granite, which is rolled dry, then grouted up similarly to the bottom coat, rolled again and sprinkled with chippings. These roads have stood well, except as to one road, which had too much bitumen grout run in, which worked up in the hot summer of 1911, and caused a great deal of trouble by pulling horses' shoes off. This difficulty was overcome, and the road is now in excellent condition. The cost of roads constructed upon this method in Norwich works out at about 3s. 5d. per super. yard. With this class of road, which was generally constructed along tramway routes, a maximum cross-fall of 1 in 30 was fixed, and was not laid in roads having a gradient steeper than 1 in 20 on account of its being more slippery than water-bound macadam; the flatter cross-fall, which is more necessary than with water-bound macadam, is, of course, an advantage to traffic, and the water will run off quite as well as from water-bound macadam roads with their usual cross-falls. Further, the road is punished less by heavy motor commercial vehicle by reason of greater distribution of traffic.

Although this class of road has been constructed in Norwich in winter, it is not advantageous to do so on account of the increased cost through sheeting up, and having to stop the work frequently, and it is almost impossible to prevent the stone from getting wet at times before grouting.

Tar-Painting

Where the roads are of secondary importance, tar-painting annually appears to fill many requirements. One of the methods in Norwich is to apply the tar received from the gasworks at a temperature of about 180 deg. to 200 deg. Fahr. by means of an old water cart, which is fitted with two outlets at the rear; a brush, extending over the full width of the cart, is trailed behind and weighted; this spreads the tar more or less uniformly, and a couple of men following up with ordinary road brooms brush it in well, and local pea gravel is spread. Before the tar is applied all dust and dirt are thoroughly brushed off. The cost of this work amounts to about 1⅞d. per super. yard. Llewellins & James' tar-spraying machines are also used, and the cost with these amounts to 2.18d. per super.yard, using prepared tar at 3 2-3d. per gallon.

Tar-painting greatly extends the life of certain roads, such as the outlying roads of such a city as Norwich, where it is not feasible to regularly water them. It prevents their breaking up in hot weather, and the scouring action of heavy rains; the author had a very good example of this in the August flood of last year in Norwich, in the case of a road carried on an embankment across the river Wensum Valley on the up-stream or north-west side of the city. The bridges in this embankment were totally inadequate to pass the flood waters which rose and flowed about 4 ft. deep across the top of this embankment road. The middle portion of the road, which had been tar-painted, was not damaged, except at the up-stream edge, which in places had been doubled over in sections of about 9 in. wide; the sides which had not been so painted were deeply scoured.

Direction Posts

The author is of opinion that the usual system of direction posts is quite inadequate for fast traffic, and requires considerable alteration to suit the traffic now on the roads. For instance, when approaching a narrow fork, it is very often impossible to read the usual type of signpost until the traveller is practically opposite it, and it is a common experience to take a wrong turning, the chances being equal that he will do so. The type of road direction board suggested is that which has been adopted in Norwich to a considerable extent. This type can be read some considerable distance in advance, and so prevents the annoyance of taking the wrong road and danger of endeavouring to turn into the right road at the last moment; there have been numerous accidents arising from this last cause.

The boards should be placed vertical, and at such an angle in plan that travellers aproaching from any road toward the board should be enabled to have a clear view of one face. The boards require to be of sufficient size to enable the names of the towns, etc., thereon to be painted in block letters, 4 in. deep, with arrows showing the direction of the roads; a traveller should imagine the board laid down as he would a plan—horizontally—in front of him in the way he is travelling. The arrows would then orientate—i.e., be parallel with the roads leading to the places to which they refer. Where it is desired to direct to a road making an acute angle with one on which the vehicle is travelling, it is advantageous to supplement the arrow with a pointer or model hand.

Some people who have had no experience of such boards do not clearly understand them at first, but the majority do, and the author is of opinion that if some such direction board as this were generally adopted they would soon be understood and appreciated by all road travellers. The boards should bear at the top the name of the district in which they stand, and should also give the mileage to the various places named thereon. They should also be illuminated on both sides if lighting be available. In towns they can generally be so placed as to take the place of light standards.

The author is not in favour of making carriageway turns from side roads into main roads too easy, but would like to see extended the practice of making visible to each other the traffic on cross, side and main roads. In Norwich mirrors have been used for the past eighteen years at certain narrow and busy street junctions, such as where one street runs into another at right angles.

Opinion is rather divided, however, as to the utility of these, as drivers generally fail to appreciate exactly what they see reflected in them owing to their small experience with them in consequence of the fewness of such mirrors provided by highway authorities. To avoid endless fittings on the job, the attachments are designed to generally fit the particular situation, and are made adjustable in plan and elevation so as to get each mirror into the exact plane for the most effectual results. Most of those erected in Norwich have been destroyed by runaway horses or mischievous people, and notwithstanding demands for reinstatement the corporation have not seen fit to incur the cost.

Asphaltic Concrete as Paving for Residence Streets

THE question of permanency in highways has become of vital importance both to rural and urban municipalities. The very great change in vehicular traffic with every prospect of increase rather than decrease has made it absolutely necessary that the subject should be thoroughly investigated and the labor of construction placed upon a scientific basis. We publish herewith an abstract of a paper prepared by Mr. Lynn White for the Civil Engineers Society of St. Paul. Mr. White is the chief engineer of the South Park Commissioners, Chicago, and a man of wide experience in the matter of road construction and is hence able to speak with some authority upon this important matter.

The ideal pavement for all conditions has not yet been produced and probably never will be. On light-traffic streets, or those of mixed service, permanency is hardly so imperative as on heavily traveled streets, and the consideration of cost becomes more important. Here, also, the future growth or probable change from a district partly occupied by residences to one devoted entirely to business should receive careful consideration.

It is proposed to discuss here residence streets, boulevards and those serving suburban districts. The general character of the districts served may be considered fully well established, so no great changes in kind of traffic may be anticipated. The traffic on such streets is seldom what is probably termed "heavy," but may be "intense," that is, there may be a great many rapidly moving, comparatively light vehicles. Automobiles will predominate, with a lesser number of horse-drawn pleasure vehicles. At times, heavy teaming of building material, produce, coal, etc., must be provided for, and the general delivery and express service for the district.

To satisfy the requirements of such cases, a pavement must have many high qualities, and the standard is all the time growing higher, the public exacting and expecting better service. It must be reasonably permanent, moderate and flexible in cost, serviceable on all kinds of foundations, sanitary, smooth, dustless, noiseless, non-slippery, resilient, and agreeable to the eye in strong sunlight—quite a formidable list of virtues difficult to attain.

Examining the different kinds of pavements we will at once pass up many of them as possessing in an eminent degree only a few of the qualities named. Brick, concrete, stone block and wood block all possess some of these qualities but are lacking in others. Macadam cannot be classed as a permanent pavement, and we are thus reduced to some form of bituminous paving surface.

Sheet asphalt (sand asphalt) pavement is the best known and most widely used form of bituminous pavement—at least, it has been so for years past, though now other forms are becoming extensively known. Sheet asphalt must, however, be made comparatively thick, say 3 in., to conform to accepted standards; its cost is comparatively high, dependent on its thickness, though not in direct ratio thereto; it is suitable for use only on a concrete base; has a smooth, sheet-like surface more or less slippery; and last but not least has fallen somewhat into disrepute because of the skill and care required to produce a successful paving mixture and the constant effort during recent years to reduce its cost.

Asphalt block is a pavement that has been in existence for many years, but has not come into general use because of its high cost and difficulty of manufacture and transportation.

Macadam surfaces bonded by the application of bitumen in a liquid form have come largely into use during recent years, but have not established themselves as a standard type of pavement because lacking in the very essential quality of permanency under considerable traffic. Their place is on the country highway and roads of occasional traffic.

Having thus briefly reviewed the principal varieties of street pavement known and used in this country, we come to the one remaining general variety, designated as "bituminous concrete." Under this general name is included all paving mixtures consisting of broken stone combined with sand or other fine mineral matter, cemented together by a bituminous binder, which may be either tar as asphalt, making either "tar concrete" or "asphaltic concrete."

While both tar and asphalt are hydrocarbon compounds, their qualities are quite different. Tar, for practical use in a pavement, cannot have a melting point much higher than 130 deg. F., as it would become very hard and brittle in cold weather. In this climate it is not unusual to find temperatures of 115 deg. or even 120 deg. on the street surface, under which conditions a tar binder melting at less than 130 deg. would be almost liquid and have but little cementing or bonding value. In other words, tar, while quite adhesive and ductile, is very susceptible to changes of temperature. For these reasons it will not be considered further in this discussion.

The various asphalts that may be used in an asphaltic concrete have very different qualities and require different treatment, which will be briefly alluded to later.

For a paving mixture to merit the name of asphaltic concrete, the broken stone, according to a definition adopted by the American Society of Municipal Engineers, must be in sufficient quantity to form an important part of the mixture; also the ingredients must be combined and mixed before being laid. Neither the size of the stone nor the proportion of the various sizes in the mixture can be limited by the name "asphaltic concrete," any more than the size and proportions in a hydraulic concrete can be limited by the name. This can be done only by the specification of the particular mixture it is desired to produce.

Several varieties of asphaltic concrete are offered on the market under trade names, copyrighted or patented, that presumably conceal or but half reveal their somewhat mysterious qualities, such as "Bitulithic," "Amiesite," "Filbertine," "Warrenite," "Westrumite," etc. They are all asphaltic concretes founded on the old concrete idea of a broken stone aggregate supported and held together by a mortar matrix.

The first one named, "Bitulithic," is supported by letters patent in which the principle of filling the voids in the aggregate by the use of successively smaller sizes down to impalpable powder is exploited. It is claimed by this method of grading the sizes of the mineral that an "inherent stability" is produced in the pavement independent of the asphaltic binder, which then may be very soft and serve only to waterproof the mixture and to fill the remaining small percentage of voids.

Several patents have been issued to the originators of this pavement, the claims of which to the lay mind seem very similar, all of which rely upon this main idea of carefully grading the aggregate, and some of which describe carefully the process of separating the mineral into a number of sizes and recombining them according to a definite formula. This brings out the idea of "predetermining the sizes" of the mineral aggregate, which is a phrase met with in "Bitulithic" literature.

There is another claim in the "Bitulithic" patents that is an excellent one is carried out to its logical conclusion, that is, that by reason of filling voids so completely by grading the mineral the quantity of asphaltic binder may be reduced and the pavement "produced at a smaller cost." This is a quotation from the claims of the patent, and if produced at a smaller cost it naturally should be sold at a smaller price, thus justifying protection under the patent laws and earning the gratitude of the nation.

These references are made to the claims of the "Bitulithic" pavement, disregarding the other special asphaltic concrete pavements named above because the "Bitulithic" is the only one that endeavors so to broaden its claims as to monopolize the field of asphaltic concrete paving. If we sum up the claims of the "Bitulithic" patents, we find they hinge upon, and in fact are reiterations of, the principle of reducing voids by carefully graded sizes so that an "inherent stability" is produced and less bitumen used, thus reducing cost and increasing usefulness.

If it is true that "Bitulithic" methods are the best and cheapest, it becomes the duty of every engineer and city official to support them and use them. Let us examine the situation a little further and see what conclusions can be drawn on this point.

It cannot be contended that good "Bitulithic" pavements are not produced, for many excellent examples may be found throughout the country. At the same time many excellent examples may be found of sheet asphaltic pavements, and it cannot be contended there is any "inherent stability" in the sand of which they are composed. All the stability must be supplied by the asphaltic cement.

In 1907 a contract was let to the Bitulithic Company for about three miles of pavement on Michigan Ave. and South Park Ave. in Chicago, which was laid during 1907 and 1908. On these avenues there is but little heavy teaming, as they are boulevards and under usual boulevard restrictions as to traffic. In 1908 a traffic census showed from 3,000 to 5,000 vehicles per 24 hours on the three miles of pavement in question, which by 1912 had increased to from 5,000 to 12,000 per 24 hours—practically doubling the average number.

During the summer of 1909 some small portions of the surface began to show a tendency to form waves and ruts, but was scarcely noticed, being considered only local or accidental defects. It was not thought there could be anything very serious the matter; the spell of "inherent stability" was too strong.

By the summer of 1910 conditions were much worse, and the contractors put heavy rollers on to smooth out the waves and ruts, also attempting to roll into the surface, first limestone screenings, then granite chips, and, finally, crushed granite about ¾ in. in size.

These expedients one by one failed. The screenings, chips and crushed granite could not be forced very deeply into the surface and most of the particles were easily loosened and torn out again by the traffic. It was found that while the rollers smoothed out the surface it wouldn't stay smooth, but quickly formed ruts again as long as warm weather continued. By keeping the rollers going more or less all the time until cooler weather arrived, the streets were kept in fair condition for the winter, but early in the summer of 1911 the campaign had to be begun again.

This season it was prosecuted more vigorously. The crushed granite was coated with bitumen to make it bond more effectually into the body of the pavement.

The surface of the street was punctured full of small holes into which the coated stone was swept and then rolled. These efforts were all of doubtful and temporary value. Conditions all the time grew worse, and it is safe to estimate fully $20,000, or from 25 to 30c per sq. yd., was expended by the contractors during the three seasons named without materially improving the condition of the pavement.

In the summer of 1912, under strong pressure from the Park Board, the contractors abandoned their efforts to stiffen up the pavement and resurfaced the whole area with a layer of new asphaltic concrete about 1½ in. thick. The method followed was to go over it with surface heaters, softening up the surface until about an inch in thickness could be removed with rakes. Then the new 1½ in. layer of asphaltic concrete was spread and rolled, thus making it about ½ in. thicker than formerly. After this resurfacing the pavement was left in excellent condition at the end of the season of 1912 and so remains up to the present time.

It is to be noted the original pavement was specified to be at least 2 in. thick and actually averaged 2½ in. throughout a large portion of it; also that the original binder was tar. Thus the pavement is now composed of 1 to 1½ in. of tar concrete, overlaid with 1½ in. of asphaltic concrete.

In extenuation of the troubles on this particular pavement it may be pointed out that there are many excellent examples of "Bitulithic" pavement to be found. This is true. There is one other piece of "Bitulithic" pavement in Chicago, about one-half mile long, on Sheridan Road, which is as fine a piece of pavement as can be found, and it is older than the Michigan Ave. pavement. But it is from one failure like this that we can learn more than from numerous successes that teach nothing.

It may also be argued that the traffic on Michigan Avenue was extremely severe, or that if the original binder had been asphalt instead of tar the result would have been better.

This may be true, but it is not to the point. The main point is the very important "inherent stability" was not in the pavement to resist displacement independent of the support of the binder; and if it was there at all it was not sufficiently "inherent" to resist the severe traffic.

The traffic, while severe, was not prohibitive—was not sufficient to strain a good asphaltic concrete pavement be yond a safe limit. It was merely a severe test and developed a weakness that might have developed to a lesser degree or more slowly under lighter traffic.

In 1909 an asphaltic concrete pavement was laid on Michigan Avenue, between Twelfth St. and Jackson St., which in 1911 was carrying a traffic of 17,000 vehicles during 24 hours. This was not laid by the Bitulithic Company nor under their specifications, and was the subject of a suit between the Bitulithic Company and the South Park Commissioners, of which more will be said later.

No trouble has occurred with this pavement up to date except a comparatively small number of cracks which have in every case been traced to the concrete base. In explanation it should be said the street between these points is 75 and 85 ft. wide between curbs, having been widened 35 ft. to the eastward when paved in 1909. Thus a portion of the sub-foundation is new filled ground and a portion the old street, and the support is uneven. Also the construction of a number of large buildings on the west side of the street has caused settlement in places and consequent cracks in the pavement. This pavement is between the "Bitulithic" pavement and the center of the city and carries a larger traffic.

There were also asphaltic concrete pavements laid adjoining the "Bithulithic" on Michigan Ave. at 39th St., and on South Park Ave. at 35th St. They are on both avenues extensions of the "Bitulithic" to the southward and carry the same traffic in slightly decreasing numbers. No trouble has occurred with these pavements and they have cost nothing for repairs up to date except on two intersections where the cross traffic was quite severe and has occasioned minor repairs.

As stated above, neither "Bitulithic" methods nor formulas were followed. No special care was taken to grade the aggregate except to be sure there was plenty of mortar to fill voids and the fine material in the mortar was in proper proportions to give a well-filled mixture. Beyond this the success of the pavement depended on the proper preparation of the base and the use of a suitable asphaltic binder. Dependence was had on only common-senes methods to resist lateral displacement, and the paving mixture was intended to be waterproof for obvious reasons.

The heating and mixing were done in portable plants working on the street; the proportioning of the mineral ingredients was by wheelbarrow loads; and the prepared material was delivered quickly and directly on the street surface. Much of the success and moderate cost were doubtless due to the methods and machinery used. There was no overheating or chilling of material due to long hauls, no separation of ingredients from the same cause, and no bad work on account of delays either at the plant or on the street. The concentration of all operations in one place, under one superintendent, undoubtedly tended to better results in many ways.

The comparison of cost between the three sections of pavement referred to above is as follows:

The "Bitulithic" by contract cost $1.90 per sq. yd., exclusive of cost of base.

Asphaltic concrete by contract on Michigan Ave., between 12th and Jackson Sts., $1.73 per sq. yd., including concrete base, which would make it exclusive of base about $1.10 per sq. yd.

Asphaltic concrete laid by day labor on Michigan Ave., south of 39th St., and on South Park Ave., south of 35th St., less than 75c. per sq. yd., exclusive of base.

Following are the analyses of the mortar constituent (that is, 10-mesh material or less) of several samples of asphaltic concrete which have been under traffic for long enough periods of time to demonstrate their good or bad qualities. The first four proved to be very good, and the latter two indifferent in quality.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
	%	%	%	%	%	%
Bitumen	18.8	18.9	16.1	21.0	18.9	16.3
200-mesh	10.8	11.6	11.7	10.9	4.3	3.5
80-mesh	10.6	11.5	7.0	26.2	5.9	5.7
40-mesh	36.8	35.3	22.7	19.3	50.3	54.1
10-mesh	23.0	22.7	42.5	22.6	20.6	20.4
	100.0	100.0	100.0	100.0	100.0	100.0

As far as the coarse aggregate is concerned, that is, all material coarser than 10-mesh, there were considerable variations in the different samples, but the total quantity was approximately the same, and the variations seemed to have nothing to do with the success or failure of the sample. Samples 1 to 4 were successful, and they were rich in dust and reasonably well proportioned in other sizes up to 10-mesh. Samples 5 and 6 were practically failures, and they are seen to be lean in dust with an excess of 40-mesh material not well filled by the smaller sizes.

Here is where stability is found, or such "inherent stability" as belongs to the mineral aggregate of asphaltic concrete, not in the careful grading of the larger sizes. It would not matter if there was 25 or 50 per cent. of mineral larger than that passing a 10-mesh screen added to the mortars of samples 1 to 5; the result would have been the same. Nor would it matter if this 25 or 50 per cent. of coarse mineral was all of one exact size or of several carefully graded sizes; the pavements would have been good.

Therefore, in the making of good asphaltic concrete, it is an axiom that we must have a good mortar, well proportioned as to mineral, with a good asphaltic cement to bond it properly together. Having this, the coarse aggregate may be added with considerable freedom.

There are, of course, certain precautions that must be taken and certain useful refinements that may be attained, as in the making of other bituminous pavements. For instance, too much dust in a mixture will require more asphalt, etc. All such points could not be covered in such a discussion as this, but the principles stated above may be taken as fundamental.

There are on the market two general classes of asphalt binders, or asphaltic cements, as they are more properly called when of a character suitable for use in paving mixtures, distinguished generally from each other by the presence or absence of any considerable degrees of ductility.

Ductility is the quality that enables a substance to be drawn out like chewing gum without breaking. It is of no direct value in the paving industry, but is supposed to indicate other qualities of value, such as cohesion and adhesion. At the same time it indicates other objectionable qualities, such as susceptibility to changes of temperature. A considerable degree of ductility is required in most sheet asphalt specifications, but engineers conversant with the most successful practice in asphaltic concrete work agree that ductility is not an essential quality.

It may be conservatively said that good work can be done with either ductile or non-ductile asphalt, with simplicity of manipulation somewhat in favor of the non-ductile material.

These statements, however, are not intended to dispose of the question of which is the most durable under heavy traffic or to suggest that one class be chosen in all cases to the exclusion of the other.

Successful foundations may be made of either concrete or macadam. Where traffic is comparatively heavy, unquestionably the concrete base has the advantage of greater rigidity, more "inherent stability." On the other hand, macadam in some cases may be the more advantageous to use. It does not have to stand so long to set up before you can apply the wearing surface, consequently the street is not out of service so long, and if you are working over an old street, where there is some old macadam in a more or less worn-out condition, frequently considerable economy can be effected by using a macadam base. This is a question for the engineer to work out in each case.

One principle may be laid down to apply to either concrete or macadam base. Don't finish it up smooth, but leave the surface rough and grainy, so the paving material may be forced into the interstices. The specifications promulgated by the Association for Standardizing Paving Specifications go into the question of preparing the base pretty well. Up to date considerably over 1,000,000 sq. yds. of asphaltic concrete pavement has been laid in Chicago.

Building Activity at Fort William

The Kaministiquia Power Company, who already have 35,000 h.p. of hydro-electric developed, are contemplating an additional outlay of one million dollars in enlarging the present plant at Fort William. Acting under instructions from Mr. H. S. Holt, president of the Kaministiquia Power Co., Mr. R. S. Kelsch, the enginetr in charge of the Kaministiquia Power Company's plant has been making preliminary surveys between Fort William and Kakabeka Falls a distance of seventeen miles, putting camps in shape and so forth in anticipation of orders from headquarters to go ahead with the work. The contemplated additions will consist of either two units each of 5,000 h.p., or a single unit, of between 10,000 and 15,000 h.p., that will increase the total development of the hydro-electric power plant of this city to nearly 50,000 h.p.

The new terminal elevator being built for Fort William Elevator Company at West Fort William commonly known as the David Horn elevator is fast assuming a finished appearance. The building when completed will be one of the most modern and up-to-date grain handling plants on the Continent. The storage house consists of forty-eight round tanks and thirty-five interspace bins, ninety feet in height, with a capacity of 1,500,000 bushels. The work house portion contains thirty-two circular bins and sixteen outer-space bins with a capacity of 500,000 bushels, so that the total capacity of the elevator will be 2,000,000 bushels.

The special feature of the elevator is the drying plant to be used for the treatment of tough or damp wheat, 1,000 bushels of grain per hour can be put through the drying process without any difficulty. The big terminal elevator of the Dominion government with a capacity of 3,500,000 bushels is nearing completion and will be used to assist in handling this year's crop.

The Fort William Brass Foundry, which was recently destroyed by fire has been reorganized under the name of the Varlow Foundry Company, Liimted. The company have been issued corporation papers and are capitalized at $40,000. The new plant is already in operation with a staff of fifteen brass molders, with the promising outlook for this particular industry. The president and managing director of the concern predicts that within twelve months they will have at least fifty employees.

The contract for the construction of Fort William's new incinerator has been awarded to Mr. M. H. Braden. The cost of the incinerator will be in the neighborhood of $20,000 and will be of a metropolitan type. The site selected for the erection of the plant is in block "A" St. Paul addition. Messrs. The John Inglis Company were the successful tenderers for the construction material.

The Navigazione Generale Italiana and the Italia Steamship Company have just started a line between Italy and Canada. The service is at present a monthly one conducted with two ships, the Palermo and Napoli, which leave Genoa for Naples, Palermo, Halifax, and Boston. On the return journey the call at Palermo is omitted.

From the Pacific Province Cities

Building Active—Fine Residences for Vancouver—Extensive Plans — Victoria Erecting Many New Structures

Correspondence of the Contract Record

A CAREFUL review of conditions in the building and constructional field at Vancouver and other important Coast points justifies the statement that in point of business blocks at present under construction there is little, if any, falling off in the number and value as compared with the corresponding period of last year. The fine weather of the last few weeks has enabled contractors to make excellent headway with many important buildings in the central business districts; and in the adjoining municipalities of Point Grey, South Vancouver and Burnaby, the activity in the construction of dwellings is even more pronounced than in the residential sections within the city boundaries.

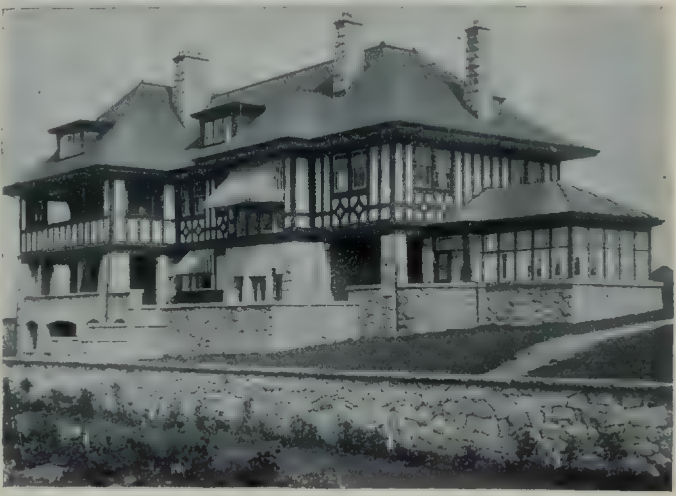
There is every prospect that present conditions, which are considered very satisfactory despite the tightness of money will continue steadily throughout the remaining months of the year, the quantity of work contemplated or already under way warranting the utmost confidence in the future.

A Typical Coast Residence

While it must be admitted that, like other western cities of meteoric growth, Vancouver and its suburbs are far from presenting the uniformity of appearance which exists in the older cities of the east, there is no denying the fact that of recent years a remarkable improvement has taken place in the quality of residences erected in the suburban districts of the rapidly expanding capital of British Columbia. Visitors from all parts are invariably impressed with the important phase of the city's development, and in this respect, it can be truthfully stated that the credit is almost entirely due to those members of the architectural profession of comparatively recent arrival. The illustration produced herewith shows a residence in the Vancouver Heights district, designed with the excellent taste displayed in large numbers of dwellings of the better class type situated in various parts of the city and adjoining municipalities. The materials used in the construction of the residence shown are stone to the first storey, and half timbers with plaster panels for the upper portion. A spacious basement partitioned off into storerooms, playrooms, etc., is provided. Hardwood flooring is used for the entrance hall, study and smoking room, dining-room and drawing-room on the ground floor. The dining-room is panelled in Australian mahogany and quartered oak is used as panelling in the entrance hall and corridor, the staircase, being also of this material. The panelling of the study and smoking room is in Yaka wood. Plaster cornice and enriched ceiling ribs contribute to the attractiveness of the drawing-room and corridor, while the ceilings of the dining-room, study and smoking room are beamed in woodwork to match the finish in each compartment. The first floor is occupied by six bedrooms, three bathrooms, with toilets, and a sleeping balcony. Three bedrooms, billiard room and bathroom are contained on the attic floor. All bedrooms are finished in plaster, with trimmings of B. C. fir, the latter material having been also utilized for the floors and corridors in the upper storeys. Mr. C. J. Peter is the owner of this handsome dwelling, which is situated on an eminence overlooking Burrard Inlet. Messrs. MacLure & Fox, of Vancouver, were the architects, and Mr. Geo. Calder, of Victoria, carried out the general contract.

Two New Vancouver Buildings

Vancouver is fortunate in possessing many architects who specialize in the designing of apartment blocks, and the example here shown is an excellent type of which numbers are constantly being erected in various parts of the city, chiefly in the west end. This building, known as the Colonial Apartments was designed by Mr. Kennerley Bryan and is situated in the 500 block, Burrard street. The measurements are 66 x 66 feet, and the height five storeys with full basement. The construction of the lower storeys consists of reinforced concrete and partial steel frame, the upper portion being composed of Dennison interlocking tile, while the exterior facing on all sides is red Alberta brick, with stone trimmings. The ground floor contains one large store and the main entrance to the apartments; the upper storeys being occupied by 28 suites of four rooms each. Both entrances have terrazzo tile flooring, and the main entrance hall is lined with marble. All interior woodwork is B.C. fir, finished in ivory white enamel, and the fittings of the apartments are modern in every respect. The equipment installed in the basement comprises a steam heating plant, vacuum cleaning outfit and electrical arrangements. The construction of this building which is estimated to cost approximately $80,000, is rapidly approaching completion. Mr. J. H. Vickers has charge of the general contract.



Residence of Mr. C. J. Peter, Vancouver Heights.

The accompanying photograph, showing the progress of construction on the new Yorkshire Building, Vancouver, serves as an illustration of the excellent type of structures which are constantly being erected in the central business sections of the city. This building occupies a space 50 x 120 feet and is of reinforced concrete construction with front exterior facing of terra cotta, selected pressed brick being utilized for the side and rear elevations. The entrance lobby will be treated in marble and tile, and marble will be used for the stairways and as wainscotting in the corridors. The floors of the banking rooms on the ground floor will be laid in tile with marble baseboards. The counters and office partitions will be of hardwood. The interior equipment throughout will compare favorably with the most elaborately planned buildings of this type in Western Canada. The Dominion Construction Company has charge of the contract. Messrs. Somervel & Putnam are the architects.

Colonial Apartments, Vancouver.

Many Substantial Structures Planned

A contract was recently awarded to Messrs. Baynes & Horie for a four storey building which is to be located, at the corner of Cambie and Nelson streets, Vancouver. The proposed structure will occupy a ground floor area measuring 88 x 100 feet, and is to be of mill construction costing when complete about $150,000. The Mainland Ice & Cold Storage Company are the owners. Messrs. Gould & Woods prepared the plans. A three-storey apartment building is to be erected shortly in the 600 block Seventh avenue east, Vancouver, by Mr. R. J. Coleman from his own plans, to cost $60,000. The structure will be of brick on a concrete foundation, having galvanized iron cornice, tar and gravel roof, hot water heating, etc.

It is understood that plans for an eight-storey apartment building of reinforced concrete, brick and tile construction which is to be erected at English Bay for Messrs. Hampton & Edgar, Vancouver, will be completed before the end of August. The name of the architect is withheld for the present. The structure will occupy a lot 132 x 90 feet, and although few constructional details are available at this date, it is announced by the owners that no expense will be spared to make the building one of the best of its type in Vancouver. Construction is to commence very shortly on a two-storey brick and veneer hotel building at Port Coquitlam which is to be erected for the Coquitlam Terminal Company, after plans by Messrs. Parr, Mackenzie & Day, Vancouver. The building will be replete with modern innovations throughout, and will be built at an expenditure of upwards of $60,000.

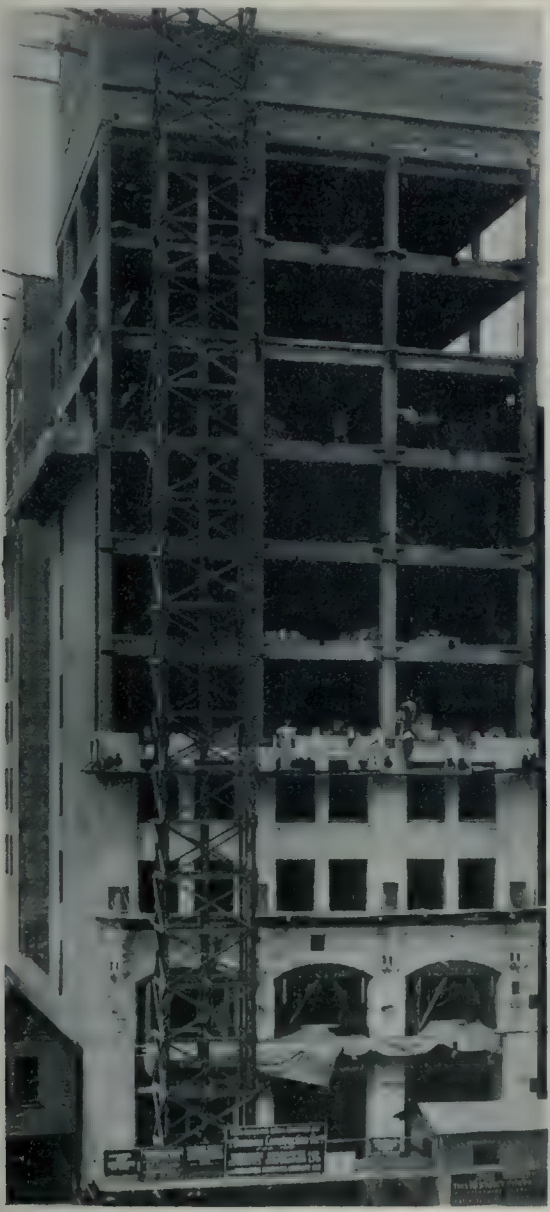
A building permit was issued recently at Vancouver for the construction of a three-storey and basement, brick warehouse building on the corner of Homer and Davie streets. The ground floor of the structure measures 119 x 200 feet and the specifications include granite window sills, tar and gravel roof, galvanized iron cornice, fireproof doors, etc. Work is to commence without delay. Messrs. Sharpe & Thompson are the architects. The cost will be about $70,000. The same architects have completed plans and closed general contract tenders for the erection of a reinforced concrete garage building on Georgia street, Vancouver. This building will be two storeys high and will measure 60 x 80 feet. Terra cotta will be used as exterior facing on the front elevation, and the remaining elevations will be faced with pressed brick. It is expected that construction will be started in the course of the next few weeks.

It is reported at the Coast that the Department of Public Works, Ottawa, has practically completed plans for the proposed new immigration sheds which will be erected by the Dominion government in this city, and that in all probability tenders for the work will be invited very shortly. The proposed buildings are to be of reinforced concrete and brick construction, and will cost approximately $250,000. Excavation work is well under way on the site of a new reinforced concrete garage building which is being erected on Seymour street, near Smythe street, Vancouver, for the North-West Trust Company. The structure will measure 50 x 120 feet, and will be two storeys in height, the cost when completed being estimated at approximately $30,000. The specifications call for a concrete building throughout with exterior facing of pressed brick. Campbell Bros. have charge of the excavating, and the Dominion Construction Company have been awarded the general contract. Mr. W. F. Gardiner is the architect. Plans have been approved by the Vancouver building inspector for two brick buildings which are to be erected by the Salvation Army officials at the corner of Seventh Avenue and Quebec street, and at Lansdown avenue and Quebec street. Both buildings will be three storeys, of brick and mill construction, and have been designed by Mr. J. W. Spence who will also handle the general contract. The building at the first location mentioned is estimated to cost about $30,000, while the outlay on the second structure is not expected to exceed $20,000. Work on both structures will probably commence some time in August.

Tenders for the erection of a handsome residence for Mr. Robert Kelly in Shaughnessy Heights, Vancouver, were closed recently and actual construction work is expected to commence immediately. The building is planned along the lines of an Italian Villa, the design providing for brick and stucco construction with tiled roof. The interior of the main floor will be finished in mahogany and quarter-sawed oak. Specifications call for hot-water heating, modern plumbing, and heating, and all modern equipment. Mr. R. A. Nicolais is the architect for this residence, which is estimated to cost fully $35,000. Plans are now being prepared by Mr. R. A. Nicolais, Vancouver, for a splendid residence to be located at Eburne, in the adjoining municipality of Point Grey. The building will be two storeys and full basement, with stone and stucco exterior. A garage and stables will be erected in connection, also a large greenhouse in the basement of which will be situated the boiler room for the heating system to be used throughout the establishment. Contract tenders will be called for at the end of August.

VICTORIA STILL FORGING AHEAD

Plans for a new theatre which is to be built for Mr. Alex Pantages, head of the Pantages vaudeville circuit, are in course of preparation by Mr. J. M. Warren, the well-known Victoria architect. According to the limited information at hand the structure will be located on Government street, between Cormorant and Fishguard streets, Victoria, and is being designed along the lines usually adopted for up-to-date theatre buildings of this class. An exceedingly ornamental front is to be provided and the specifications will call for class "B" construction, brick and steel. The building will accommodate 1,000 persons. Modern methods of steam heating, ventilation and lighting will be employed and the total outlay is expected to reach approximately $125,000. Excavating operations are now proceeding on the site and the actual work of construction will be commenced at an early date.



Yorkshire Building, Vancouver.

The provincial government has decided to use stone instead of terra cotta in the construction of the new Provincial Normal School at Victoria, and a contract covering all the stone required for the structure has been awarded to Messrs. Whitworth & Stewart, of Vancouver. The stone will be obtained from the quarries of the Denman Island Stone Company, and will be used wherever the original specifications called for terra cotta. It is understood that the change in materials was made to give employment to local tradesmen. The contract for the new Normal School which was recently awarded to Luney Bros., of Victoria, calls for an expenditure of approximately $300,000.

Mr. H. Bryant Newbold, a busy Victoria architect, is designing a hotel building to be erected at Sidney, to cost about $20,000. Among other works which Mr. Newbold now has under way is a residence to be erected at Alta Dena for Mr. E. Kennedy, to cost approximately $10,000, six residences for Sidney and one for Union Bay district, and a 54-suite apartment building to be erected in Victoria shortly for a local syndicate.

An immediate start has been planned for the construction of a new hotel building to replace the present structure occupied by Murphy's Cafe, Victoria. The plans prepared by Mr. J. M. Warren provide for the construction of an eight-storey building with a frontage of 25 feet and a depth of 75 feet, but for the present the structure will be six storeys in height only. Reinforced concrete and fireproof construction will be adopted throughout. The ground floor will be occupied by office, buffet and other departments, and on the upper floors will be bedrooms with private bathrooms, telephones and all modern accessories of an up-to-date hotel. In the basement will be located a large grill. The exterior of the building will be faced with pressed brick and terra cotta trimmings. Steam heat will be installed throughout. An expenditure of $50,000 has been estimated for this contract. A permit was issued recently in Victoria for a three-storey apartment building which will occupy a site at the corner of Linden avenue and Fairfield road. The type of construction chosen is reinforced concrete. The building will contain altogether twenty-one apartments of two and three rooms each. Mr. A. McCrimmon is the contractor. The cost will be approximately $42,000.

The B. C. Granitoid Company, Vancouver, has been awarded a contract for the erection of a two-storey reinforced concrete warehouse building at the corner of Store and Telegraph streets, Victoria, for the Swift Canadian Company. The actual construction contract will represent an outlay of approximately $55,000, apart from the cost of equipment which is expected to estimate as high as $100,000.

The contract for the new public building which the Dominion government will erect in Duncan, Vancouver Island, was recently awarded to Messrs. Rourke, McDonald & Moncrieff, Vancouver. The building will be of brick construction, two storeys in height and has been planned along the usual lines of such structures. The contract price is approximately $39,000.

Actual work has been undertaken on the Prince Rupert drydock buildings by the Wineland Construction Company, Vancouver, general contractors. The work includes the power house, 104 x 108 feet, with steel frame chimney of fireproof construction, 11 ft. in diameter, and 200 ft. in height. A shipbuilding shed, 160 x 300 feet, with 10-ton travelling crane; boiler and blacksmith shop, 76 x 150 feet, with concrete flooring; 15-ton travelling crane; six 400-h.p. water tube boilers; a machine shop, 76 x 150 feet, with complete equipment of tools.

The West Kootenay Light & Power Company has awarded a contract for an 8,000 h.p. water wheel to the Allis-Chalmers Company, and an 8,000 h.p. generator to the Canadian General Electric Company to provide additional power at the company's power plant at Bonnington Falls, near Nelson, B.C. This will give 25,000 horse-power at the upper plant, and 3,000 h.p. at the lower plant, as well as 3,000 h.p. at the Cascade additions. It involves an expenditure of $130,000 made necessary by the constantly increasing load of the Rossland mines and the Trail Consolidated smelter.

It is announced that plans will be completed before the end of August for the proposed government piers adjoining the breakwater at Victoria, and the general contract tenders will be invited without delay. This work involves two piers, of solid concrete construction, each 1,000 feet in length and the probable cost is about $1,000,000.

The following officers of the British Columbia Society of Architects were elected for the ensuing year at a recent meeting of that body held in Vancouver: President, Mr. Hoult Horton, Victoria; vice-president, Mr. J. L. Putnam, Vancouver; secretary, Mr. N. E. Read, Victoria; treasurer, Mr. P. L. James, Victoria; executive council, Messrs. Horel, Dodd, Hope, Thompson, Birkenhead (of Vancouver), Messrs. Cullen, Wilson, Jameson, R. Wilson and Keith (of Victoria).

From the Saskatchewan Capital

Correspondence of the Contract Record

In spite of the financial stringency, which seems to be Dominion-wide, there is an optimistic note in the construction world in this city, and all trades seem to be busy, with prospects that there will be enough work for all during the coming winter. The prospects are now that the bricklayers strike will be settled shortly, and that the Builders' Exchange will be on the way towards reaching an agreement with the union throughout the province. Conditions as to labor continue quiet, with enough men to fill the demands of the building in progress. There are under construction in this city several large buildings which will necessitate large numbers of all trades during the winter months, and the contractors are hastening the construction so as to have the buildings all enclosed when the first cold weather arrives. The city finances seem to be in as healthy condition as could be expected, practically all expenditures are well within the available cash, and the condition of the city finances reflects a healthy tone throughout contracting circles.

Building Operations

Rapid progress has been made on the half-million dollar Dominion Customs warehouse, the contractors, J. McDiarmid & Company, Limited, of Winnipeg, having the foundations placed and the structural steel well under way. In the erection 1,450 tons of steel will be supplied, fabricated by the Manitoba Bridge & Iron Works, Limited. Jones & Lyttle, Ltd., of Calgary, the contractors for the superstructure of the ten-storey Lancaster Building, have completed the placing of the concrete fireproofing and floors for the first five storeys and are making rapid progress towards its completion. The same contractors have recently completed the warehouse for the Cockshutt Plow Company, Limited, one of the largest and finest appearing commercial structures in the city. The architects are Lawson & Fordyce, of Calgary. Fyshe, McNeill, Martin, Trainer, Limited, have about completed the four-storey reinforced concrete warehouse for the Northern Electric & Manufacturing Company, Limited, and are making favorable progress on their other contracts, including the ten-storey office building for the Herald Publishing Company, Limited, and the store for the Calgary Furniture Store, Limited. The same contractors conducted their first annual picnic to Banff, in the Rocky Mountains, recently, and gave a free outing to over 260 employees and friends.

Although the amount of building permits has not approached the volume for the year 1912, still, there is a very appreciable amount of new work under way. Permits for the past month of July amounted to $1,164,600, making the total for the first seven months of the year $4,484,500, a decrease of 43 per cent. over the same period of 1912. Nevertheless, there is no anxiety displayed here, not even the most optimistic "boomer" of Calgary could expect the record of 1912 to be duplicated in a city the size of Calgary, let alone exceed it. The building of a number of moving picture theatres commenced here recently, the largest among them being that for the Canadian Film Exchange, Limited, on Eighth avenue, a building having a frontage of 50 feet in the heart of the business district. The construction will be entirely of reinforced concrete, the two-way Floordome System recently placed on the market by the Trussed Concrete Steel Company, being used for the first time in this city. The building is being constructed for the owners by day work, the architect being James C. Teague, of Calgary. Among the new work about to be commenced is a large reinforced concrete warehouse for the Canadian Consolidated Rubber Company, Limited, to be built by the Canadian Stewart Company, Limited, of Montreal and Chicago. The same contractors have under way an addition to the malting plant of the Canada Malting Company, Limited, of Toronto, which will practically double the capacity of the plant built last year. The malt house is already being increased and the excavation has been made for the addition to the grain elevators. The contract for the Pilkington Bros., Limited, warehouse has been let to Carter-Halls-Aldinger Company, Limited, of Winnipeg, and work will be commenced shortly. The architects are Hodson, Bates & Beattie, of Calgary.

Northwest Travellers' Association Building.

P. Lyall & Sons Construction Company, Limited, have the contract for the new building for the Northwest Commercial Travellers' Association, and have recently completed the placing of all reinforced concrete, involving a total of 875 cubic yards of concrete and 75 tons of reinforcing steel. The Kahn System of Reinforced Concrete was used. The building will be 60 ft. by 100 ft., and will be only four storeys high at present, though provision has been made in the design for an additional two storeys. The exterior will be of red pressed brick with Ohio sandstone trimmings, though the entire ground floor will be finished with the cut stone. The interior finish will be B.C. fir, and all floors will be finished concrete, these having the heaviest wear, as corridor floors, being finished with Master Builders' Method surface. There will be one Turnbull electric elevator installed at present, with provision for the addition of another when the building is enlarged. The building will be heated by a vacuum steam system, requiring one 80 h.p. Leonard boiler. This will be the first large building to have positive ventilation of all rooms and corridors according to the new city by-law to that effect. All rooms will have false, registered, ceilings, connected to a large vent shaft in the corridors which in turn leads to a vertical shaft in the rear of the building, the draft being induced by the presence in this shaft of the smoke-stack from the heating system. The ground floor will be devoted to stores and to sample rooms for the use of members of the association; two of the upper floors to offices, also for members; while the top floor will contain a club-room, billiard room, rooms for cards and reading, and a large banquet hall with kitchen and service attached. In the basement will be the heating system, and elevator machinery, besides a pool room, and other sample rooms. There will be a party light well on the north side. Another feature of the building will be the enclosed fire escape with indirect access. The total cost will be about $100,000. The architects are Burroughs & Richards, of Calgary.

Police Headquarters

Work has been commenced on the new Police Headquarters Building for the city of Calgary, the general contractors being Messrs. Thomas, Jamison & McKenzie, Limited, of Calgary. The general contract is for $103,000, other contracts to be let for the police cells, elevators, electric wiring, and plumbing and heating. The building will be very complete of its kind. The building will be 94 ft. 1 in. deep, with a frontage of 76 ft. on Seventh Avenue East, immediately in the rear of the present City Hall, and will be four storeys high. The frame of the structure will be reinforced concrete, the Kahn System to be used, and the exterior will be of red pressed brick with cut stone trimmings. The walls of the light court over the diffuser sash for the police court will be of white hollow brick. The interior trim will be of white oak, with partitions of 4 in. terra cotta blocks. Steel sash will be used on alleyways and light courts. The architects are Lang & Major, of Calgary. Mr. W. W. Hay, formerly secretary of the local Builders' Exchange, has been appointed supervising engineer for the city.

Railway Construction

Conclusive evidence of the real entrance of the Grand Trunk Pacific Railway and, to a lesser extent, of the Canadian Northern Railway, into this city is to be found in the city limits. The C. N. R. have about completed their grading into the city, and their contractors have placed the concrete for all the structures along their right of way except actual terminal buildings. There will be a six-span bridge crossing the Bow river in East Calgary, just to the south of the crossings of the C. P. R. and of the G. T. P. lines. The piers and abutments for this bridge are ready, and the arrival of steel will enable it to be completed. Within the city limits there will be an overhead crossing of the McLeod trail, and in the heart of the city there will be a subway at Second street, east. At the head of First street west there have just been completed the piers and abutments for a three-span bridge crossing the Elbow river, at the terminus of the line into Calgary. This is the last concrete to be placed for permanent way on a contract held by F. Ferhenbach & Company, Limited, of Calgary, covering the 30 miles to the north of Calgary. The G. T. P. has laid the steel up to the site of the barracks of the Northwest Mounted Police, and have a large number of teams grading the site of what is expected will be their Calgary terminal. The entrance into the city necessitated the erection of a two-span bridge in east Calgary, crossing the Bow river. The type of bridge is seen from the cut, being a single track, 9-panel, bridge, with equal spans of 157 ft. 6 in., with a short plate girder approach span on the east side of the river. A three-span plate girder bridge crosses the Elbow river at its junction with the Bow river, just east of the terminus of the line. The Calgary-Tofield branch of the G. T. P., as the line is known officially, will undoubtedly operate a limited service by the end of the month. The railway officials of both lines have observed extreme reticence in the matter of giving out definite information as to the plans of their final terminal in this city, so that a change in plans would not be surprising. The G. T. P.., at least, has laid steel and are grading a site for some terminal arrangement, whether it be final or not.

G. T. P. Bridge, East Calgary.

The factor determining the size and power of large locomotives is the physical endurance of the fireman. An ordinary fireman cannot put into the firebox more than from five to six thousand pounds of coal an hour. This is one of the considerations which render compounding and superheating, which under favorable conditions secure as much as 40 per cent. economy, such valuable factors in the development of the locomotive.

The Army airship Delta, the longest of the three in possession of the military wing of the Royal Flying Corps, made its record flight recently. It covered nearly two hundred miles in between four and five hours. Leaving Aldershot, it sailed south and passed Winchester. It returned over Guildford and made a good landing at Farnborough.

Third International Road Congress,[*] London, 1913

By Arthur H. Blanchard, M. Am. Soc. C. E., Professor of Highway Engineering, Columbia University and Consulting Engineer, New York City

"Stop, Look and Listen," the characteristic sign which attracts the attention of the traveller at crossings of highways and railways throughout the United States, contains advice of inestimable value to those interested in the development of highways. As a pertinent citation of its application, the work of the Third International Road Congress is worthy of careful study in order that the mass of information collated through the medium of reports, discussions, conclusions and exhibitions may be drawn upon to furnish ideas which may be used in the development of highway engineering in this country.

First Congress

To-day the world appreciates the admirable work instituted by the French Government in 1908, through the medium of its famous Department of Roads and Bridges in calling to Paris highway engineers and officials from all over the globe for the purpose of mutual exchange of opinions pertaining to the administration, construction, and maintenance of highways. At this convention, the First International Road Congress, steps were taken to form the Permanent International Association of Road Congresses.

Membership

The Association includes in its membership national governments, state governments, municipalities, associations and societies, companies manufacturing materials and machinery, and individual members. According to the 1913 report of the executive committee of the association the membership on May 31st included 32 national governments, 256 corporate bodies and 944 private members. The dues of these members for the year ending May 31, 1913, was $21,520; of which $14,980 was subscribed by national governments.

Of particular interest to the citizens of the United States are the regulations relative to the affiliation of national governments. The pertinent portions of the regulations pertaining to the two controlling bodies of the Association, the Permanent International Commission and the Permanent Council, are as follows:

"The Permanent International Commission is composed of members belonging to the various countries represented in the Association. Each country has the right to one representative for each $200 of its total annual subsidy. Provided, however, that the number of representatives from any one country shall not exceed fifteen and that any country which pays not less than $50 shall have the right to appoint one delegate.

"The Permanent Council is composed of representatives chosen from among the members of the Permanent Commission: one for each country whose annual subsidy does not exceed $100; two for each country whose annual subsidy exceeds this amount, and is less than $2,000; three for each country whose annual subsidy exceeds $2,000."

It is unfortunate that our national government stands alone among the great governments of the world in not having affiliated with the Permanent International Association. Our neighbors, Cuba and Mexico, are among those who have lead us in officially expressing the interest of their national governments in the improvement of highways.

Since 1908 the subject of affiliation has been under consideration in the United States and since the Second International Road Congress held in Brussels in 1910 an active campaign has been waged to secure the adherence of the United States. In order that the United States may take its proper and dignified place in the world progressive movement conducted under the association it appears the duty of every association interested in good roads to pass resolutions memorializing the congress of the United States to take the necessary steps to become a member of the Permanent International Association of Road Congresses.

Future Meetings

During the sessions of the Third International Road Congress held in London in June, 1913, it was decided to accept the invitation extended by the German government to hold the 1916 congress in Munich. Since the Brussels congress there has been a tacit understanding that the fifth international congress should be held in the United States in 1919. It is, of course, obvious that unless the United States becomes a member prior to 1916, it will be practically impossible to carry out this very desirable programme, desirable not only from the standpoint of the citizens of the United States, but also from the standpoint of highway engineers and officials in all the countries of the world.

Organization

A brief outline of the scheme upon which is founded the work of an international road congress will give some idea of the large amount of available information relative to every phase of highway engineering which is disseminated among highway engineers and officials throughout every land. The Permanent International Commission about two years in advance of a congress meeting decides upon a series of topics which it considers of vital importance and upon which a large amount of investigative work is in progress. Another series of topics is selected pertaining to subjects upon which thought has not crystallized as definitely as in the case of the first set of subjects but information in regard to which will serve as the basis for future concentrated and co-operative work. The first set of topics is defined as questions, the second set as communications. The executive committee of the association then notifies the national representatives in various countries of the list of questions and communications and requests that in each country a reporter or a group of reporters be designated to prepare a comprehensive review on each question and upon each communication, the view point in each case being national. The reports are delivered to the executive committee some six to nine months prior to the meeting of a congress, are printed in the three official languages of the association, English, French and German, and distributed before the opening of the congress to all members of the association. In the country in which a given congress is held general reporters on each question are appointed to review all reports submitted, to summarize the practice indicated and to draft a set of conclusions which represent the majority opinion relative to various essential phases of each subject. These general reports are supposed to be distributed prior to the meeting of a congress. The business sessions of the various sections of a congress are devoted to a consideration of the conclusions submitted by the general reporters. Naturally many amendments are proposed before the conclusions are finally adopted by the section particularly interested in a given subject. The conclusions as reported by the various sections are submitted at the final general meeting of a congress where they are considered for final adoption. The discussions, conclusions, general work of the congress, and description of the excursions, entertainments and the exhibition are published as the proceedings of the congress.

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[*] Paper presented before the convention of the North Carolina Good Roads Association at Moorehead City, N. C., Aug. 1, 1913.

At the Third International Congress a total of 140 reports was presented by reporters from nineteen national governments, nine questions and ten communications composing the programme. Nine general reports by British engineers were prepared relative to the questions. The meetings of the third congress were well attended, the total attendance being between 2,500 and 3,000. The congress was so conducted that the proceedings of the various sessions, although carried on in the three official languages of the congress, English, French and German, were interesting and instructive. By having present expert interpreters, those in attendance were made acquainted with the remarks of members from all countries without any material delay in the progress of the meetings.

The exhibition was divided into four divisions: road materials and machinery; traffic; models, maps, drawings, and publications; and historical data. The first division comprised 42 exhibits of the principal types of materials and machinery employed in Great Britain and on the Continent.

The practical influence of the congress on the development of administration and organization of highway departments and the improvement of roads and pavements will depend to a marked degree upon the extent of the adoption of the principles and recommendations contained in the conclusions of the congress. The conclusions, although expressing in many instances the fundamentals of modern highway engineering practice, nevertheless will repay careful digestion by every American interested in good roads. Unfortunately American engineers and highway officials have not universally adopted many of the fundamental principles laid down at the International Road Congresses. Among the 83 conclusions adopted at the third congress, which are of especial interest to those having charge of highway work in the United States, are the following:

1st Question—Planning of New Streets and Roads

"As a general principle, it is better that new main roads be constructed to pass outside rather than through towns, and that, where an existing main road passing through a town is unsatisfactory for through traffic, it is often better in preference to widening an existing narrow main road through the centre of a town, new roads should be planned according to the principles of the science of town planning.

2nd Question—Types of Surfacing to be Adopted on Bridges, Viaducts, Etc.

"On short bridges in town or country, it is desirable that the surfacing should be the same as that on the adjoining streets or roads.

3rd Question—Construction of Macadamized Roads Bound With Bituminous (including Tarry and Asphaltic) Materials

"Confirming the conclusions adopted in 1910 by the 2nd congress (Brussels, 2 Question), which called attention to the advantages of a dry foundation and a sound subsoil, the congress especially insists upon the great importance of efficient foundations in the case of road crusts bound with bituminous (including tarry or asphaltic) binders for the following reasons:—

The road crust being expensive, it is important to give it a base which will increase its life.

As the weight, speed and intensity of the traffic continually tend to increase on roads considered worthy of such a crust, it is best to provide a foundation which has been so constructed as to secure for the crust the best possible conditions of resistance to wear.

"It is agreed that it is absolutely necessary to carry out repairs, in the case of all bituminous (including tarry and asphaltic) road crusts, immediately the necessity for them arises.

"The complete renewal rendered necessary by wear must be carried out immediately the depth of the road crust is below a given limit of safety, or when its waterproofing qualities have become so poor that the road will unduly suffer from climatic conditions.

"In the mixing method the stone must always be dry, and if necessary it must be heated.

"One must never employ road rollers which are too heavy.

"Sufficient information is now available to enable engineers to select and specify bituminous binders which will have no prejudicial effect upon public health, fish life, or vegetation; but which, on the contrary, will conduce to conditions of considerable hygienic advantage.

4th Question—Wood Paving

"Hard woods give varying results according to local circumstances, and it does not appear desirable to recommend them for roads with intense traffic in large cities, unless some means are devised to effectively prevent the rapid destruction of the joints and the resulting destructive effect on the concrete below.

5th Question—Methods of Lighting

"Every vehicle whether standing or moving should carry or show a light of sufficient power at night which can, except when specially authorized, be seen from the rear as well as from the front of the vehicle.

"Every motor car must carry after nightfall, two lighted lamps in front, and one at the back; if it is able to move at a high speed it must be fitted in front with a headlight of sufficient illuminating power to light up the road or path for at least 50 yards to the front. In inhabited places where the ordinary lighting is sufficient to allow motorists to see their way and to be easily seen, the light of the headlights must be limited to that of the ordinary lamp.

"One and the same colour should be universally adopted as the colour for danger signals.

"It is desirable that each government should do away as soon as possible with coloured lights on automobiles.

7th Question—Regulations for Fast and Slow Traffic on Roads

"That all regulations for the control of road traffic should be based on the principle of allowing the speed practicable for each different kind of vehicle consistent with public safety, general convenience, and the normal wear of the road.

8th Question—Authorities in Charge of the Construction and Maintenance of Roads. Functions of Central Authorities and Local Authorities

"A principle that can be laid down as of universal application is, that the unit of highway administration shall be sufficiently large and command sufficient resources to employ and adequately remunerate a competent staff.

9th Question—Finance of the Construction and Upkeep of Roads. Provision of Revenues

"The expenditure on the maintenance and improvement of roads which are used mainly by long distance traffic; unless such expenditure is borne wholly out of the national revenues under a system of state administration of roads (which system is practicable and suitable in the case of some roads in some countries) should be mainly paid for out of national revenues, whether or not such roads are locally administered and maintained, subject, where local administration prevails, to the supervision of a central government authority both as to efficiency and expenditure.

"It is desirable to abolish, so far as possible, all tolls on public roads, but it is equitable that vehicles which, on account of their weight or weight combined with speed or any other exceptional circumstances connected with either the vehicle or use of the road, cause special damage to roads beyond the wear and tear of the ordinary traffic of any district, should be subject to special taxation, the proceeds of which should be earmarked for expenditure on roads.

"Borrowing money for new road construction and for the periodic renewal of the surface coating of a road is consistent with sound financial principles provided that the loan period in the case of loans for renewals, is kept well within the life of the surface coating."

Even a brief summary of the work of the Third International Road Congress should not be closed without reference to the hospitality and elaborate series of entertainments and excursions provided by our British cousins and the officials of the Permanent International Association of Road Congresses.

Civic Development*

By His Worship, Mayor Short, Edmonton

This is a problem which may be looked at from various points of view. First, there is the merely physical growth, the adding of house to house, street to street, industry to industry. Second the exercise and increase of the powers of local self government; third the administration of the city's affairs, and the systematizing and perfecting the machinery for that purpose. I should prefer to confine myself to the two latter.

The Townsite

To begin with, we should ask the government to provide that no townsite shall be laid out or extended upon land not reasonably suitable for the purpose, and not then, unless a reasonable water supply and drainage facilities are possible. Throughout Western Canada townsites have been laid out, often with little or no regard to the fitness of the site itself, or to the possibility of securing these advantages. What is done may not be mended. There is still nearly half of the four great Western Provinces to be taken care of, and let us ask government to do so. Persons putting townsites on the market should be first required to provide therein water, sewer and pavements, for these are absolute necessities of civic life. The enormous unearned increment that has been swept away from our citizens in the past ten years by the exploitation of townsites were quite large enough to have provided these improvements.

Provision for Streets

Again, there should be provided streets not less than 80 ft. and lanes not less than 20 ft., the latter to carry sewer, water, gas, light, telephone or other wires and these should be laid out in harmonious relation to each other, and there should be radials capable of extension, so that it would be possible to get to all points of the compass readily from a common centre.

There should also be boulevards, wider than ordinary streets so as to permit of buildings of a public or semi-public character located to form a view calculated to impress.

There should be parks and breathing grounds for rest or recreation scattered regularly throughout the townsite. All places of special scenic beauty, such as the banks of a river or a ravine with boulevards skirting the same, should be dedicated to the public use. Broken ground or such places as only with difficulty and great expense could be rendered amenable to general civic purposes, should be likewise retained for parks. It certainly seems unfortunate that lands entailing expense for fitting up far beyond their intrinsic value should be allowed to be utilized for townsite purposes. Provision should also be made that certain classes of buildings and business should in a general way be kept each in its own location.

Administration

Turning from this more purely physical point of view, one meets the more difficult problem of administration. This is the difficulty of getting trained men. The problem is that of the man. Whether the final executive control is placed in the hands of a Board of Commissioners, a Board of Control, a Burgomaster, or an executive head under any other name, the problem is pretty much the same. Separate your activities into departments. Chart the duties of all who are required to administer the work, but above all, get a good managing head for the department. It is easy to get men who will carry out work, but hard to get those who will carry it out efficiently and with economy.

Far too little do city authorities realize that they are spending trust moneys. Far too much do they assume that money and economy are last to be thought of. Having thoroughly organized, having chosen heads who have demonstrated their integrity and managing ability, let us then provide for a thorough audit of all expenditures; not by an auditor who is the equivalent of a girl with a comptrometer, but by a real auditor who gets to the bottom of every expenditure and the why and wherefore. As his complement, let us appoint an efficiency officer whose duty it will be, not only to see that the work done is such that should be done, and that it is done in the right way, but also that we get a hundred cents worth for every dollar we spend. Let us standardize the method of keeping accounts, and of doing work, then let us ask the government to establish a local government board with general supervision over the activities of all cities and towns whose special duty it shall be to see that our standardization is made effective.

Local Self Government

Turning again to the government side, one finds a new problem. Local self government, is the legislative problem of to-day. A few years ago powers were dealt out to cities, towns and villages by schedule and only those on the list could be exercised. From year to year new needs arose. Demand was made and grudgingly powers were widened. Today there is a letting down of the barrier and it is beginning to be realized that civic government embraces wider fields than were dreamed of a few years ago. In the Edmonton Charter, which in itself is a departure, the powers of the city were defined as being to make laws for "the peace, order, good government and welfare" of the city. In effect these are the words of authority given to the Dominion Government. The difference in exercise of the powers is merely in the scope wherein they are to be exercised. Under them it is our privilege to grow, to develop in succeeding years. That which seems beyond the powers of the city will with growing public opinion become entirely proper a few years hence. What Canadian city twenty years ago would have thought of installing and operating water, light, telephone, street railway system, or providing a prison farm for the weak and neglected? Yet within that time these powers have been granted and acted upon, and that action is looked upon as a reasonable and proper exercise of municipal authority. The people themelves, upon the ground, conscious of their need, can when charged with the duty, more readily evolve rules and regulations to meet the case, than can a parliamentary body hundreds of thousands of miles away.

How then shall we justify this broadening of powers of local self government? Let us undertake no activity that is not clearly within the scope of municipal adventure. Let us obtain the right kind of men to administer the powers and responsibilities. Here there is need of educating the public. Too much our best men reserve their activities for the wider fields of Dominion and provincial affairs. Too little they give attention to the possibilities of local self government. Let us set to work to get out our best men.

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* Before the Union of Canadian Municipalities, Saskatoon, July, 1913.

Conclusion

How then are we to obtain a betterment? Will increasing the powers of a city increase the capacity of its representatives? Experience does not seem to lend color to that view, still men strive to be representatives of a class or clique and still the more experienced and more capable business men are unwilling to face the campaign often of personality and misrepresentation. Until we change that civic development will not come to its own. There is no system of government which is perfect. The best in the world will fall down in the hands of incapable and irresponsible persons. On the other hand a crude and unscientific system in the hands of good men will yield good results. One conclusion seems inevitable, and that is, that bureaucratic government is just as dangerous to-day as it ever was, and that no system should be adopted which takes out of the hands of the people and their elected representatives the ultimate authority.

Important Road Congress

The joint committee having the matter in charge decided to hold the American Road Congress at Detroit during the week of September 29. This will mean the greatest road assemblage ever held in the United States as the Congress comprises the American Highway Association, with upwards of 2,000 regular members and more than 15,000 associate members; the American Automobile Association, with over 70,000 members; the Michigan State Good Roads Association which is strongly organized in every part of the state, and in addition to this it is quite probable that the Ontario Good Roads Association will join with the others thus making the Congress an international affair.

A commercial exhibit will be held under the auspices of the National Association of Road Machinery and Material Manufacturers, and arrangements have already been made for the exhibition of the collection of road models owned by the United States Government. The President of the United States and the Governor-General of Canada will be urged to attend and already the foremost engineers and highway officials of the country have accepted places on the programme. The President of the Congress, is L. W. Page, director, United States Office of Public Roads.

Conditions of Competition Announced

The commission of architects appointed by the Government to direct the preparation of designs for the new Departmental buildings at Ottawa, recently submitted its rereport outlining the conditions of the competition. It will be open to competitors throughout the British Empire. There will be at least two buildings, and probably a third one for the Courts, and half a million superficial feet of floor space will have to be provided. Designs of a general character will first be submitted and from this number the best six will be selected. The authors of these will be asked to elaborate their designs. The one finally selected will superintend the work based on his plans, and will be given a 5 per cent. commission. The cost of the buildings will probably aggregate five million dollars. The other five competitors who will be asked to develop their general designs will each receive $3,000. The sketches will be received up to January 2 next. Then three months will be given for the best half-dozen to develop their plans. The competitor whose plans are accepted will be given a further period of four months to prepare working plans. Afterwards tenders will be called for, but in view of the time allowance this will not be before next autumn.

The Geological Congress

The members of the Twelfth International Geological Congress held their meeting in the city of Toronto, Ont., August 7 to August 14. This body is one of the most notable scientific organizations that has ever visited that city. In all, some 600 delegates were present, representing 45 different nationalities. On Wednesday evening, August 6, the members began to assemble at the University buildings, coming in groups from the trips for geological observation which were arranged for by the local committee under the chairmanship of Prof. Coleman. On Thursday morning the Congress was formally welcomed by the Hon. W. H. Hearst, Minister of Lands, Forests and Mines for Ontario, and by Acting Mayor Church on behalf of the city of Toronto and Dr. Falconer on behalf of the University of Toronto. The official welcome was delivered by Sir Chas. Fitzpatrick, who gave a message from H. R. H., the Duke of Connaught, Governor-General of Canada, welcoming the delegates and regretting his absence. The chief question for discussion on Thursday was the World's Coal Resources. The discussion was introduced by a paper read by Mr. R. W. Brock, General Secretary of the Congress, which discussed the monograph which has been prepared by a special committee, dealing with this important question. The discussion was continued by M. A. Defline, an eminent French engineer, who dealt with the coal resources of France, while Dr. Krunsch delivered a paper by M. Boker, dealing with the coal fields of Germany. In the evening Emmanuel de Margerie, Past President of the Geological Society of France, delivered before the Congress in Convocation Hall, an address on the plotting of a geological map of the world.

The Congress will continue its sessions until August 14, when a number of additional trips to points of geological interest in Canada will be made. The President of the Congress is Dr. F. D. Adams, F.R.S., Dean of the Faculty of Applied Science and Logan Prof. of Geology of the McGill University, Montreal.

Convention at Cleveland

The National Paving Brick Manufacturers' Association United States will convene at Cleveland, Ohio, September 17 and 18. Formerly meetings have been held during the winter months but last year it was decided to hold future conventions during the "open season."

This will afford, instead of the usual program of written papers, discussion and criticism of brick street and brick road construction methods while work on the highways is in actual progress. The large amount of construction work in Cleveland and Cuyahoga County will afford splendid opportunity for investigation in a most practical way. Officers of the National Paving Brick Manufacturers' Association are: Charles J. Deckman, Cleveland, president; Will P. Blair, Cleveland, secretary; C. C. Barr, Streator, Illinois, treasurer.

The New York Board of Water Supply recently made corrosion tests on several metals by burying samples in the earth for six months, and periodically wetting the earth with dilute solutions of corrosive salts. The losses noted were:—Phosphor bronze, 0.09 per cent.; Tobin bronze, 0.11; monel metal, 0.12; manganese bronze, 0.12; Muntz metal, 0.33; and steel 1.04 per cent.

Personal Mention

Mr. James Wilson, a contractor at Welland, and formerly of Brantford, Ont., died recently as the result of a train accident at the former place.

Mr. W. A. Casey, until recently a member of the staff of Mr. C. H. Topp, consulting engineer, Esquimalt, has been appointed municipal engineer of that city.

Messrs. William Binnie and R. S. Tickell are preparing a report on Ottawa's water supply. Sir Alexander H. Binnie, of London, Eng., who had the work in hand, was forced to abandon the task owing to ill-health.

Messrs. Ross & Macdonald of Montreal, have been appointed architects for the Halifax terminals of the Intercolonial Railway. The plans include a passenger station and train shed, estimated to cost a million dollars.

Mr. E. P. A. Phillips, B.A.Sc., O.L.S., who for some time past has been associated with the firm of J. G. Mackay, Hamilton, has been appointed corporation surveyor of Port Arthur, Ont. Mr. Phillips is a graduate in the faculty of civil engineering of the University of Toronto.

Mr. Allan George, architect, son of Sir Ernest George, late President of the R. I. A. B., England, has taken into partnership Mr. Walter A. Moorehouse who has been with Sproatt & Rolph for some years. Business will be carried on at 6 Victoria street, Toronto, under the name of Allan George & Moorehouse.

Mr. W. A. McLean, Ontario Provincial Engineer of Highways, and vice-chairman of the new commission, has returned to Toronto after a two months' tour abroad, during which he made a thorough study of road systems and methods in England, Scotland, France, Switzerland, Germany and Belgium.

Mr. A. E. Grant, formerly manager of the Cardiff office of the British Insulated and Helsby Cables, Limited, will assume the position of managing director of the Canadian British Insulated Company, Montreal. Mr. A. E. Grant is a brother of Mr. Lawford Grant former managing director of the company.

Mr. Lawford Grant will assume his new position in connection with the Eugene Phillips Electrical Works, Montreal, immediately. Mr. Grant recently resigned from the position of managing-director of the Canadian British Insulated Company, Limited, Montreal, but retains the presidency of the company.

The Committee of Management of the International Engineering Congress, 1915, announces that Col. Geo. W. Goethals, Chairman of the Isthmian Canal Commission and Chief Engineer of the Panama Canal, has consented to accept the Honorary Presidency of the Congress and will preside in person over the general sessions to be held in San Francisco September 20-25, 1915.

Improvements in Tokio Harbor

Tokio harbor improvements costing $10,000,000, says the Engineering Record, are to be constructed during the next ten years, according to a report from the U. S. consul general at Yokohama. Three or four large dredges are to be ordered at the outset, together with rails and other material for a 5-mile construction railway. The improvement project contemplates the reclamation of 1,191 acres of waterfront by utilizing the output of the excavating operations. There will be a canal 5 or 6 miles long, 270 ft. wide at the base and 372 ft. at the top, with a depth of from 12 to 25 ft. at low tide. The excavation operations will cover in all an area of more than 1,000 acres. The need for this improvement is based upon an estimated average annual freight movement of 3,500,000 tons, 80 per cent. of which originates in Yokohama. The freight charges per ton are at present from 58 to 92 cents, but it is estimated that these can be reduced to from 29 to 42 cents.

Concrete Insert

Through an oversight the name of the manufacturers of the concrete insert described on page 63 of the Contract Record, July 30, was omitted. The makers of the insert are the Star Expansion Bolt Company, 147 Cedar street, New York. The advantages of the insert are readily seen when it is considered that the threaded device for the insert may be installed when the concrete is being poured and the timbers can be changed around or replaced with little trouble and without drilling new holes and greater strength and security is obtained.

Public Roads and Highways Commission

The Ontario Government in order to carry out its policy of extensive roadway improvement, has appointed a commission to investigate thoroughly methods of construction and maintenance of highways and to prepare a report to be submitted to the government. The members of the commission are Messrs. Charles A. Magrath, C.E.; William A. McLean, C.E., and A. M. Rankin, M.P.P. Mr. Magrath is at present chairman of the Canadian section of the International Deep Waterways Commission and has had a wide experience in various engineering works, notably roadmaking in the Canadian Northwest. Mr. McLean is at present Provincial Highway Engineer for Ontario and for the past nine years has devoted himself to the work of improving the provincial highways. Mr. Rankin has been connected with the good roads movement for some time and at present is vice-president of the Ontario Good Roads Association. The province is to be congratulated on the personnel of the commission.

Mainly Constructional

The News in Brief—From Coast to Coast

West Vancouver is to have a new waterworks system costing $100,000.

The city of Toronto is spending the sum of $250,000 on new buildings for the Canadian National Exhibition this year.

The summer convention of the Ontario Granite and Marble Dealers' Association was held at London, Ont., on August 4th.

The new Barry Hotel at Saskatoon was recently opened to the public. This is a four-storey building with basement and cost about $200,000.

The members of the Saskatoon Builders' Exchange have started a movement to bring about the removal of duty on all building material in the Canadian west.

The value of building permits issued in Vancouver for the month of July totalled $441,085, making a total for the first seven months of the year of $10,206,732.

By the decision of the Montreal Board of Control, building permits will now be required for municipal buildings as well as for any other buildings erected in the city.

It is expected that the new Ontario Provincial Highways Commission will hold a meeting in a few days to discuss arrangements for their tour of the United States in search of road information. Until the commissioners return from that tour no policy will be mapped out.

The city of Calgary contemplates the construction of a third municipal paving plant and expects to be in a position to handle all its own paving work next year.

Street Commissioner Wilson of Toronto will apply to the Board of Control for co-operation in some new drastic building laws in so far as they affect the condition of the streets.

The Roger-Miller Company, of Toronto, was awarded the contract for the Prince Edward Island terminal at Carleton Point of the Intercolonial car ferry. The figure is $950,000.

Building operations continue active in Welland. Permits for July amounted to $89,710 and for the past seven months $318,896, nearly twice the total for the same period last year.

The large dredge, which was under construction at the Polson Iron Works, Toronto, for dredging the harbor at Port Nelson, has been completed. It is 180 feet long, 44 feet wide and cost $270,000.

Railway construction on the Grand Trunk Pacific east of Prince Rupert, B.C., is going ahead rapidly, good progress having been made during the past month. Track was laid to mile 218 east of the Pacific Coast.

A catalogue of the Herbert Morris Chain and Hoist Company, Limited, has come to hand. The list contains a good deal of descriptive matter concisely stated and is well illustrated. It will repay a careful study.

The amount of building permits in Toronto for the first seven months of this year was $17,657,321, as compared with $15,494,845 for 1912. The permit of the new Dominion Bank, amounting to $1,000,000, was recently issued.

Building permits issued in Montreal for July amounted to $1,555,665, a slight falling off from July of last year. The total value of the permits issued during the first seven months of 1913 is $11,497,950. This is an increase of 17 per cent. over the same period last year.

About eleven miles of sewer work is now under construction at Edmonton. This work has been in progress for over two years and at least another year of steady work will be necessary to complete it. Over $2,000,000 has been expended on this sewer system.

Tenders have been called for the construction of a second section of the Montreal conduit system. The work is from Craig street to Pine avenue, and from Atwater avenue to Guy street on St. Catherine street. Mr. G. M. Gest has now the first part of the system in hand.

The Government has retained Mr. C. S. McInnes, K.C., of Toronto, to represent it in preparing the case to be submitted to the International Waterways Commission with reference to the projected damming of St. Mary's River at Sault Ste. Marie by the Michigan Lake Superior Power Company.

A commission of engineers consisting of Mr. W. A. Bowden, of the Railway Department; Mr. Jefferson Chapleau, of the Public Works, and Mr. W. J. Stewart, of the Hydrographic Survey, will go to the scene early in August to secure data upon which the case will be based.

It is understood that the Canadian Northern Railway is seeking from the Government running rights over the Intercolonial Railway to take effect from the time when its Montreal to Port Arthur line is finished. The privilege will, of course, not be required until the construction of the line is much further advanced, particularly on the section between Port Arthur and Montreal.

It is expected that the Hudson Bay Railway will be completed by December, 1914. The work is being pushed ahead with great vigor, and the development of the terminal facilities at Nelson are being driven ahead so rapidly that the resources of the new port will assist materially in finishing the northern portions of the railway. There are at present 1,200 men on this work and it is hoped that 150 miles of grading will be completed this fall.

We acknowledge the receipt of a volume from Messrs. Drummond, McCaul & Company, of Montreal, dealing with the "Stoney" sluice as manufactured by Ransomes & Rapier, Limited, of London, England. The volume describes some of the difficulties encountered with the solid weir and shows the advantages of the "Stoney" sluice, together with its application in numerous large engineering works, such as the Manchester ship canal, and the Assuan dam on the Nile. The book is a model of workmanship.

The marine architects, Messrs. F. E. Kirby and W. T. Donnelly, New York, are in Prince Rupert, B.C., preparing to carry out the construction of the drydock for the Grand Trunk Pacific Railway. A floating type of dock is to be provided with a capacity for vessels of 20,000 tons. The shipbuilding shed that is to stand over the launching platform will be a splendid piece of work. It is designed to have a covered space 86 feet by 200 feet, with a clear height under the cranes of 50 feet and under the girders of 56 feet.

The exhibit of Canadian Allis-Chalmers, Limited, at the Convention of the Canadian Association of Stationary Engineers held at Owen Sound included a perfect working model of ⅜ in. size Squire's trap. Water was supplied to it by a small centrifugal pump driven by an electrical motor, and a great deal of interest was taken in its operation. This was supplemented by very interesting literature covering the new type Barrow Combination Fire and Water Tube Boiler, and also literature covering Cochrane Feed Water Heaters and Steam specialties. The exhibit was in charge of Mr. C. N. Schrag assisted by Mr. J. G. Boyer.

The meeting of the steel and the completion of the laying of the rails for the Ginson and Minto railway in the vicinity of Fredericton, N.B., which is being operated by the C. P. R., took place recently. A temporary bridge has been erected over the Burpee stream to replace the one which was carried away last winter, and this will be used along with others until the steel structures are ready for erection. The new line is for hauling coal principally, and while the road is to be put into service immediately it is not expected that the company will take it over from the contractors until September, as there still remains a considerable amount of work to be done in the way of ballasting and finishing up, and the contractors are hurrying this along as rapidly as possible.

Messrs. Magoon & Macdonald, architects, Edmonton, have been awarded the first prize of $2,000 for the plans submitted by them for the proposed new masonic temple in that city. The building will be a six-storey one and is estimated to cost $500,000. Owing to the present financial situation it is not proposed to erect the temple immediately, but a start will probably be made next spring.

The American Consul at Gothenburg has reported that the Swedish State Railway authorities are experimenting with the use of peat powder, prepared on the Ekelund system, for use in locomotives in place of coal. The powder is delivered to the fire-box through a pipe, and is consumed with the aid of special apparatus invented by an engineer named H. von Porat. It is claimed that this method enables 1½ tons of powder to give the same results as are obtained with 1 ton of coal, that the powder does not cause the emission of sparks or smoke, and that it lessens the labour of stoking.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Dundas, Ont.
Cement walks planned by City Council. Mayor, E. A. Woodhouse. Plans, specifications, etc., at office of Clerk, J. S. Fry, Town Hall, who will receive tenders until August 13. 9,000 feet.

Guelph, Ont.
Paving Eramosa Road planned by City Council. Sec., T. J. Moore, City Engineer, M. Ferguson.

Hamilton, Ont.
Sewer, $2,000, Barnesdale Boulevard, between Dunsmuir Ave. and Main St., planned by City Council. Clerk, S. H. Kent.

Islington, Ont.
Tenders received by Clerk, J. A. L. Macpherson, until August 11th, for 4,000 lin. ft. concrete sidewalk in villages of Lambton and Humber Bay. Plans at office of clerk.

Le Pas, Man.
Sedimentation basin. Tenders received by Sec.-Treas., H. H. Elliott, M.D., till August 20th, 1913, for construction of sedimentation basin. Gravel is 75 c. f.o.b. The Pas. Plans, specifications, etc., at offices of Resident and Consulting Engineers, Murphy & Underwood, Ross Bldg., Saskatoon.

London, Ont.
Tile sewers on Wellington and Partridge streets. Chairman Board of Works, B .W. Bennett. Engineer, W. N. Ashplant. Tenders are to be called at once.

Montreal, Que.
Underground conduits for Board of Commissioners. Sec., L. N. Senecal. Engineer-in-charge, Dr. Herdt, McGill University. Tenders received by Sec., City Hall, until 12 o'clock August 15th, for construction of a system of underground conduits, main and service manholes, transformer chambers, etc., in, upon and adjoining portion of St. Catherine street, between Atwater Ave and Guy street. Plans, etc., at office of Electric Commission, New Birks Bldg. Also in adjoining Bleury St. and Park Ave., between Craig St. and Pine Ave. Contract No. 3.

Peterboro, Ont.
Pavements for City Council. Tenders received by Chairman Board of Works, William Buller, until August 20th, for bitulithic, asphaltic, concrete and Portland cement, concrete pavement, on Hunter, George and Charlotte streets. City Engineer, R. H. Parsons.

Port Dalhousie, Ont.
Waterworks system for Town Council. Clerk, T. G. Wand. Reeve, J. Sutton. Plans prepared.

Toronto, Ont.
Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders received until August 19th. Specifications at office of Commissioner of Works, 22 streets.

CONTRACTS AWARDED

Montreal, Que.
Road improvements, Longueuil, for Montreal & Southern Counties Railway, Canada Express Bldg., Montreal. General contractors, Massicotte & Frere, c/o H. Beauregard, 70 St. James. Concreting between tracks and road about 1 mile of work.

Ottawa, Ont.
Pavement, cost $15,000, Dalhousie, for City of Ottawa. City Engineer, Archibald Currie, City Hall. General contractors, Ottawa Construction Company. Asphalt pavement between Sussex and St. Andrew.

Winnipeg, Man.
Sewers for Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractors, The Dominion Construction Co., 290 Selkirk Ave., for sewer in McKenzie St. from Mountain to Anderson Ave. General contractor, J. W. Ashley, Engineer of Construction, City yards, for sewer in Niagara St., Crescent Road to Godfrey Ave.

Railroads, Bridges and Wharves

Annapolis Royal, N.S.
Piers. Tenders received by Secretary, R. C. Desrochers, Dom. Govt., Dept. of Public Works, Ottawa, until September 3rd. Plans, etc., at office of C. E. W. Dodwell, Dist. Engineer, Halifax, F. G. Goodspeed, Dist. Engineer, St. John, Postmaster, Annapolis Royal, and at Department, Ottawa.

Burks Falls, Ont.
Dredging for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until August 20th, for dredging Magnetawan River. Plans at office of Dept.

Calgary, Alta.
Stations for C. N. Rly. Company's architect at Winnipeg has prepared plans for stations on Vegreville-Calgary Line at Rise Deer, Benyou, Redland, Rockyford, Barntill, Hawick, Lyall, Norfolk, Cheslermer Lake and Barlow. On the Saskatoon-Calgary Line at Excel, Cereal, Chiriook, Dobson, Youngestown, Stanmore, Richdale and Modena.

Chatham, Ont.
Grand Trunk Railway Company has been authorized to construct spur to premises of Dowsley Spring & Axle Co., Ltd.

Twp. Deacon, Ont.
C. N. O. Rly. Co. has been authorized to construct bridge to carry line across Petawawa River (west crossing) Twp. Deacon, Dist. Nipissing, mileage 159.3 west of Ottawa.

Peterboro, Ont.
Canadian Pacific Railway Company has been authorized to construct spur for the De Laval Dairy Supply Company.

Two bridges, McDonnel and Park Sts., for City Council. Tenders received by Chairman Board of Works, William Buller, until 5 p.m. August 20th, for reinforced concrete arch bridge, 26 ft. span, 66 ft. long on Park St. Reinforced concrete slab and beam bridge, 27 ft. span, 66 ft. long, on McDonnel St. City Engineer, R. H. Parsons.

Poupore, Que.
Pier and revetment wall for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Sept. 2nd for construction of etaoin hm bmbm m hr daiartdar thar ar training pier and revetment wall. Plans, etc., at offices of J. L. Michaud, Dist. Engineer, Post Office Bldg., Montreal, J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Postmasters at Buckingham and Poupore and at Dept., Ottawa.

Prov. of Quebec
Bridge, cost $2,950, McGibbon Bridge, for Municipal Council of St. Philippe. Mayor, Henry Dixon. Sec.-Treas., H. B. Marton. Plans, etc., at office of Sec.-Treas. One span, 40 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $6,650, over Red River, planned by Municipal Council of Coteau du Lac. Mayor, Dr. Elz. Deguire. Sec.-Treas., A Dauth. Plans, etc., at office of Sec.-Treas. One span, 75 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $4,400, over Missisquoi River, for Municipal Council of East Bolton. Sec.-Treas., J. F. Bryant. Plans, etc., at office of Sec.-Treas. One span, 55 x 14, concrete, steel and 4 in. red pine.

Bridge, cost $4,300, over Muddy Creek, for Municipal Council of Chatham No. 1. Mayor, Aime Dickson. Sec.-Treas., Geo. B. Martin. Plans, etc., at office Sec.-Treas. One span, 40 x 17, concrete, steel and 4 in. red pine.

Bridge, over Thetford River, for Municipal Council of Black Lake City. Mayor, Dr. C. D. Paradis. Plans, etc., at office of Sec.-Treas., Albert Houle. One span, 75 x 17, concrete, steel and 4 in. red pine.

Bridge, over Chateauguay River, for Municipal Council of Ste. Martin. Sec.-Treas., Nap Mallette. Plans, etc., at office of Sec.-Treas. One span, 250 x 17, concrete, steel and 4 in. red pine.

Bridge, cost $3,300, over Pointe due Jeur Creek, for Municipal Council of Lavaltrie. Plans, etc., at office of Sec.-Treas., Sim. Martineau. One span, 25 x 16, concrete, 5-15 in. I beams, 29 ft. long, steel and 4 in. red pine.

Regina, Sask.
C. P. R. Co. has been authorized to

construct spur for the Saskatchewan Motor Company, Limited.

St. Catharines, Ont.
Tenders received by Dom. Govt., Department of Railways and Canals, L. K. Jones, Secretary, Ottawa, until August 27th for section No. 3, Welland Ship Canal. Plans, etc., at office of Chief Engineer of Department, Ottawa, and Engineer in charge, St. Catharines.

Track ties for Dom. Govt. Dept. of Railways and Canals. Tenders received by Sec., L. K. Jones, Ottawa, Ont., until August 14th, for track ties for Welland Ship Canal. Specifications, etc., at office of Dept. Purchasing Agent, Ottawa, Ont.

St. Martin Junction, Que.
C. P. R. Co. has been authorized to construct spurs for Laurentide Brick & Sand Co., Ltd. Co. l'Assomption, Parishes of St. Henry de Mascouche and Lechenaie at mileage 12.25 from St. Martin Junction.

Sooke Harbour, B.C.
Dredging for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, till August 27th. Plans, specifications, etc., at office of Department.

Stratford, Ont.
Station, cost $60,000, for G. T. R.. General Supt. Ont. Lines., H. E. Whittenberger, Montreal. Two storeys, red brick and granite, fireproof. Plans prepared.

G. T. Ry Co. has been authorized to construct siding for Farquharson Gifford Co., Ltd.

Streetsville, Ont.
C. P. R. Co. has been authorized to construct spur for Medina Shale Brick Co., Ltd., and Streetsville Brick Co., Ltd.

Swift Current, Sask.
C. P. R. Co. has been authorized to construct spur for Revelstoke Saw Mill Co., Ltd., across 5th Ave. and Block 123.

Toronto, Ont.
Grand Trunk Railway Company has been authorized to construct sidings for Harris Abattoir Co., Ltd., north of St. Clair ave., crossing Symes Road.

Electric railway planned by Forest Hill Railway Company. Representative, T. J. Glover, Temple Bldg. York Twp. Council have granted franchise. Will operate in neighborhood of Eglinton ave. Forest Hill Road, Bathurst and Dufferin.

Pier for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Sept. 2nd, for East Pier, eastern entrance Toronto Harbor. Plans at office of Sec., J. G. Sing, Confed. Life Bldg., Toronto, H. J. Lamb, Windsor, Ont. Reconstruction of part of superstructure.

Upper Salmon River, Que.
Extension to breakwater. Tenders received by Sec., R. C. Desrochers, Dom. Govt. Dept. of Public Works, until Sept. 2nd. Plans, etc., at offices of F. C. Goodspeed, Dist. Engineer, St. John, Geoffrey Stead, Dist. Engineer, Chatham, N.B., Postmaster, Upper Salmon River, and at Dept., Ottawa.

Winnipeg, Man.
Switching apparatus, cost $4,830, Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St., for supply and erection of switching apparatus for generating and terminal stations to Canadian Westinghouse Co., Ltd., Portage Ave. E.

CONTRACTS AWARDED

Annapolis Royal, N.S.
Railway station, cost $12,000, for Dom. Atlantic Railway (C. P. R.) Engineer, M. A. Fullington, Kentville, N.S. General manager, P. Gifkins, Kentville. General contractors, Falconer & McDonald, 59 Granville St., Halifax. Work to start at once.

Galt, Ont.
Freight sheds, cost $12,000, Main street, for C. P. R. Co. General contractor, Jas. S. Webster. Carpenter, W. Hallman. Painting, J. W. Swain. Plumbing, I. Lockhart. One storey, 150 x 40, cement foundation, brick construction.

Kelly's Cove, N.S.
Extension to breakwater for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, A. W. Girroir & R. H. McDonald, Antigonish, N.S.

London, Ont.
Bridge substructure, Wharncliffe Rd., for City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. General contractors, Bain & Ross, Embro, Ont., $6,441. Cement abutments and approaches for new bridge.

Montreal, Que.
Freight sheds and offices, cost $90,000, Wellington, for G. T. R., McGill street, Montreal. Architects and builders, Jno. S. Metcalf Co., Ltd., 54 St. Francois Xavier. Roofing, Campbell-Gilday Co., 663 St. Paul street.

Ottawa, Ont.
Railway for Ottawa & Morrisburg Elec. Rly., Can. Life Bldg. Sec., R. S. Bishop, Canada Life Bldg. General contractors, R. J. Tierney Co., Ottawa. Construction of right-of-way, including stations, etc., cost will average $10,000 to $12,000 per mile, minimum of 12 miles to be constructed.

Pitt River, B.C.
Dredging, cost $158,220, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The Pacific Dredging Co.

Prov. of Quebec
Bridge, cost $3,500, over Le Bourdais River, for Municipal Council of St. Tite. General contractor, E. Bourassa, Three Rivers. Plans, etc., at office of Sec.-treas., J. J. Cloutier. One span, 60 x 16, concrete, steel and 4-in. red pine.

Bridge, cost $3,500, over Esturgeon River, for Municipal Council of Ste. Martine. General contractor, Narcisse Beaudreau, Beauharnois, Que. Plans, etc., at office of Sec.-Treas., Nap. Mallette. One span, 40 x 17, concrete, steel and 4 in. red pine.

River Du Loup En Haut, Que.
Dredging for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, W. J. Poupore Co., Ltd., 124 Board of Trade Bldg., Montreal.

St. Paul, Man.
Bridge for Municipality of St. Paul. Sec.-Treas., W. Gorham, Birds Hill, Man. General contractors, Fowler & Young, 221 McDermott Ave., Winnipeg. Reinforced concrete construction.

South Edmonton, Alta.
Station and freight sheds, cost $40,000, for C. N. Rly. Architect, R. B. Pratt, Room 461 Union Depot. General contractor, Geo. McLeod, 497 Raglan Road, Winnipeg.

Steveston, B.C.
Jetty, cost $83,500, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Broley & Martin, New Westminster, for complete jetty at mouth of Fraser River.

Public Buildings, Churches, Schools, etc.

Chapleau, Ont.
Hospital, cost $15,000. Tenders received by Architects, Gordon & Helliwell, 525 Confederation Life Building, Toronto. Architect is desirous of immediate tenders, guaranteed delivery of material on the job. Concrete foundation, brick veneer construction.

Charlottetown, P.E.I.
Sanitarium, cost $30,000, for Prov. Govt. Dept. of Public Works. Acting Sec., W. F. Fidmarsh, 8 Brighton Road. Architect, Archibald Scopes, c/o Scopes & Fenstman, New York, N.Y. Site has been purchased near North Wiltshire, 14 miles from Charlottetown. Concrete foundation, frame construction.

Edmonton, Alta.
Masonic temple, cost $50,000, Jasper Ave., for Masonic Temple Assn. Architects, Magoon & MacDonald, Tegler Bldg. Eight storeys, 1st 2 storeys granite construction. Plans drawn.

Fredericton, N.B.
Central fire station, cost $12,000, King St., planned by City Council. Clerk, J. W. McCready. Architect, Kenneth M. Campbell, Springhill, N.B. Preliminary plans have been approved and tenders will be called. Three storeys, brick construction, 110 ft. long.

Gravelbourg, Sask.
Interior fittings for post office, Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Plans, etc., at office of Postmaster, Gravelbourg, W. T. Mollard, Clerk of Works, Regina, and Department, Ottawa. Tenders received by Secretary till August 25.

Halifax, N.S.
Tenders will be received until Sept. 2, for the construction of a wooden lighthouse tower at Five Islands, Colchester County. Plans, specifications, etc., at Dept. Marine and Fisheries, Ottawa and Halifax, and Post Offices Truro, Parrsboro, Economy and Five Islands. Address, A. Johnston, Deputy Minister of Marine and Fisheries.

Kamloops, B.C.
Drill hall for Dom. Govt. Dept. of Militia and Defence. Plans, specifications, etc., at Dist. Officer Commanding Military District No. 10, Victoria, City Clerk, Kamloops, and Director of Engineer Services, Ottawa. Tenders received by Sec., E. F. Jarvis, Ottawa, till noon August 16, 1913.

Louth Twp., Ont.
School, cost $6,000, planned by Trustees School Sec. No. 7. Tenders receiv-

ed by architect, A. E. Nicholson, St. Catharines, Ont., until Aug. 27th. One storey, 40 x 46, stone foundation, brick construction, Georgia pine floors.

Montreal, Que.
Children's school, cost $45,000, Cedar Ave., for Children's Memorial Hospital. Architects, Brown & Vallance, 44 Canada Life Bldg. Excavating, W. V. Brennan, 6 Lincoln Ave., Verdun. Tenders received by Architect for all other trades. Cement foundation, Montreal limestone and Laprairie brick.

Church, cost $25,000, St. Henri Ward, for St. Henri Parish. Contract will be signed about March, 1914. Tenders received by Architect, J. T. Decarie, New Birks Bldg. 180 x 50.

Ottawa, Ont.
Government buildings for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Chief Architect, D. Ewart. Commission appointed by government have prepared conditions for competition. Sketches will be received until January 2nd, 1914. Estimate cost of buildings $5,000,000. Open to all British Architects.

Underground lavatory, cost $15,000, City Hall Square, for City of Ottawa. Mayor, J. A. Ellis. Architect, F. C. Sullivan, Castle Bldg., Queen St. Concrete foundation. brick construction.

Parrsboro, N.S.
Post office and customs fittings. Tenders received by Dom. Govt., Dept. of Public Works, R. C. Desrochers, Secretary, Ottawa, until August 25th. Plans, etc., at office of J. C. McDougal, Clerk of Works, Parrsboro, W. Bishop, Inspector of Dominion Buildings, Halifax, and at Department, Ottawa.

Quebec, Que.
Theatre, cost $60,000, N. D. des Anges, for P. Allaire & Jos. Desvaresne, 7 and 9 Notre Dame des Angres. 135 x 75. Plans in progress.

Regina, Sask.
Church, cost $70,000, 8th Ave., for St. Andrews Presbyterian Church. Architects, Reilly, Dawson & Reilly, 512 Westman Chambers. Brick foundation and construction. Plans prepared.

Toronto, Ont.
Registry Office planned by Board of Control. Mayor, H. C. Hocken. Time has been extended until October 1st for filing competitive plans.

Memorial gateway, cost $4,000, High Park Ave. and High Park, planned by Board of Control. Park Commissioner has had plans prepared. Tenders will be called shortly.

Winnipeg, Man.
Postal sub-station, Portage and Lipton streets, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Have purchased site at corner of Portage Ave. and Lipton street.

Refrigeration plant, cost $12,470. Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. For supply of motor driven refrigerating plant and refrigerator boxes for King Hospital, Morley Ave. to Linde Can. Refrigeration Co., Youville Sp. and St. Peter St., Montreal.

Excavation for church, cost $50,000, Cathedral ave., for St. Johns Presbyterians. Pastor, Rev. J. P. Jones, Bannerman ave. Architect, R. L. Smith, 417 Somerset Bldg. Excavation contractor, Arthur Morrison, 37 Athol ave. Tenders will be called shortly for construction of basement. Remainder will be done next year.

Drill hall, for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Sept. 3. Plans at office of Dept. and H. E. Matthews, Supt. Architect of Dominion Public Buildings, Winnipeg.

CONTRACTS AWARDED

Beauport, Que.
Drill hall, cost $30,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Celestin Parent, Beauport.

Charlottetown, P.E.I.
Rebuilding church, cost $200,000, for St. Dunstan's R. C. Cathedral. Builders, John S. Metcalf Co., Ltd., 54 St. Francois Xavier Street, Montreal. Supt. of Construction, F. R. Hodge, Box 217. Walls to be reinforced with brick and cement, steel beams, 45 x 30, 2 storeys.

Edmonton, Alta.
Addition to hospital, cost $55,000, 8th ave. west, planned by City Commissioners. Architects, Wilson & Herrald, Baalim Block. General contractors, Alson & Johnson, University Grounds. Two storeys, 20 x 52, brick and stone construction, brick foundations. Excavating done.

Greenwood, B.C.
Post office, cost $41,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Jno. Benmis & Son.

Le Pas, Man.
School, cost $76,578, for Dom. Govt. Dept. of Indian Affairs, Ottawa. General contractors, Snyder Bros., Portage La Prairie

Matane, Que.
Public building for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, J. H. Morin & Son, Trois Pistoles, Que.

Medicine Hat, Alta.
School, cost $8,000, Bridge Street, for School Board. Architects and builders, Sackrider & Turner, Toronto and Main Streets. Two storeys, 50 x 100, brick and structural steel construction.

Montreal, Ont.
Addition to post office, cost $20,200, Lachine, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Dalbe Viau, 76 St. Gabriel. General contractor, Adolphe Gauthier, City Building Inspector, Lachine. One storey, 30 x 40.

Ottawa, Ont.
Hall, cost $6,000, for St. John Evangelist Church. Architects, Horwood, Taylor & Horwood, Sparks St. Mason, Geo. Ambridge, Besserer. Carpenters, Taylor & Lackey, 1st ave. Stone foundation, solid brick construction, felt and gravel rfg.

Addition to church, cost $4,000, Clarence, for St. John Evangelist Church. Architects, Horwood, Taylor & Horwood, Sparks St. General contractor, Geo. Ambridge, Besserer. Stone foundation, brick construction.

Quebec, Que.
School, cost $200,000, Massue, for The Catholic School Commission. Architect, R. P. Lemay, 19 d'Aiguilion. General contractors, Jinchereau & Lamonde, Que. Masonry and plastering, J. B. Jinchereau, 325 Richardson. Carpentry, P. A. Lamonde, 52 St. Francois. Roofing, Eug. Falardeau, 143 Dorchester. Painting, Marier & Tremblay, Bridge Street. Heating, plumbing, and electrical work, Fortunat Gingras, St. Augustin St. Three storeys and basement, 150 x 75, stone foundation, Scotch brick construction.

Repairs to No. 3 fire station, Dorchester, for City Council. Mayor Nap. Drouin, City Hall. General contractor, carpenter, steel, Le Boivin, 202 Richelieu. Roofing, E. Falardeau, 143 Dorchester. Painting, Simard & Frere, 270 St. Joseph.

Red Deer, Alta.
Armory, cost $36,000, for Dom. Govt. Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa. Architect, C. A. J. Sharman. General contractors, Nesbit & Miller. Two storeys, stone foundation,

Rothesay, N.B.
Addition to college residence for Rothesay Collegiate School, c/o Rev. W. R. Hibbard. Architect, G. E. Fairweather, 13 Germain street, St. John. General contractor, Jas. Henderson.

Regina, Sask.
Jewish Synagogue, cost $15,000, planned. President, S. Pearlman, Tenth avenue and Broad Street. General contractors, Melville & Dowell. 30 x 50, brick and stone construction, slate roofing. Foundations in.

Toronto, Ont.
Theatre, cost $8,500, 373 Yonge street, for E. Jackson, 661 Spadina Ave. Architect, J. W. Siddall, 75 Yonge St. General contractor, Thos. McCarty, 20 O'Hara. Two storeys, 33 x 130, brick foundation.

Winnipeg, Man.
Addition to Synagogue, cost $10,000, for Schaarez Schomajim Synagogue, Dagmar street. Architect, M. Blankstein, 450 Dufferin ave. General contractors, A. J. Bennett & Bros., Confederation Life Bldg. Stone foundation, pressed and common brick construction. Seating capacity will be increased by 200.

Club building, cost $50,000, Broadway, for Adanas Club, 208 Main street. Architects, Pratt & Ross, Electric Railway Chambers. General contractors, National Construction Co., 307 Donalda Bldg. Steel, Vulcan Iron Works, Point Douglas ave. Plumbing, Bearto Plumbing Co., Fort St. Electrical work, McDonald & Willson Lighting Co., 309 Fort St. Three storeys, brick construction.

Business Buildings and Industrial Plants

Bradford, Ont.
Watson Limited contemplate building a factory. Ratepayers to vote August 12th to loan $42,000 to company for twenty years.

Fort William, Ont.
Warehouse, cost $35,000, Hardisty, for

Fife Hardware Co., Hardisty street. Tenders received by architect, R. E. Mason. Four storeys, 60 x 125, cement and pile foundation, brick construction.

Hamilton, Ont.
Alterations to store, cost $5,000, York St., for Duff Stores, Ltd. Architects, Watt & Blackwell, Lister Chambers. Tenders received by owner.

Store, cost $5,000, King St., for B. H. Webster, Wentworth and King streets. Tenders received by architect, F. W. Warren, 808a Bank of Hamilton Bldg. One storey, 24 x 80, cement foundation, pressed brick construction.

Medicine Hat, Alta.
Candy factory, cost $25,000, for John H. Taber et al. President, Ald. W. H. Doty. Vice-president, Chas. England, Redcliffe, Alta. Plans in progress.

Montreal, Que.
Store, cost $20,000, Viger, for J. B. Drapeau, 915 St. Hubert. General contractor and builder, D. Dupras, 430 Champlain. Brick, Treffle Guilbeault, 914a Demontigny. Carpentry, general contractor. Steel, Phoenix Bridge Co., 83 Colborne. Tenders for roofing, plastering, painting, heating, plumbing and electrical work to close in about two weeks with general contractor.

Garage, cost $20,000, Maisonneuve (Notre Dame near St. and Desjardins) for Elz. Dansereau, 673 Notre Dame. Architect, C. A. Reeves, 38 St. James. Three storeys, 43 x 100, concrete foundations. Plans ready.

Factory for Metals Extraction, Ltd., c/o L. G. Glass, 30 St. James St. Company has authorized capital of $100,000. Plans in progress.

Pt. Rowan, Ont.
Shoe store, cost $7,000, planned for Harrison Harringer, Main St. Plans may be obtained from owner. Two storeys, stone and cement foundation, white brick construction.

Regina, Sask.
Office and store, cost $20,000, Broad, for Geo. Broder, Winnipeg St. and Victoria ave. Two storeys, brick construction and foundations, maple and concrete floors. Plans in progress.

Richmond Hill, Ont.
Greenhouse, cost $50,000, for J. H. Dunlop, 644 Lansdowne ave., Toronto. Architects, Gordon & Helliwell, 525 Confederation Life Bldg., Toronto. Boilers and heating, H. V. Pierce, Detroit. Tenders called for boiler house. Owner building greenhouse probably by day labor. Necessary equipment required. Concrete foundation, steel construction.

St. Catharines, Ont.
Factory, cost $40,000, Carleton, planned for Armstrong Cork Co., Pittsburg, Pa. Architect, company's architect. Tenders received by owners. One storey, concrete foundation, frame and galvanized iron construction.

Toronto, Ont.
Hotel, cost $35,000, Danforth Ave. & Dawes Rd. Architects, Ellis & Connery, Manning Chambers. Three storeys, concrete foundation, stone and brick construction.

Victoria, B.C.
Bank building planned for Bank of British North America. Site purchased at S.W. corner of Superior and Menzies St. Plans will be prepared.

Windsor, Ont.
Addition to laundry, cost $15,000, Wyandotte, for I. O. Sanboran. One storey, 47 x 46. Work to be done by day labor. Complete equipment required.

CONTRACTS AWARDED

Edmonton, Alta.
Biscuit factory for North West Biscuit Co. Manager, Mr. Shaw, 348 Jasper Ave. E. General contractors, Wilson & Hughes, 348 Jasper Ave. E. Two stys., brick construction, three ovens, full equipment required.

Halifax, N.S.
Warehouse, Windsor street, for Rhodes Curry Co., Ltd., Amherst. John MacLellan, foreman, Robie St. General contractor, owner. Warehouse to be built on Windsor street instead of old site on Robie street.

Hamilton, Ont.
Addition to store, cost $5,000, King E. for Walter Howell, Emerald and King Sts. Architects, Mills & Hutton, Bank of Hamilton Bldg. General contractors, Hogan & Farr, 15 Fairholt Ave. Two storeys, stone foundation, brick construction.

Medicine Hat, Alta.
Store and residence, cost $5,000, 4th ave., for J. N. MacLeod, 111 Montreal St. Architect and builder, owner. Two storeys, 35 x 50, frame.

Moncton, N.B.
Factory, cost $9,700, Botsford, for Maritime Hat & Cap Co., Church. Architect, H. C. Mott, 13 Germain Street, St. John. General contractors, R. C. Donald and S. O. Humphrey. Three storeys, 75 x 50.

Montreal, Que.
Office and light manufacturing building, cost $25,000, 146 St. Urbain, for Succession David Ouimet, 8th floor, 136 St. James. General contractor, Gilbert Demers, 1215 St. Denis.

Store and residence, cost $6,000, Mountain, for H. N. Cohen, 129 Mountain St. Architect, L. J. T. Decarie, New Birks Bldg. General contractors, Purves & Henderson, 214 St. Antoine. Two stys., 31 x 60, concrete foundation, brick construction.

Addition to factory, cost $30,000, Parthenais street, for Dom. Oilcloth Co., 1192 St. Catherine E. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractors, Church, Ross & Co., 40 Hospital St. Roofing, D. M. Long, rear 39 Windsor.

Factory, cost $8,000, Provinciale Lane. Builder and owner, Mariotti Marble Co., 269 Ottawa. One and two storeys, 132 x 107, brick construction.

Shoe factory, cost $11,000, Carriere, for British Construction Co., 238 St. James. Architects and builders, owners. Mason; Ant. Violanga, 624 St. Christopher. One storey and basement, 100 x 45.

Port Arthur, Ont.
Stores and offices, cost $425,000, for Jas. Whalen & Co. Architects, Brown & Vallance, 32 Canada Life Building, Montreal. General contractors, Canadian Stewart Co., E. T. Bank Bldg., Montreal. Tenders called by general contractor for marble and tile work, painting and glazing. General contract closed August 7th.

Richmond, Que.
Hotel for J. H. Lane, Main street. Architect, C. E. White, 137 Wellington St., Sherbrooke. Iron and steel, MacKinnon, Holmes & Co., Sherbrooke. Four storeys, 86 x 80.

Regina, Sask.
Office building, cost $15,000, Scarth, for Canadian Financial Corporation. General contractor, H. Black, New Black Block. Two storeys, brick construction, concrete foundation.

Saanich Inlet, B.C.
Hotel, cost $76,000, Brentwood Bay. Owner, c/o architects, Hault & Horton, 729 Fort St. General contractor, A. Lacoursiere, 1312 Gladstone. Three stys. and basement, frame and roughcast construction. Forty rooms, billiard room. Swimming tank 150 ft. long.

St. Stephen, N.B.
Shoe factory, cost $10,855, for Town Council. Mayor, Mr. Dinsmore. Clerk, Jas. Vroom. Inspector of construction, David Johnston. General contractor, Thos. Toal. Two storeys, cement foundation, frame construction. Work to start at once.

South Edmonton, Alta.
Store and apartments, cost $8,000, 19th ave. south, for L. L. Pearce, 16 Jasper Ave. E. Architect, C. W. Morehouse, 27 Jackson Block. General contractors, Chappel Bros., 102 York St. Two stys., 33 x 55, frame construction.

Toronto, Ont.
Two stores and residences, cost $12,000. Owner and general contractor, W. J. Young, 27 Danforth ave. Architect, P. H. Finney, 79 Adelaide St. E. Work to be done by day labor. Three storeys, brick construction, felt and gravel rfg.

Warehouse, cost $35,000, 145 College St., for Temple Pattison Co., 12 Queen E. Architects, Denison & Stephenson, 20 King W. General contractors and carpenters, Carlyle & Son, 18 Toronto St. Mason, H. Needham, 148 Crawford. Five storeys, 138 x 41, concrete and brick foundation, brick and steel constr.

Walkerville, Ont.
Addition to Office Bldg., for Canadian Bridge Co. General contractor, Victor Williamson, Huron and Walker Road. Contract for 70 h.p. boiler and equipment awarded to Messrs. E. Leonard & Sons, London.

Residences

Dundas, Ont.
Residence, Sydenham, for W. M. Armstrong, King St. Architect, M. H. Hewitt. Tenders received by owner until August 13th. Three storeys, 24 x 34,

cement foundation, artificial stone construction.

Hamilton, Ont.

Residence, cost $6,000, for E. Carlton, Balmoral Hotel. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½ storeys, 33 x 40, stone foundation, pressed brick construction. Plans in progress.

Two residences, cost $5,000, Locke St., for Mrs. Geo. Husband, c/o architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½ storeys, 17 x 40, stone foundation, brick construction.

Medicine Hat, Alta.

Residence, cost $4,000, Alberta. Architect and owner, T. Montgomerie & Co., 12 Hull Block. Two storeys, 28 x 36, frame construction.

Montreal, Que.

Flats, cost $16,000, Coloranie, for D. Raymond, 1896 Clark. Three storeys, 216 x 40, brick construction. Plans ready.

Apartment house for Metropolitan Apartment Co., Ltd., c/o J. G. Avard, 120 St. James St. Above company capitalized at $250,000 and will build in the fall. Plans not decided yet.

Residence, Pointe Claire, for G. Napier. Tenders received by architects, Turner & Carless, 116 Board of Trade Bldg., Montreal. Three storeys, 70 x 50, concrete foundation, field stone, roughcast and brick construction.

Flats, cost $12,000, Fortune Ave., for L. Lavinge, 140 Gordon ave. Architect and builder, masonry, carpentry, plastering and painting, owner. Roofing, heating and plumbing, owner open for tenders. Three storeys, 75 x 50, brick construction.

Ottawa, Ont.

Residence, cost $7,000, Wilbrod, for Wolf Shenkman, 226 Friel St. Architect, F. C. Sullivan, Castle Bldg., Queen St. 2½ storeys, 33 x 40, stone foundation, brick construction.

Sandwich, Ont.

Two family flat, cost $5,000, for Wm. Jackman. Architects, G. Jacques & Co., Windsor, Ont. Two storeys, 26 x 44, frame construction.

Toronto, Ont.

Residence, cost $6,000, for E. E. Horton, 13 Rose ave. Architects, Gordon & Helliwell, 525 Confederation Life Bldg. Residence to be built in place of apartment house. Tenders received by architect. Three storeys, stone foundation and brick construction, shingle roofing.

Residence, cost $5,000, Greenwood, for H. Seddon, 122 Brock ave. Architect, E. R. Conlan, 73 Glendale ave. Owner calling for tenders for all trades. Plans and specifications at 122 Brock ave. 2½ stys., 24 x 30, stone foundation, brick construction.

Residence, cost $8,000, York Mills Rd., for Mrs. Chas. Catto, c/o architects, Page & Waffington, Confederation Life Bldg. Stone and brick construction. Contracts not yet awarded.

Bungalow, cost $8,000, Port Credit, Owner's name withheld. Architect, J. A. Thatcher, 31 Queen W., Toronto. Cobble stone construction.

Apartment, cost $15,000, Winchester St. Owner's name withheld. Architect, L. Foulds, 21 Leader Lane. Three stys., concrete foundation, brick and stone construction.

Vancouver, B.C.

Residence, cost $15,000, for Dr. M. F. Keeley, 736 Granville street. Architect, M. L. Taylor, Dominion Bldg. 2½ stys., and basement, 40 x 42, frame and stucco construction. Plans ready.

Victoria, B.C.

Apartment building, cost $12,000, for Thomas & Dawson, c/o architect, Jesse M. Warren, 503 Central Bldg. Two stys., and basement, frame and stucco constr,

Westboro, Ont.

Residence, cost $5,000, Highland ave., for W. Hager, Main St. Stone foundation, brick veneer construction. Plans in progress.

Residence, cost $4,500, Highland ave., for Geo. Linton. 2½ storeys, stone foundation, brick veneer construction. Plans in progress.

Winnipeg, Man.

Residence, cost $50,000, Wellington Cres., for Mrs. I. V. Chalmers, 57 Carlton St. Architects, Jas. Chisholm & Sons, Enderton Bldg. Three storeys, concrete foundation, stone construction. Tenders will be called shortly.

CONTRACTS AWARDED

Brandon, Man.

Residence, cost $4,000, 7th St., for G. W. Kerr, 258 12th St. Architect and Builder, A. C. Jones, 816 7th St. Two storeys, 36 x 48, frame construction.

Edmonton, Alta.

Residence, cost $4,000, 4th ave. north, for C. M. Rummel, 622 7th St. N.W. Architect, E. W. Morehouse, Jackson. General contractors, Chappel Bros., 102 York street. Two storeys, 24½ x 46½, frame construction. Foundations in.

Residence, cost $4,000, 22nd, for Cushing Bros., Elizabeth St. Two storeys, 28 x 44, frame construction.

Halifax, N.S.

Residence, cost $6,300, Lucknow, for H. H. Stanford, 156½ Hollis St. Builders, Maxner & Dunlop, 152 Windsor St. doing all work. 2½ storeys, 27 x 48, cement foundation, frame construction.

Medicine Hat, Alta.

Residence, cost $9,500, Ogiltree Street, for J. Shields, 205 Main St. Architect and builders, Hotson, Leader & Goode, Main St. Three storeys, 26 x 38, brick and stone construction.

Residence, cost $5,500, Crescent Hts., Lot 7, Block 16, for A. McCarter, 825 Main St. Architect and builder, owner. Two storeys, 30 x 42, frame and artificial stone construction.

Residence, cost $4,200, Lawton Street, for A. R. Pointer, City Hall. Architect and builders, Hotson, Leader & Goode, Main St. 2½ storeys, 26 x 36, frame, cement foundation.

Residence, cost $8,500, for J. E. Davies, c/o Alberta Foundry & Machine Company. Architects, Bourne & Morrison, Huckvale Block. Work done by day labor in charge of Mr. Young, 428 Toronto street. 2½ storeys, 34 x 40, cement foundation, frame construction.

Residence, cost $4,000, Charles, for E. Schmid, C. P. R. Depot. Architects and builders, Hotson, Leader & Goode, Main street. Two storeys, 26 x 30, frame.

Montreal, Que.

Flats, cost $9,000, Maisonneuve(between Wm. David St. and 4th avenue). Architect and builder, Alberic Lemaiy, 274 1st ave., Viau.

Residence, Westmount (Redfern Ave.) for W. J. Brennan, 421 Mount Pleasant. Architects, Gordon & Aird, 115 Stanley St. Masonry, Murray & McRitchie, 20 St. Nicholas. Carpentry, Bromsgrove Guild, 456 Clarke. Plastering, MacIntyre Plastering Co., 53 Latour. Painting, Alex. Craig, 41 Jurors. Heating and plumbing, Thos. O'Connell, 183 Ottawa. Roofing and electrical work not let.

Apartment house, cost $10,000, Ed. Charles, for Eusebe Lecavalier, 65 Cherrier. Builder, Mr. Chasse, 4221 Chateaubriand. Three storeys, 26 x 69, cement foundation, solid brick construction.

Five flats, cost $15,000, Visitation, for British Building Co. Architect and builder, owner. Painting, Come Chaterand, 497 Dorchester St. E. Plumbing, E. Callaghan, 28 Gallery Sq. Three stys., 41 x 85.

Terrace four residences, cost $22,000, Westmount (Holton ave.) for J. B. Scott, 30 Springfield. Architect and builder, owner. Two storeys and basement, 22 x 50, reinforced concrete construction.

Residence, cost $7,000, Bordeaux. Builder and owner, Mercure Hardware & Lumber Co., 1124 Rachel St. Three storeys, 50 x 40, cut stone and brick construction.

Residence, cost $25,000, Pine Ave., for J. A. Trudeau, 22 Notre Dame W. Architect, Wilford A. Gagnon, Room 1002 New Birks Bldg. General contractors, John Quinlan & Co., 4412 St. Catherine W. Two storeys, 23 x 35, concrete foundation, stone and brick construction.

Two residences, cost $9,000. Westmount, Burton ave., for J. H. Norris, 122 Arlington ave. General contractor, carpentry, roofing, owner. Plastering and painting not let till August 26th. Heating, plumbing and electrical work, August 12th.

Flats, cost $6,500, Verdun, Gordon, for Messrs. Valiquette & L. Lavigne, 140 Gordon. Builder, L. Lavigne. General contractors, owners. Tenders received by builder for roofing, heating and plumbing. Three storeys, 36 x 44, brick construction.

Quebec, Que.

Residence, cost $11,000, Lockwell, for Chrysante Jobin, 3 Racine. General contractors, carpentry, painting, interior fittings, owner. Masonry, plastering, Edward Belanger, Beauport. Roofing, heating, plumbing, electrical work, P. Paradis, 236 d'Aiguillon. Three storeys, 48 x 35, stone foundation, red and stock brick construction, galvanized iron and asbestos paper rfg. Excavating started.

Residence, cost $10,000, Lockwell. General contractor, carpenter, J. E. Jobin, 107 d'Aiguillon. Masonry, plastering, Ed. Belanger, Beauport. Roofing, heating, plumbing, electrical work, P. Paradis, 236 d'Aiguillon. Painting, Pelchait & Aubin, 182 Bayard. Three storeys, 50 x 43, galvanized iron and asbestos rfg.

Residence, cost $10,000, Limoilou, cor. 6th St. and 3rd Ave., for Nap. Bergeron, Montmorency Falls. General contractor and carpenter, Ed. Bouchard, 234 Prince Edouard St. Masonry and plastering, D. Guerin, Beauport. Three storeys, 76 x 32, Scotch brick construction.

Residence, cost $21,000, Maisonneuve, for J. V. Auger, Maisonneuve street. General contractor and mason, J. Giroux, 56 4St. Francois. Roofing, heating, plumbing and electrical work, Jobin & Paquet, 72-78 Cote d'Abraham. Four storeys, 99 x 53, solid brick construction.

Regina, Sask.
Residence, cost $6,000, Lorne. Owner and general contractor, D. J. Ruttan, Lorne St. Brick construction, concrete foundation. Excavating started.

Residence, cost $5,000, Robinson street. Architect and general contractor, W. F. Surtees, 12th ave. Two storeys, frame and brick construction. Foundations in.

Residence, cost $5,000, Garnet. Owner and beneral contractor, F. Bruce, Garnet Street. 2½ storeys, brick construction, concrete foundation.

Sault Ste. Marie, Ont.
Residence, cost $4,500, Caston Sub. D. Owner and builder, D. Jannison, Albert St. Two storeys, 26 x 31, stone foundation, brick veneer construction. Excavating started.

South Edmonton, Alta.
Residence, cost $4,500, 2nd ave. north. Architect and owner, Mrs. S. L. McLellan, 776 Whyte ave. west. General contractor, Thos. Leake ,4th ave. s.w. 2½ storeys, 26 x 38, frame.

Residence, cost $4,500, University ave. Architect and owner, Dr. McPherson, Hulbert Block. General contractor, T. W. Jackson, Commercial Hotel, Whyte ave. 2½ storeys, 37 x 28, brick veneer and roughcast construction.

Residence, cost $4,000, 5th ave. north, for Haug & Blakotad, Box 4581. Architect and builder, owner. Two storeys, 24 x 38, frame, cement foundation.

St. John, N.B.
Bungalow, cost $6,000, Mt. Pleasant. Architect and owner, W. P. Queen, Canada Life Bldg., Prince Wm. St. General contractor, R. A. Corbett, Douglas ave.

Toronto, Ont.
One detached and one pair residences, cost $6,000, Cloverdale. General contract and owner, R. C. Grieves, 53 Gladstone ave. Two storeys, 33 x 42, pair, stone foundation, brick construction.

Residence, cost $9,000, for W. H. Baker, 84 Wellington W. Architects, Chadwick & Beckett, 18 Toronto St. Work done by day labor. 2½ storeys, 38 x 50, stone foundation, stone, brick and steel construction.

Seven pair residences, cost $15,000, Fairmount Cres. General contractor and owner, H. E. Bond, 53 Shuddell. Owner will sublet heating, plumbing, wiring and plastering. Two storeys, 33 x 40, pr. stone foundation, brick construction.

Three pair residences, cost $12,000, Bowmore. General contractor and owner, H. E. Bond, 53 Shuddell. Owner will sublet heating, plumbing, wiring and plastering. Two storeys, 34 x 40, brick foundation, brick construction.

Residence, cost $8,000, Port Credit, for Father McCaffery, Port Credit. Architects and builders, Jno. Miller & Son. Port Credit. Plumbing and heating, D. P. J. Hayes, 1245 Queen W. Work done by day labor. Stone foundation, stone and brick construction.

Three residences, cost $7,000, Sellers ave., for Moore Bros., 10 Penwood ave. Architect, P. H. Finney, 79 Adelaide St. E. General contractor, owner. 2½ stys., brick foundation, frame and brick construction. Work to be done by day labor.

Residence, cost $6,000, Wells Hill ave., for Thos. Holmes, 10 Wells Hill Ave. Architect, J. Hunt Stanford, Bloor and Ossington. General contractor, owner. will sublet. 24 x 36, stone foundation, brick construction.

Five hundred residences, about $2,500 each, North of Danforth ave., for McEachren & Sons, Ltd., King St. E. Superintendent in charge, A. H. Martin, c/o McEachren & Sons, Ltd. Intend to build 500 houses if demand holds out, in lots of 15, one lot already completed. Work being done by day labor. Brick construction, stone foundation.

Residence, cost $14,000, E. Roxboro, for F. K. Birge, c/o architects, Sproatt & Rolph, 36 North St. Masonry, W. Hughes, 216 Simcoe St. Two storeys, brick construction, brick foundation.

Winnipeg, Man.
Two residences, cost $4,200 each, Norwood. Architects and general contractors, Whitlaw & McFadyen, 601 Electric Railway Chambers, Winnipeg. 2½ stys., and basement, frame construction, stone foundation. Excavating started.

Three residences, cost $9,000 each, River Heights. Whitlaw & McFadyen, 601 Electric Railway Chambers, Winnipeg. 2½ storeys and basement, brick veneer construction. Foundations in.

Residence, cost $9,000, Kingsway. Architects and general contractors, Andrews & Sons, Portage & Victor. 2½ storeys and basement, brick veneer and stone construction, stone foundation. Excavating started.

Residence, cost $25,000, Assiniboine ave., for Rev. C. W. Gordon, 567 Broadway. Architect, G. W. Northwood, 502 Northern Crown Bank Bldg. General contractors, J. McDiarmid & Co., Canada Bldg. 2½ storeys, brick veneer construction, stone trimmings, stone foundation.

Power Plants, Electricity and Telephones

St. John, N.B.
Power house for St. John Street Railway Co. Manager, H. M. Hopper, Dock St. General contractors, A. R. C. Clark & Son, 51 Water Street.

Winnipeg, Man.
Ornamental street lighting standards for Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Dawson & Co., Ltd., 56 Albert St., for 90 double arm ornamental poles, type "E" at $110.60 each. 40 single arm ornamental poles, type "B" at $90.10 each.

Addition to power house, cost $35,000, Rover St., for Board of Control. Secretary, M. Peterson. Engineer, J .G. Glassco, 54 King St. General contractors, Fort Garry Construction Co., Ross and Arlington Sts.

Addition to dorkshop, Morley avenue for Board of Control. Secretary, M. Peterson. Engineer, Geo. Stoker, Secretary of Hospital Commission for addition to power house to be used as ambulance, garage, mechanic's workshop & storeroom. Plans, specifications, etc., at office of Engineer. Tenders received by Chairman, Board of Control, till 11 a.m. August 15.

Miscellaneous

Listowel, Ont.
Fire equipment. Town Council contemplates purchase of fire equipment. Mayor, Wm. Climie.

Ottawa, Ont.
Wooden tug for Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, W. H. Kelly Lumber Co., Buckingham, Que. 50 ft. 6 in. single screw wooden tug.

Cable for City Council, Electrical Dept. Engineer, Supt. J. E. Brown. Tenders received by Chairman Electrical Department, until August 14th. 47,000 ft. of underground lead covered cables and 14 induction regulators.

Prescott, Ont.
Tenders received by Minister, Alex. Johnson, Ottawa, Dom. Govt., Dept. of Marine & Fisheries, until August 28th for construction of single screw steel steamer, 164 ft. 6 in. over all, breadth mounlded 30 ft., depth moulded 13 ft. Specifications at office of Purchasing Agent of Dept., Ottawa, Collector of Customs, Toronto, Collingwood, Port Arthur and at Agencies of Marine & Fisheries, at Montreal, Quebec, St. John, Halifax & Charlottetown, P.E.I.

Summerside, P.E.I.
Rifle range for Dom. Govt., Dept. of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. Tenders to be called as soon as property transfers are made. Three or four target range, steel constr.

Winnipeg, Man.
Tenders received by Secretary of Bd. of Control, M. Peterson, until July 31st for 15,000 lbs. 500,000 C.M. weatherproof, insulated, triple braided, stranded copper wire, 10,000 lbs. No. 0000 C.M. weatherproof, insulated, triple braided, stranded copper wire.

Business Notes

Athabasca Landing, Alta.
Grand Union Hotel and The Athabasca Hotel burned. Other building destroyed, Royal Bank Bldg., Bank of Commerce, Barracks of R. N. W. M. P., Warehouse of Athabasca Forwarding Co. Several houses and stores owned by Isaac Gagnon, total loss, $750,000.

Charlottetown, P.E.I.
Sash and door factory and woodworking mill owned by H. P. Hagan, burned. Loss $25,000; no insurance.

Hymers, Ont.
Saw mill owned by Hymers Bros., burned. Loss $30,000; no insurance.

Hensall, Ont.
Business block owned by R. Bell, burned, loss $10,000. Occupants, F. C. McDonnell, jeweler and Hugh McLean, dry goods.

Humboldt, Sask.
Business block occupied by Burnison Bros. Stockert & Elliott, barber shop

(Continued on page 74)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders will be received by the undersigned up to the **15th day of August, 1913**, for the heating of the Walkerton Public Library. Plans and specifications may be seen at the office of the secretary, Walkerton, or at the office of Mr. Geo. Gray, architect, Harriston. The lowest or any tender not necessarily accepted. W. B. Thompson, Secretary. 32-33

Tenders for Concrete Bridges

Sealed tenders, addressed to William Buller, Chairman Board of Works, Peterborough, Ont., and endorsed "Tenders for Concrete Bridges," will be received until 5 p.m., **Wednesday, August 20th, 1913**, for the construction of a reinforced concrete arch bridge of twenty-six (26) ft. span, sixty-six (66) ft. long on Park St., and for a reinforced concrete slab and beam bridge of twenty-seven (27) ft. span, sixty-six (66) ft. long, on McDonnel Street. Separate tenders for each bridge shall be made. Plans and specifications may be seen at the City Engineer's office, Peterborough, Ont. Each tender must be accompanied by an accepted cheque for five per cent. of the amount of the tender. The lowest or any tender will not necessarily be accepted.

Peterborough, Ont., Aug. 5, 1913.

33 R. H. PARSONS, City Engineer.

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, Magnetawan River," will be received until 4 p.m., Wednesday, 20th August, 1913, for dredging required at Burks Falls, Ont.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work. Dredges and tugs not owned and registered in Canada shall not be employed in the performance of the work contracted for. Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, (no cheque to be for less than fifteen hundred dollars), which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45752. 32-33

Tenders for Pavement

Sealed tenders addressed to William Buller, Chairman Board of Works, Peterborough, Ont., and endorsed "Tenders for Pavement," will be received until 5 p.m., **Wednesday, August 20th, 1913**, for the construction of Bitulithic and Asphaltic Concrete Pavements on George and Charlotte Streets and for Bitulithic, Asphaltic Concrete, and Portland Cement Concrete Pavements on Hunter Street, Peterborough.

Plans and specifications may be seen at the City Engineer's office, Peterborough, Ont. Each tender must be accompanied by an accepted cheque for five (5) per cent. of the amount of the tender.

The lowest or any tender will not necessarily be accepted.

R. H. PARSONS, City Engineer.

Peterborough, Ont., Aug. 5, 1913. 33

Tenders for Construction of Sidewalk

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned, up to 6 p.m. of **Saturday, August 16th, 1913**, for the construction of a concrete sidewalk on Russell Hill Road, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide St. East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, August 9th, 1913. 33

Sealed tenders addressed to the undersigned, and endorsed "Tender for Clock Tower, Public Building, Brampton, Ontario," will be received at this office until 4 p.m., on **Monday, August 18, 1913**, for the construction of a Clock Tower to the Public Building at the place mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Brampton, Ontario, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 28, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44785. 32-33

TENDER

Tenders will be received by A. B. Falconbridge, Township Clerk, Aberfoyle, up to 8 p.m., **Wednesday, August 20**, for the construction of a Beam Bridge on sideroad 15 and 16, Concession 1, Township of Puslinch, known as Paddock's Bridge.

Plans and specifications may be seen at and forms of tenders obtained from the office of Malcolm & Rudd, Engineers, Guelph.

A marked cheque for $25 must accompany each tender as a guarantee of good faith.

The lowest or any tender not necessarily accepted.

MALCOLM & RUDD, Engineers.

Guelph, August 6, 1913. 33

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913**, by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
32-37 Cayuga, Ont.

Sealed tenders, addressed to the undersigned, and endorsed "Tender for East Pier, Eastern Entrance, Toronto Harbor, Ont.," will be received at this office until 4 p.m. on **Tuesday, Sept. 2, 1913**, for the reconstruction of part of superstructure of East Pier of Eastern Entrance to Toronto Harbor, in the County of York and Province of Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life, Building, Toronto, Ont., and H. J. Lamb, Esq., District Engineer, Windsor, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 1, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43525. 32-33

THE PAS, MANITOBA

Notice to Contractors

Sealed tenders, registered and endorsed on the envelope, "Tender for (tender bidding on)" and addressed to H. H. Elliott, M.D., Sec.-Treas. of the Town of The Pas, Man., will be received up to 6 p.m., **August 20th, 1913**, for the construction of the following works:

Tender A—Construction of Sedimentation Basin.

Tender B—Foundations for Power House.

Gravel 75c f.o.b. The Pas, Man.

Marked cheque for five per cent. (5 p.c.) of the amount of the bid must accompany each tender, or in lieu of the said cheque, the tenderer may furnish the bond of an approved surety company.

Plans, specifications and instructions may be seen at the offices of the Consulting Engineers, Saskatoon, or at the Resident Engineer's office at The Pas, Man., or plans and specifications will be given or forwarded on a deposit of Twenty ($20) Dollars—the deposit cheque to be returned if the plans and specifications are returned with the tender.

H. H. ELLIOTT, M.D., Sec.-Treas.,
The Pas, Man.
MURPHY & UNDERWOOD,
Consulting Engineers,
32-33 Ross Bldg., Saskatoon, Sask.

Department of Railways and Canals, Canada

Trent Canal

Port Severn Section—Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Port Severn Section—Severn Division, Trent Canal," will be received at this office until 2 o'clock p.m., on **Monday, August 25th, 1913**.

Plans, specifications and form of contract to be entered into can be seen on or after July **26th** at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.; at the office of the District Engineer, Public Works Department, Midland, Ont., and at the office of the Postmaster, Orillia, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of $10,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 29th July, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—45677. 32-33

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, A1	$700
Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new	$2,500
Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1	$3,500
Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1	$2,800

TRACTION ENGINE

Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?

TRY US!

WILLIS SHAW MACHINERY CO.

La Salle Street, Chicago. Ill.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, August 19th, 1913, for the construction of the following works:

SEWERS

Earlscourt Drainage System, No. 2—Davenport Rd. and Station Rd.

Carlaw Ave. Storm Overflow Sewer, Section No. 2.

Midway Sewer System, outlet via Hiawatha Ave., Gerrard St. and Morley Avenue.

Division No. 2, West Toronto, Woodville Ave.

East Toronto, Section "A," outlet.

Balsam Ave., from Queen St. to Kingston Rd.

Birch Ave., from Queen St. to Lake Front.

Munro Park Ave., from Queen St. to Lake Front.

Neville Park Boulevard, from Queen Street to Lake Front.

Melita St., from Christie St. to 558 ft. east.

Ashworth Ave. from Christie to 531 ft. east.

Awde St. from Dufferin St. to 689 ft. west.

Fort Rouille Ave. from Springhurst Ave. to 142 ft. south.

Lane first north of Bloor St. from Dovercourt Road to east end.

Wilfred Ave. from Servington Cres. to Belsize Drivt South.

Oswald Cres. from S.S. Manor Rd to Wilfred Avenue.

Belsize Drive North, from Thurloe Ave. to Wilfred Ave.

Glebe Rd. from Tullis Drive to Yonge St.

Thurloe Ave. from Servington Cres. to Belsize Drive North.

Servington Cres. from S.S. Manor Rd. to W.S. Thurloe Ave.

Woodbine Ave. from 200 ft. north of Queen St. to Kingston Road.

Berwick Ave. from Yonge St. to 528 ft. west.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto), or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, August 7, 1913.

Department of Railways and Canals, Canada

SOULANGES CANAL

Rebuilding Head of Guard Pier at Cascades Point, Que.

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for rebuilding head of Guard Pier, Lower Entrance, Soulanges Canal," will be received at this office, until noon, on **Friday, August 29th, 1913**.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, Birks Building, Phillips Square, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labor, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached tht actual signature, the nature of the occupation and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada for the sum of $5,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into a contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 9th August, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—46228. 33-34

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont. 29-t.f.

Situations Wanted

Architectural Draughtsman open for engagement. Capable Superintendent, having had large practical experience.

Moderate remuneration to get established. Reliable. Box 849, Contract Record, Toronto. 33

Sand, lime and brick engineer, expert in all silicate products with 18 years experience in Germany, England and the U. S. A., with all machinery and systems, wants to get acquainted with interested parties. Fritz Klaeck, Alexandria, Ont. 33-34

Position Wanted -Engineer, electrical and mechanical, age 26, with extensive workshop experience and University training, desires suitable engagement, more particularly on the sales staff. References, Box 850, Contract Record, Toronto, Ont. 32-33

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Business Notes

(Continued from page 71)

and pool room, and Hallings bakery, completely destroyed. Loss $50,000.

Louiseville, Que.

Stores and residences, burned. Owners, J. E. Beland, shirt factory and residence, loss $35,000; Mr. Francis Trepanier, store and residence, $10,000; L. Asselin, shoe store and residence, $10,000; Gerard Chevailer, factory, $3,000; J. Bourret, store, stables and residence, $25,000; Eugene Bellemare, shop and residence, $4,000; O. Pichette, bakery, $3,500.

Montreal, Que.

Racing stables of Montreal Driving Club, Delorimier Park, Chausse and St. Jerome, burned, loss $7,000. Owners will rebuild. Secretary, Roy Irving.

Sash and blind factory, 206 Papineau ave., owned by Albert M. Wener, 170 McGill St., burned; loss $7,000.

Ottawa, Ont.

Factory, owned by W. D. Ardley, 427 Bank St., burned, loss $6,000. Will rebuild.

Factory owned by Mica Co. of Canada, Ltd., 532 Wellington St., burned, loss $3,000. Will start up again. New machinery wanted.

Revelstoke, B.C.

City Hotel, Clayton Tapping, proprietor, completely destroyed by fire. Loss $32,000.

St. Catherines, Ont.

Brewery storehouse of Taylor & Bates burned. Loss, $6,000; insured.

St. John, N.B.

Stores burned owned by Mrs. A. E. Jones, dry goods; E. W. Moir, Woodstock, N.B., drug store; loss $18,000, covered by insurance.

New Companies

Commercial Power, Light and Coal Co., Ltd., has been incorporated with a capital of $250,000, to carry on the above business in all its branches, with head office at Winnipeg, the incorporators are F. M. Burbidge, barrister, R. C. McPherson, accountant, and R. W. Killey, clerk, all of Winnipeg.

Dorval Land Company, Ltd., has been incorporated with a capital stock of $100,000, to carry on business as builders and contractors, with head office at Montreal. The incorporators are Frank Cunningham, real estate agent, W. G. C. Lanskail, accountant, and Arnold Wainwright, K.C., all of Montreal.

Wrightville Realty Limited, incorporated with a capital stock of $100,000, to carry on business as a general land and building company, with head office at Ottawa. The incorporators are Dr. A. T. Shillington, J. K. Meredith and E. S. Church, merchants, all of Ottawa.

Metropolis Apartments Company, Ltd. has been incorporated with a capital stock of $250,000, to erect apartment houses and carry on business as contractors, etc., with head office at Montreal. The incorporators are D. E. Anthony, manager, C. H. Query, insurance broker, and H. J. Girard, bookkeeper, all of Montreal.

Frontenac Floor and Wall Tile Co., Ltd., has been incorporated with a capital of $250,000, to carry on business as manufacturers and dealers in wall tile of every description, with head office at Kingston. The incorporators are Dr. J. C. Connell, C. A. Macpherson and C. J. Warwick, manufacturers, all of Kingston.

Page & Company, Limited, have been incorporated with a capital of $250,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are Walter Page, G. H. Kilmer and J. A. McAndrews, all of Toronto.

Realty Holding Company, Limited, has been incorporated with a capital of $300,000, to carry on the general business of a land and building company, with head office at Toronto. The provisional directors are A. D. Davidson, real estate commissioner, Cawthra Mulock, financier and Gordon Perry, manufacturer, of Toronto.

The Northern Veneer Company, Ltd., has been incorporated with a capital of $200,000, to manufacture and deal in timber, wood, lumber, shingles, woodworking machines and builders' supplies, with head office at Grimsby. The provisional directors are T. C. Haslett, W. F. McGiverin, and R. C. Ripley, accountants, all of Hamilton.

The Jasper Land Company, Limited, has been incorporated with a capital of $40,000, to erect buildings and deal in building material, with head office at Toronto. The provisional directors are W. A. Phillips, school teacher, W. D. Hay, insurance manager, and Dr. S. M. Hay, all of Toronto.

The Bay of Quinte Wood Company, Limited, has been incorporated with a capital of $500,000, to manufacture and deal in timber, lumber and wood of all kinds, with head office at Toronto. The provisional directors are C. E. Bailey, lumberman, A. M. Donovan, barrister, and W. F. Greig, law student, all of Toronto.

STEEL & RADIATION LIMITED
Products all Made in Canada

Toronto, Ont. Fenestra SOLID STEEL WINDOWS Montreal, Que.

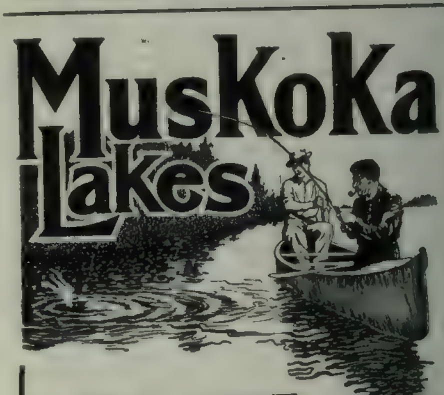
Steelcrete Concrete Reinforcing
Steelcrete Metal Lath
Steelcrete Steel Lockers

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

IF YOUR BUSINESS ISN'T WORTH ADVERTISING, ADVERTISE IT FOR SALE

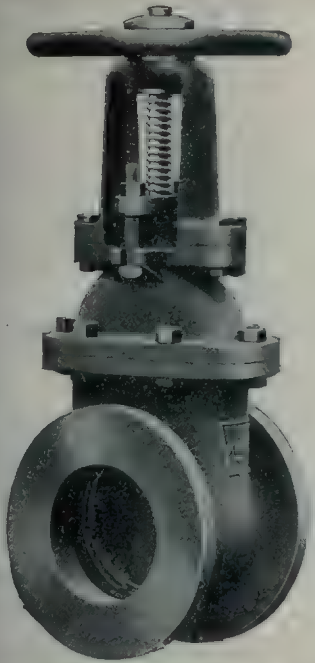


FOR RENT COTTAGES

If you want a real holiday, plan to spend your vacation, this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Canada Lumberman
Toronto, Ont.



The KERR "Keystone"

Iron Body GATE VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

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exclusive output.

Light Your Mill or Factory with

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"LIGHTS LIKE THE SUN"

It reflects the light in the darkest rooms and will cut down your lighting bill.

Can be washed, and will not chip off when applied over delicate machinery.

It is a fire retarder, and when used on wood work lessens the fire risk. Bears the label of the National Board of Fire Underwriters. Can be used equally well in the damp or dry rooms of your mill or factory. Is impervious to moisture or fumes.

IT WAS USED HERE

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Densmore & LeClear, Engineers.

Ask your dealer for it. If he cannot supply you, write us. Drop a postal for Booklet M that tells you all about Bay State Brick and Cement Coating.

Wadsworth, Howland & Co., Inc.
Paint and Varnish Makers and Lead Corroders
82-84 Washington Street
Boston, Mass.
New York Office: 101 Park Avenue at 40th Street

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	18 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	30 00	
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	26 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime, per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $9.00 per 100 lbs.

Boiled Linseed Oil in bbls., 64c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 61c per gallon.

Turpentine, in barrels, 56c per gallon.

Pure Red Lead, dry $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Argenteuil Granite Co., Limited
42 Craig Street West, MONTREAL

We are in the market to bid on your plans for granite on buildings.

Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

SEND US BUILDING PLANS TO-DAY

CAST IRON PIPE SHIPPED FROM STOCK

Prompt Shipments are necessary if your lines are to be laid before frost.

We make all sizes, from 3" to 84"

UNITED STATES CAST IRON PIPE AND FOUNDRY CO.

General Offices:—BURLINGTON, NEW JERSEY

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We Build All Kinds of Cranes for

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Brickmaking Machinery

Complete Outfits for Brickmakers

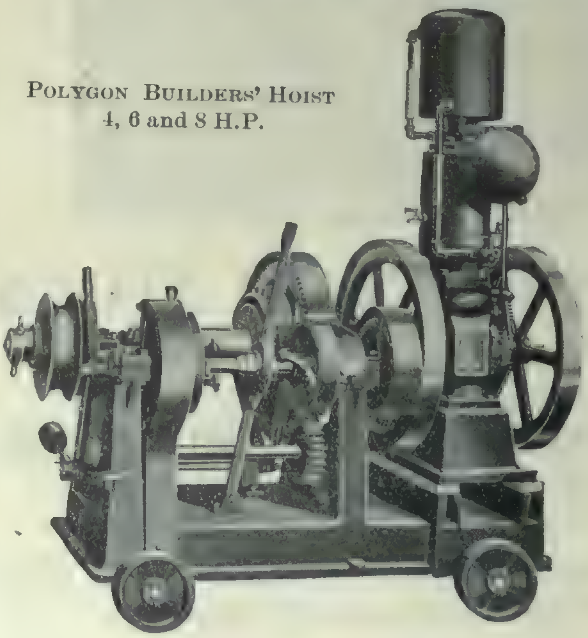
Repairs

Hepburn Scotch Derricks

All Standard Sizes in Stock from 1/2 Ton Upwards

POLYGON

CONCRETE MIXERS
AND
BUILDERS' HOISTS



Polygon Builders' Hoist
4, 6 and 8 H.P.

represent the highest efficiency yet attained in their respective lines. They have demonstrated their superiority through ten years of steadily growing appreciation and large sales all over the world.

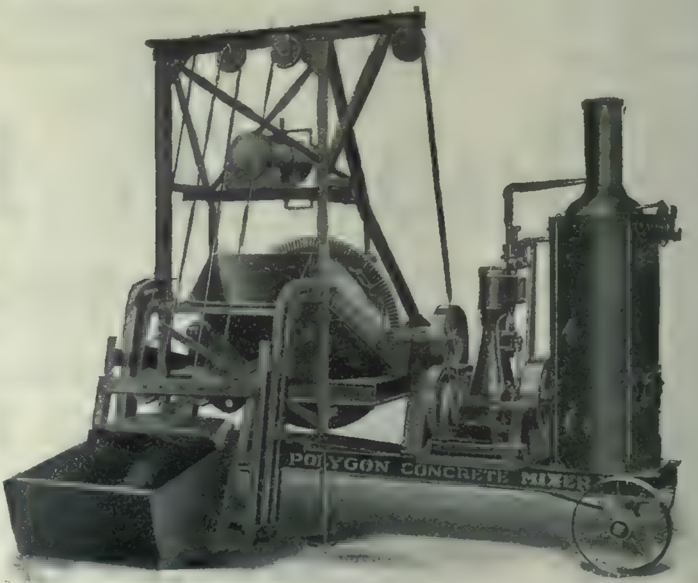
THE POLYGON BUILDERS' HOIST

is a distinctly great advance over all machines of the kind yet designed. Large lifting capacity in ratio to power employed; rigidity, long bearings, covered gears, easy control and other exclusive features warrant examination by all who wish the most efficient hoist to be obtained at moderate price.

The
Polygon Concrete Mixer

has the reputation of being "The Fastest Perfect Mixer." The POLYGON (many sided) form of drum is its distinguishing feature. Once you grasp the POLYGON principle of mixing you will have no other. It mixes concrete, mortar, and other materials, fine or coarse, wet or dry, with equal facility. Size for size the POLYGON will turn out a greater quantity of perfectly mixed concrete than any other mixer.

In all points that make for profit on the job, the POLYGON is the logical choice of all who really investigate. Ask us for full particulars.



Polygon Tilting Drum Steam Outfit with Side Loader
Built in capacities of 7½ to 50 cubic ft. of unmixed material per batch.

WATERLOO CEMENT MACH'Y CORP'N

117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

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Send for Descriptive Bulletin and Prices.

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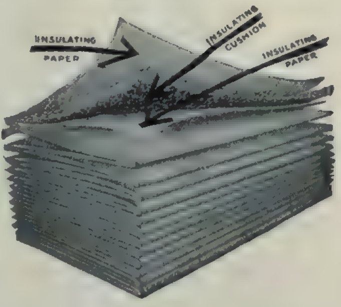
Why Keystone is The Best Insulator



It is an acknowledged fact that to obtain the highest possible insulating efficiency it is necessary to have as many confined or dead air spaces in a material as possible. Keystone Hair Insulator has more dead air spaces to the square inch than any other insulator.

It is made of a heavy layer of cleansed and sterilized cattle hair, securely fastened between two sheets of strong, non-porous building paper. These hairs cross and recross each other at every conceivable angle, forming small air chambers, and the paper on each side seals up the dead air immeshed in the hair fibres. Therefore no other material will keep a building so cool in summer or so warm in winter as Keystone Hair Insulator.

Hair makes a better material for this purpose than vegetable materials. Being a negative substance composed of a series of layers of spongy material, hair is naturally a better non-conductor than a vegetable fibre which contains more or less mineral elements. Hair will not pack down nor settle, dry out and split, rot, attract moisture or carry flame like vegetable materials.

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Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO, MONTREAL, WINNIPEG, VANCOUVER
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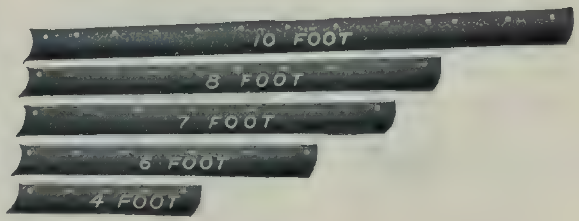

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THE
SHUNK PLOW COMPANY
BUCYRUS, OHIO

Canadian Agents Wanted

15 Leaders of 15 Lines——

We specialize on the following:

- Gray Silica Face Brick and Glazed Brick.
- Esco Steel Protective Paints.
- Ceresit Waterproofing Compounds.
- De Lavergne Artificial Ice Plants.
- Keystone Gypsum Blocks.
- Nelson Bronze Iron and Steel Valves.
- Terra Cotta and Faience.
- Feed Water Filters and Grease Extractors.
- Reliance Ball Bearing Door Hangers.
- Sturtevant Ventilating Sets and Blowers.
- Sky Lights and Metal Windows.
- Steel and Kalameined Doors.
- Custodis Radial Brick Chimneys.
- Taylor Gravity Underfeed Stokers.
- "Pen Dar" Metal Lockers.

Write us for quotations

Douglas-Milligan, Limited

Builders' Supplies and Engineering Specialties

304 University Street, Montreal. Toronto, Confederation Life Building.

Sun Bricks

Heavy Hard Burned Red
Shale Side Wire Cut

Stock Face **Inside Gray**
Red Stock **Clinker Brick**

Try our purple face brick. It makes a most attractive residence.

We have excellent shipping facilities on C.N.R. also team and truck delivery. Send us your next order.

Sun Brick Co., Limited

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ESTABLISHED 1886

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Alphabetical Index of Advertisers
Page 16

Vol. 27 **August 20, 1913** **No. 34**

Trade Extension Over-Seas*

GREAT though the improvement that has been effected during recent years in Canada's trade relations with the countries of the Old World, a careful examination of existing conditions reveals vast scope for further effort on both sides. The "Contract Record and Engineering Review" has had representatives in attendance at the International Road Congress (London) and other meetings this summer, and the opportunity has been taken to consider the trend of developments and the things that make for and against trade betterment.

In the first place it is gratifying to note an increasing disposition on the part of British manufacturers to discuss the possibility of doing business with Canada. This is worthy of mention at the outset, for the average Britisher of the class with which we are concerned is very conservative; he arrives at his decisions slowly and then sticks to his ground. Hence, by the way, his influence is a desirable factor in Canada, which is impelled occasionally by phenomenally rapid developments to hasty and ill-considered plans. The remarkable strides in every phase of human activity made by Canada in the last decade seem to have excited the interest and admiration of "the man in the street," and the suggestion of lethargy remarked on previous occasions is not in general evidence. True, business is not forthcoming by leaps and bounds, but in many cases this is attributable to the fact that trade conditions at home are so prosperous at the moment and the factories so occupied with orders for local markets that attention to new fields is practically impossible. We refer to a "suggestion of lethargy" advisedly, not unmindful of the two billion dollars odd that has been invested to date in the Canadian field by British interests.

It would appear to be yet another exemplification of the adage, "Nothing succeeds like success." Canada, as a constructional phenomenon, compels attention. England's greatest men visit Canada and return to testify in enthusiastic terms as to the unprecedented development of towns, cities and railroads and the characteristic enterprise of the people. Rudyard Kipling, who, after a few years' absence from Canada, returned to find the dreams of less than a decade translated into realities of brick and stone is generous in his praise of Canada in such good company as Earl Grey and His Royal Highness the Duke of Connaught. Of itself the testimony of such men would avail little were it unsupported by the opinion of the rank and file in the business world. Lustre was added to the name of Canada upon the return of the party of British manufacturers who visited the principal towns and cities of the Dominion recently. The enthusiasm of prominent men coming back to England with the impress of Canada upon them is catching. And so we find the Britisher in a more receptive mood. So much the better for our mutual interests.

Of the constructive factors, none is more potent than the interchange of visits by responsible persons whose opinions and statements are entitled to rank as first-hand, reliable information. Only well-balanced reports are worth having. The pros and cons must be taken together. Alluring pictures of distant fields often mean a set-back ultimately.

A careful reconnaissance of the field by one of the principals of a firm is essential, for the reason that the varying practice of the constructional world necessitates special adaptation in the consideration of new territory. The appointment of reliable, enterprising agents is half the battle, and it is only after a close observance of local conditions that one is able to make such appointments wisely. Not infrequently one finds British manufacturing concerns placing their agencies indiscriminately with men who are either incompetent or who have too many irons in the fire to do justice to the introduction of new lines, which require the concentration of a man expert in adaptation, from the technical standpoint, and enterprising, yet judicious, in publicity. The Englishman who knows his Canada well, not from book-lore but from personal intercourse, will also appreciate the desirability of sending out experienced men, who, by a broad knowledge of the world, have lost the insular prejudices so often found in younger men who have received promotion to Canadian agencies by virtue of their technical qualifications and a period of meritorious service at the works. Adaptability, in Canada, is a sine qua non; enterprise is another. Technical ability of itself is a poor recommendation for a resident agent. Where representatives are appointed direct from Great Britain an irrefutable argument in favor of sending the best men is that we Canadians are apt to estimate the character of the home industry by that of the man with whom we have to deal on our own ground. We make no apology for thus emphasizing this point.

Before passing on to another phase of our subject we will express the opinion that in all cases a liberal appropriation is necessary at the outset. Many competent men have been handicapped most unfortunately by an insufficient salary and expense allowance. Canada is a large field—nearly as large as Europe, and generous terms must be allowed those who undertake to exploit it. It is an economic absurdity to place a man in the field and restrict his operations by limited means.

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* Direct from one of the Editors of this journal now in London.

Without exception, the complaints heard in England and elsewhere concerning Canadian practice, or rather malpractice, have been the subject of many an editorial discourse in the "Contract Record," and to recount them again would be wearisome. Suffice it to say that they are identified mainly with the short-sightedness and incompetence of our governing bodies. A great contractor in old London, whose achievements, engineering and otherwise, have made him world-famous, told us in the course of an interesting discussion of trade relations that the good men in Canada were all too busy with the advancement of their own interests to participate in administrative affairs, and that Government work suffered in consequence and fell into disrepute with outsiders. Loyalty to home institutions is strong with us, but we blush to recall certain occasions where undue preference has been shown Canadian firms in what has been advertised as open competition. If we are to develop on broad lines, in keeping with the extent and opportunities of our country, we must see to it that the competitions for our constructional undertakings are universally associated with the idea of a fair field for all. In business there is little place for sentiment. Value for value is the fundamental business principle. There can be no "Open sesame" committed to a privileged few. The only advantage that Canadian firms should have over British, or British over United States, is where all other things are equal.

As to insufficient time allowance and inadequate publicity, we have already placed ourselves on record a number of times, but we will go so far as to say that the hasty expenditure of public monies is criminal. We are entitled to demand that the works planned by Government authorities should be pre-arranged to such an extent that all competent contractors of good financial standing are able to figure on them. With all that has been said about Canada's great development, ignorance is still to be found in the most unexpected quarters. This can only be overcome by effective publicity, the most potent force in the world to-day.

There remains but little to add except in emphasis of the general prosperity of Canada. British manufacturers are apt to be unduly influenced by reports of the "tightness of money" and the depression of stocks. Sometimes they overlook the fact that Canada is uniformly prosperous, that every trade in the country is taxed to the utmost resources of its activity and that temporary depressions are a blessing in disguise for Canada in that they serve as a check upon real estate speculation and divert money into the channels of legitimate enterprise. Money is not wanting for sound investments. Undertakings of a substantial character, promoted by men of repute, seek no backers.

Trade returns show the same ratio of increase. Just as the year 1912 was better than 1911 so 1913 is consistently better than 1912. In support of our contention we are prepared to furnish authoritative returns from city clerks and city engineers. We have them at hand, but the short space allotted to this article, as well as a consideration for the reader, who generally dislikes statistics, prevents our introducing them. We assert confidently that there is no ground for a pessimistic outlook.

Canada offers an unparalleled opportunity to the British manufacturer—particularly in regard to the introduction of such equipment as the progressive interests identified with this journal are in need of, e.g., labor-saving machinery of all kinds.

We rejoice in the prosperous conditions now obtaining in the Old Land, but history repeats itself, and when a falling-off in home trade is experienced, the man who has fortified his business by establishing a good connection with Canada—which has not infrequently remained the one bright spot in a world of depression—will pay tribute to the inscrutable workings of a Providence which guided him in the direction of the New Canaan.

Canada as a British Market

CANADA'S trade for the year ending with April, 1913, passed the billion mark, the total being $1,079,934,018, an increase of 22 per cent. over the previous year. This does not include that great mass of purely local and inter-provincial trade for which there are no statistics, but refers only to the volume of interchange carried on with those outside of our own borders. Canada has become an important market for a great variety of manufactured products. Nor has this market reached its limit. For years to come this part of the British dominions must remain largely an agricultural community. Each year adds hundreds of thousands to the population and with an expanding population comes an increased demand for manufactured goods, so that as a market for this class of products Canada presents remarkable opportunities.

During the fiscal year which ended March, 1913, the trade of the Dominion with the United Kingdom of Great Britain and Ireland amounted to $269,045,844. The total of the exports to Great Britain was $151,853,413, while the imports from that source amounted to $117,192,431.

In 1893 the trade with the Motherland (import and export) totalled $107,392,176. Each year since that date, excepting 1895 and 1896, has seen a marked increase. 1911 shows an increase of 14 per cent. over 1910 and 1912 an increase of 6 per cent. over 1911.

The imports of the Dominion of Canada from all countries during the year which terminated March, 1913, reached the sum of $678,587,617. Of this amount, as previously stated, $117,192,431, or 17 per cent. of the total came from Great Britain. France furnished $11,885,706, Germany $11,146,746 and United States $368,145,107. It will be observed that France and Germany furnished each less than 2 per cent. of the imports while the Republic to the south supplied over 54 per cent.

Some details concerning the value of the respective imports will doubtless prove informative and will serve to show the possibilities for trade expansion between this part of the Overseas Dominions and the United Kingdom.

The greatest import for the year was in metals and minerals and in manufactures of the same. The total volume of this class was $123,776,577. This includes brass $3,538,865; copper $5,193,165; iron and steel $96,181,586; tin, $5,420,188. To this large and growing class of imports Great Britain furnished $18,515,856, largely made up as follows: pig iron, $978,467, rolled iron or steel beams, $619,460, machinery, $2,180,168, iron or steel sheets galvanized, $1,389,343, bridges, $205,487, lead $533,464. A glance will reveal the fact that in this most important field, we obtained less than 15 per cent. from the Homeland. The lesson is obvious. Here is a splendid field for the English manufacturer.

The import of cotton fabrics for the year amounted to $30,982,915, of this the United Kingdom supplied $14,528,500, or very nearly 47 per cent. The point to be noted here is that while the cotton import has risen in five years from $23,427,248 to $30,982,915, the amount purchased from Britain has remained almost stationary and the percentage has fallen from 56 to 47. The very least that the British manufacturer should do is to hold the place already won in the expanding trade of this market. The value of woollen or partly woollen fabrics imported for the year reached the sum of $26,677,312. In this branch of trade with Canada, Britain stands without a rival and sent us 85 per cent. of the total import.

The question of the importation of machinery deserves more than passing notice. By machinery in this case we refer to such articles as printing presses, crushers, drills, compressors, cranes and articles of a similar nature. The total import for 1912 reached approximately $30,000,000, double the amount imported in 1908. These figures afford a striking commentary on the growth of Canada's manufactures. Of this total during the year just tabulated, Britain sent to Canada about 6 per cent. In 1908 she sent out to this country $1,280,858 worth of the machines mentioned or about 8 per cent. of the total import. The percentages are not very significant. The plain fact is this, that in five years Canada has doubled the import and added approximately $15,000,000 to its value, while the British manufacturer has added only a million to his export to Canada along this line. Here again is a splendid field for the British manufacturer and exporter if he cares to enter.

During the past five years Canada has experienced a most remarkable expansion in the building trade. So great has been the demand for builders' supplies, that with their plants working to the utmost capacity, the manufacturers have been unable to meet the requirements of this market. Extensive importations of this material have therefore been necessary. Bricks for building to the amount of $465,997 were imported. Great Britain furnished only $27,345 of this or less than 6 per cent. Sewer pipe and drain tile totalling $395,445 were bought away from home, and of this amount the British producers contributed $54,484 or about 12 per cent. While there are numerous cement industries in this country, the excessive demand required the importation of $890,612 of this important material. Of that amount $215,495 or 24 per cent. came from Britain. Bridge and structural steel prepared or partly prepared for the work of construction amounting to $651,244 was imported, Britain furnishing $205,487 or 31 per cent. The importation of glass for building purposes is an item of considerable importance, the largest quantity coming from Belgium. The total was $1,856,611, of which the British manufacturers contributed 20 per cent. The assurance of continued activity in the building trades in this country should warrant the producers of this class of material in the United Kingdom thoroughly investigating the possibilities of increased trade along these lines.

There are two classes of obstacles to be overcome in the development of the Canadian market for the British manufacturer. These may be termed geographical obstacles and local obstacles.

In discussing the former the distance separating these two parts of the Empire must be noted. The time required for communication, the long delay and great expense arising from any mistake in orders, the time and danger involved in transportation, all these are natural deterrents to British trade. However, improved cable service and still more rapid transit and cheaper ocean rates will, at least to some extent, lessen these hindrances.

The local obstacles are perhaps matters of temperament and long established custom. We have been trying to show that the Canadian market will amply repay any effort made to capture it, but this can be done only by determined, insistent and systematic endeavor. A thorough and detailed knowledge of the Canadian market, the manufacture of an article suitable to the needs and ideas of the buyer in Canada, and a widespread and constant publicity campaign are absolutely necessary on the part of the British exporter, in order that his goods may find as ready and extensive a market in Canada as every son of the Empire would wish.

Building Trades and Building Material

A MONTH ago a feeling of depression was perceptible in the building and construction trades of Canada. Reports for the first six months of 1913 from thirty cities throughout the Dominion, showed a falling off amounting to about seven per cent. in the building permits as compared with the same period of 1912. It was frequently stated that in the Northwest Provinces extensive projects were being abandoned, both by individuals and municipalities, because of the difficulty of financing the undertakings. In some quarters a drop in the price of building material was anticipated and owing to the greater abundance of labor some decline was expected here.

The month has passed and sentiment is more confident and hopeful. It cannot be denied that building operations have fallen off. Speculative building has been restricted and this has been accompanied by a more plentiful supply of building material and a greater abundance of labor, but it is also true, that there has been very little decline in prices and no serious depression such as was at one time anticipated. A comparison of the price list found on page 43 of this issue with the price list of any issue for the last six months will reveal very little difference in the prices. Some kinds of bricks and some brands of plaster may show a slight decline but on the other hand some material will show a slight advance. The prices are firm with every indication that there will be little change and the opening of spring will likely see a renewal of building activity.

A number of causes working together have prevented anything like a serious depression. The restoration of peace in Europe has renewed confidence and money is a little more easily obtained by Canadian banking institutions. The manufacturing concerns were stocked with orders for some time ahead. Just when most needed the various governments in Canada and the three great railway corporations announced the expenditure of immense sums in building and construction. The lesson of 1907 was not lost, and, as the president of one of the largest manufacturing concerns in Canada informed us, the larger firms had been providing a cash reserve for some time past which enabled them to tide over the stringency.

There is every evidence of a good crop and money to move it, so that the beginning of the next season will see a period of expansion along all lines, including building and construction, without the fever of excessive speculation.

Third International Road Congress

A Review of Some of the Canadian and United States Papers Presented at the Congress at London, England

(Staff Article)

We gave, in our issue of July 16, the text of the resolutions which were adopted by the Congress at its final meeting on June 27th. These resolutions were adopted after the consideration and discussion of the papers submitted, which numbered some 140 in all and represented the opinions of many nationalities. We had intended to present our readers with a precis of the whole of the papers, but careful perusal has convinced us that the space at our disposal could be better utilized in the presentation, in a much fuller form, of a selection from those papers contributed by Canadian and United States authors only. It must be noted that we have adopted the titles given to the papers by the authors, which vary in many cases from the official heading of the section in which a paper appears. The actual text of an author is printed below in smaller type than that in which the precised parts are set.

Planning of Systems of Streets and Roads

By Nelson P. Lewis, M. Am. Soc. C. E., Chief Engineer, Board of Estimate and Apportionment, New York City

In this paper, dealing for the most part with the direction of main roads as connections between populous centres, the author commences by showing that originally most of the main roads in America were merely trails which, whether long or short, were seldom actually constructed. The tractive force was great and the gradients necessarily light so that instead of cuttings and fillings, difficult topography was overcome by detours often necessitating a line twice the length of the direct line. With the comparatively short distances covered in the past and the ample time allowed, this was not a matter of vital importance, but to be constantly improving the construction of these circuitous roads without improving the alignment and extending new systems is a mistake. If to obtain good gradients, and at the same time pass through all small towns and villages en route, the cost is excessive, then, branch roads into such places are better. He points out that gradients, especially if short, are not as objectionable to motor vehicles as to those drawn by horses.

The principles which should govern the creation of a system of highways in a city are quite similar to those applying to a state or a country. The city will also have one or more principal traffic centres and a number of subordinate centres. Direct connections between these centres are of prime importance owing to the heavier loads and the lower speeds forced by greater volume of traffic. It is a mistake to treat a city and a contiguous rural system of highways independently of each other. The motor car has placed the city in such close relation with the rural districts surrounding it and with the neighboring towns, and their interdependence has become so great, that the entire system of highways, both rural and urban, must be considered as an entity. The chief highway connecting two towns should afford a direct connection between the important traffic thoroughfares of each. Frequently this is not the case, but the main and sometimes the only adequate road connecting them leads at either end into narrow, tortuous and shabby streets which must be traversed in order to reach the business and administrative centre. How different an impression one will obtain and how largely will the pleasure, comfort and convenience of a journey be increased if the approach to a town is through a dignified, well-paved thoroughfare constantly increasing in importance and interest until the climax is reached at a well designed and convenient civic centre.

It will frequently be necessary to create new and to widen existing thoroughfares. As the village grows into a city and the city into a metropolis, such improvements are sometimes imperative. Failure to provide them will prevent or retard the growth of the town, but their cost will often be so great that they will be undertaken with hesitancy.

The primary function of the street is to provide light, air, and access, and accommodation for such amount of traffic as it will be called upon to sustain. In cities many streets are required almost solely for the purpose of affording access to the dwellings fronting upon them. The traffic which they accommodate is often little more than that involved in affording ingress to and egress from the abutting dwellings for those who occupy them and the tradesmen who supply their daily needs. A large proportion of the streets are confined to this restricted use, others accommodate a considerable amount of neighborhood traffic, while through the great thoroughfares there surges the complex business of a metropolis and that which comes to it from the surrounding rural districts.

Land values in cities are so high that the provision of a greater width of street than is actually necessary involves a very serious burden upon the abutting owner both for the acquisition of the land and for surface improvements. To the degree that additional land is taken for streets, the price of the abutting land and its rental value will inevitably increase. It might seem reasonable, therefore, to limit the width of city streets to that which will accommodate vehicles and pedestrians when their movements are so regulated and controlled as to provide a maximum of capacity with such division into roadways and footwalks as to make suitable but not unnecessary provision for both. It is impossible, however, to foresee the changes which may take place in the volume of traffic as the city grows, and future widenings will be very costly. Where the height of buildings and the proportion of the lot which may be built upon are restricted by law, it may be possible to make a fairly accurate estimate of future needs provided these restrictions are maintained. In the United States such limitations of the use to which the abutting owner may put his property are almost unknown. The district which today is devoted exclusively to two-storey detached dwellings may, by the provision of good transit facilities, be rapidly converted into a section of compactly built tenements five or six storeys in height. They may not produce a great deal of traffic, but the decent requirements of light and air cannot be met if the street is from 30 to 50 feet in width, which might have been sufficient for the character of buildings originally erected. For these reasons there is a disposition in the City of New York to make 60 feet, about 18.3 metres, the minimum street width.

Outside the cities and towns the traffic is less local in character. In agricultural communities the proportion of traffic passing a given point which originates between the two nearest intersecting roads is very small. The benefit on the rural highway is, therefore, less local than is the case in towns, and the alignment, the rate of grade, the width and the character of the road surface are of general public interest and are to be determined by public need rather than by that of the abutting owner. The width of such roads should not be less than 50 feet, and should be increased to 60, 70 or 80 feet as the roads approach towns. Where radial highways are to be created leading from important cities into the neighboring country or to other towns, it is quite probable that the growth of the city will follow such arteries of travel, and it would be wise to give such roads a width of not less than 100 feet. In most cases the width of the metalled road need not exceed that required for two vehicles to pass, say 16 feet. More than this would be a waste of money until such time as increased traffic requires it.

Mr. Lewis evidently favors the by-pass system for new main roads passing old towns. In the case of main road crossings he advocates the acquisition of adjoining land and the rounding off of curves to obtain a fuller view. Curves in main roads should not, he considers, be of less radius than will give a view of 300 feet ahead. He advocates the provision of tracks for tramways along interurban highways, so separated from the roadway that vehicles cannot pass from the roadway to the track, which should never be permitted to cross the former at grade. In cities the centre of the roadway is the best position for tramways, but in no case should they be permitted in a street unless there is room for one row of vehicles between them and the pavement.

He thinks the provision of separate tracks for trams in cities will generally not be found feasible, as such space can only be acquired when traffic will be small and the returns not sufficiently large. Grass-covered tracks prevail at New Orleans but are untidy, but he cities the Bismarck Strasse, Charlottenburg, as a successful example of such an arrangement.

Discussing the relative merits of islands and refuges to direct traffic in busy streets, he is in favor of these where the traffic passes in equal volumes in different directions at the same time, but where it varies, say to the proportion of one-third and two-thirds at different times of the day, then a street is better without such means of direction. On the whole he considers the subdivision of roads advantageous. The great decrease in the use of the bicycles in America does not justify the construction of special cycle tracks.

In conclusion Mr. Lewis directs attention to the importance of making roads attractive in appearance as well as direct. He summarizes as follows the essential considerations which should form their planning:

(1) The road, while not monotonously straight, should be as direct as the topography and limiting grades will permit.

(2) Trunk lines, articulated with those of an adjoining jurisdiction, should form the basis of a complete road system.

(3) Detours from the general direction of trunk lines to reach unimportant towns are not justified; such towns can be served by branch roads.

(4) The principal streets of a city should form a part of the trunk system of the territory in which such city is located. Facility of movement between the city and surrounding country and neighboring towns is essential.

(5) The principal highways between neighbouring towns should connect directly with their most important and dignified thoroughfares.

(6) Roads should increase in width as they approach important towns, so that as the towns grow outward along these roads it will not be necessary to incur great expense in widening them.

(7) In establishing adequate roads radiating from important cities it is unnecessary to undertake expensive widenings of the streets of small towns or villages. By-pass roads around them will answer the purpose.

(8) At crossings or junctions of rural highways sufficient space should be added to the road to afford a view of approaching vehicles. Curves should be used instead of abrupt deflections. In city streets a widening at important junctions is always desirable.

(9) Tramways are inevitable in city streets, and the best location for them is in the middle of the roadway. When they follow rural highways they should be so separated from the travelled road that vehicles cannot pass from road to tracks, and they should never cross the roadway at grade.

(10) Roads should be made interesting where possible. Picturesque vistas and extensive outlooks are desirable as well as easy gradients and a smooth surface. The highway should promote health and pleasure, as well as business.

Types of Surfacing on Bridges, Viaducts, etc.

By Henry B. Drowne, Instructor in Highway Engineering, Columbia University.

Mr. Drowne confines his report to the question of the surfacing of the roadways, it not being possible, he says, to include the surfaces of footwalks, the various details of construction at the ends of bridges, the construction around car tracks and the different arrangements for drainage, which "without drawings would involve lengthy expositions." At the present time the following types of surfacing are found on bridges in the United States:—Plank, wood block, sheet asphalts, stone block, brick, concrete, various types of bituminous pavements, macadam, gravel and earth. These types are taken by Mr. Drowne in the order given. No consideration is given by him to bridges of stone masonry, concrete or reinforced concrete, which have an earth-fill between the wearing surface and the bridge proper, "since in such cases the same surfacing is generally used which occurs on the adjacent roadways, and the writer sees no reason to expect that the cost of construction and maintenance would be any different."

Plank Surfaces

Plank floors are generally constructed of white oak, spruce or yellow pine. The floors are constructed with either one or two layers of planks. One layer floors composed of planks having a thickness of 3 to 4 inches are more frequently found on unimportant bridges of short span outside of built-up districts. Where a two-layer floor is constructed on bridges of this class, the lower layer may be 2½ inches thick and the upper or wearing layer from 1½ to 2 inches thick. On city bridges, while the upper layer is usually about 2 inches thick, the lower layer is from 3 to 4 and more inches in thickness. The width of plank varies from 8 to 12 inches, the smaller width being preferred by some engineers. A variation of about 2 inches in excess of the specified width, however, is usually allowed for planks on any one structure.

The planks are supported on steel or wooden stringers and attached to the same by spikes, wooden spiking pieces being fastened to the tops or sides of the steel stringers for this purpose. The best practice usually requires that holes shall be bored for the spikes to prevent splitting the planks. It is also customary to lay the planks with the heart side down. When a two-layer floor is built the planks in one layer are usually laid at an angle of about 45 degrees to the centre line of the bridge. No very definite rules as to whether the diagonal direction shall be given to the upper or to the lower layer seem to have been established.

Plank floors built with one layer are not usually constructed with a crown but, in the case of two-layer floors, a crown is more essential. The desired crown may be obtained in any one of the three following ways: 1. The thickness of the spiking pieces, if same are used on the tops or sides of the stringers, may be decreased an amount commensurate with the desired crown progressing from the centre to the sides of the bridge. 2. The stringers may be shimmed up if they are supported on the tops of the floor beams so that their tops will correspond with the desired crown. 3. The stringers if framed into the webs of the floor beams instead of being arranged with their tops in the same level may have the end connections at different elevations which will make their tops conform to the crown desired. It is then an easy matter to spring the planks over the stringers, thus making the floor conform to the desired crown.

The life of a plank floor is extremely variable, depending principally upon the character of the traffic and its intensity and climatic conditions. It is self-evident that the effect of horse-drawn vehicle traffic is more severe than that of motor car traffic. If the planks are not worn out by the abrasive action of traffic, they are very liable to rot out in a few years in climates where they are alternately wet and dry. In speaking of the life of plank floors on bridges not subjected to severe traffic conditions, various authorities state that they may be expected to last from three to eight years, it being assumed that at the end of that time the planks will have decayed, if not previously worn out, so as to require renewal. A better idea as to the wear of this type of surface can be gained, however, from an examination of the following instances of construction.

A 3 by 12 inch white oak floor, one layer, spiked to 4 by 6 inch yellow pine spiking pieces resting on steel stringers was laid in 1893 on Bailey Avenue Bridge, Buffalo, N.Y. The original cost of the surfacing was $1.33 per square yard. Repairs have been made from time to time as they were needed, the contract price being $48.00 per thousand feet B.M. The traffic on the bridge, which is a 175 foot through truss, is light and the floor is considered to have been satisfactory. The wear near the car tracks, which are located at the centre of the bridge, has been somewhat greater than in other parts of the bridge. Due to the water passing through the joints between the planks, the steel stringers have become corroded to such an extent that they are now being replaced with those of wood.

The Randolph Street Bridge, Chicago, Illinois, built in 1893, is of the rolling lift type, the movable span being 210 feet long, with two roadways each 22 feet wide. In November, 1911, and in July, 1912, the north and south roadways respectively were rebuilt in the following manner: A wearing surface of 4-inch white oak planks was laid on a plank sub floor composed of 4 by 12 inch yellow pine planks which was supported on steel stringers. The oak planks were fastened to the sub floor by 80d. spikes. The cost of material used in the floor was $1.34 per square yard and the cost of labor, including the removal of the old Schuman pavement, was 85 cents, making a total cost per square yard of $2.19. The bridge is subjected to a heavy traffic and at the present time the north roadway is badly worn, while the south roadway is reported as being in good condition.

The plank floor of London Bridge in Concord, New Hampshire, is surfaced with a bituminous mastic of coal tar and sand. The floor consists of a wearing surface of 1⅞-inch dressed spruce laid on a 2⅞-inch dressed kyanized spruce sub floor which is supported on 4 by 14-inch hard pine joists. The wearing surface is covered with a mastic composed of hot sand mixed with a 1 to 1 mixture of coal tar and No. 4 paving pitch. This mixture is laid hot, depth not stated, and rolled with a hand roller. The cost per square yard of the bituminous mastic in place is 45 cents and the surface is maintained at the same price. The method was first tried in 1896 and the mastic has been entirely replaced three times since that date. The bridge is a three span Pratt truss, approximating 500 feet in total length, and has an 18-foot roadway. It is reported that the traffic is heavy.

Wood Block Surfaces

Wood block surfaces are laid on a concrete base or on a plank sub floor. The concrete base may be formed on a buckle plate floor, it may be the reinforced concrete slab forming the floor, or it may be formed by concreting between steel I beams. The plank sub floor is built in a similar manner to the ordinary plank floor. Generally, however, it is composed of one layer of plank or timbers from 3 to 6 inches in thickness. Both treated and untreated timber is used in constructing the sub floor, but if untreated, it is usually waterproofed by coating it with hot asphaltic cement or by spreading over it several layers of tar paper well bonded together by a bituminous cement. Where a sand cushion is spread on the sub floor, it is essential that the floor has an even surface and that the joints between the planks are tight for unless these precautions are taken or a layer of tarred felt is interposed between the cushion and the sub floor, the sand will sift through the cracks, resulting in a consequent displacement of the surface. Sometimes the sand cushion is omitted and the blocks are laid directly on the base or a bituminous mastic or some other material is substituted for the sand cushion.

The construction of the pavement from this point is the same as it would be on the street. At expansion points in the floor or at the ends of the bridge the pavement usually ends against an angle and the expansion space is bridged over by a slip plate. Transverse expansion joints in the pavement other than those necessitated by the bridge superstructure are not thought to be necessary by some engineers, but longitudinal expansion joints next to the curb are always constructed. These joints are made from 1 to 2 inches wide and should be filled with an asphalt cement that is not so susceptible to changes in temperature as to become brittle in cold weather and to flow in hot weather. Pitch, asphalt, sand and cement grout are used as joint fillers. One trouble with pitch filler is that in cold weather it becomes hard and does not allow the pavement to expand. Several instances have been found where in cold weather the buckling of the pavement has been laid to this cause. It is apparent that in cold weather the steel will tend to contract and unless the pavement can move within itself, buckling is pretty sure to result. The base on which the wood blocks are laid, whether it is composed of concrete or planks, is constructed with a cross fall of the same amount as would be required in a pavement. As a rule the structures are stiff enough so that vibrations caused by traffic have little or no effect on the pavement. If a sand cushion is used, excessive vibration might cause a displacement of the cushion and a consequent disturbance of the surface. Blocks adjacent to car rails are sometimes forced out of place due to vibrations in the rails or in the tie rods connecting the rails.

The surface of a 100-foot girder carrying Sprague Avenue in Spokane, Washington, is composed of 3-inch carbolineum wood blocks supported on a sub floor of 4-inch planking. The sub floor was covered with tarred paper "to prevent the asphalt filler from leaking through when the joints were filled." The blocks are of tamarack, Norway or Puget Sound fir and are treated under pressure with at least 12 pounds of preservative per cubic foot. They were laid on a 1-inch sand cushion and the joints were filled with an asphalt cement, using about 15 pounds to the square yard. Two-inch expansion joints were left next to the curbs. The cost of the surface above the sub floor was $2.30 per square yard, the blocks costing $1.65 per square yard and the asphalt costing $26.50 per ton. This surface, which was finished in the summer of 1912, has been subjected to a heavy traffic and in the six months has shown no signs of wear. In some places, however, along the rails the blocks have raised vertically from ½ to 1½ inches, due to the movement of the rail stringers.

The Manhattan, Williamsburg and Queensboro Bridges across the East River, New York City, all have roadways constructed of wood block pavement. The first two are of the suspension type with total spans of 2,920 and 2,793 feet respectively, while the third is a cantilever bridge with a total span of 3,724 feet. The 35-foot roadway of the Manhattan Bridge is paved with creosoted blocks supported on a 4¾-inch creosoted yellow pine plank floor. The maintenance cost and durability of this construction has not as yet been determined since the bridge has only been partially opened to traffic for the past three years. The Williamsburg Bridge has two 20-foot roadways, both of which are surfaced with 4-inch creosoted yellow pine blocks, treated by the creo-resinate process. The sub floor which supports the blocks is composed of 12-inch steel channels which are laid close, side by side with the legs turned down on the supporting members below. The steel was treated to prevent oxidation and before the blocks were laid the surface of the channels was given a coating of hot asphaltic cement or the blocks were dipped for an inch of their depth in the same material and laid directly on the surface of the channels with no intermediate cushion. The joints were filled with an asphalt filler. Considerable trouble has been experienced in this bridge due to the buckling up of small areas in cold weather when the steel work has contracted. The heavy traffic also tends to spread the legs of the channels composing the subfloor with a consequent disturbance of the pavement directly above. This bridge takes a very heavy traffic and the floor has been in service for about nine years. The 53-foot roadway of the Queensboro Bridge is paved with standard wood blocks, laid on a ½-inch sand cushion which rests on a concrete surface formed on a buckle plate floor. The traffic on this bridge is also heavy and during the three and one-half years the roadway has been in service, it has been necessary to reset the blocks in small areas which have buckled up as was the case in the Williamsburg Bridge.

Sheet Asphalt Surfaces

Sheet asphalt surfaces are used for bridge floors and are constructed on both concrete and plank floors. The construction of the wearing surface is no different from that on the street surface. This type of construction seems to have been satisfactory in most instances except that where the pavement was laid contiguous to car tracks on the bridge, it gives trouble by heaving and disintegration along the rails. Unless the vibration in the bridge is excessive, no trouble from this standpoint arises.

There are twenty-one plate girder bridges, having spans from 34 to 96 feet and roadways 25 to 30 feet wide, in Newton, Massachusetts, on which a 2-inch asphalt wearing surface has been constructed. The base on which the sheet asphalt rests is formed by brick or concrete arches between I beam stringers and the asphalt surface was laid directly on this base without any binder course. Fourteen of these bridges were completed in 1895 and the present condition of the asphalt surface is described as generally good, with a few cracks. No substantial repairs have been made to date except on two bridges where the traffic was heaviest. The surfaces are subjected to a moderate amount of light and medium weight vehicles, both horse drawn and motor driven.

Clarissa Street Bridge in Rochester, New York, was originally constructed in 1892 with a wood block surface, 5-inch non-treated pine blocks, resting on a plank subfloor. The bridge is a 3-span latticed girder having a total length of about 385 feet. In 1899 the blocks had decayed so badly that their removal was necessary. A sheet asphalt wearing surface was then constructed on the original plank subfloor at a cost of $2.50 per square yard. A car track is situated on both sides of the roadway and the asphalt surface was built up to but not between the rails. The present condition of the surface is described as good, although some general repairs have had to be made from time to time, such work costing from $1.00 to $1.25 per square yard. The roadway traffic from a census taken for six consecutive days in 1910, over a period from 6 a.m. to 9 p.m., was as follows: 188 automobiles, 112 street cars, 134 horse drawn carriages, 225 light wagons, 356 trucks.

Post Street Bridge in Spokane, Washington, is of the steel arch type with a span of 240 feet and a roadway width of 22 feet. The double plank floor on this bridge was surfaced with sheet asphalt in the fall of 1909, the pavement being three inches in thickness, consisting of a 1-inch binder course and a 2-inch wearing surface. This structure takes a heavy traffic as it is near the down town district. From January, 1910, to January, 1912, it was subjected to an increased traffic on account of the reconstruction of another bridge in the near vicinity. Due to the lightness of the superstructure and the heavy loads carried, there is more or less vibration in the bridge which has caused the binder to creep on the plank base with a consequent rutting of the wearing surface. The original cost of the asphalt pavement was $1.20 per square yard. In 1912 some of the worn places were cut out and replaced with new asphalt at a cost of 65 cents per square yard. Although the present condition of surface is described as fairly good, the pavement has not as a whole been considered a success.

Stone Block Surfaces

Stone block pavement is not used as frequently for bridge floors due to its greater weight. In all of the instances reported this type of pavement was chosen because the bridges were on a grade and a pavement furnishing a good foothold was desired. The construction of the pavement itself is no different from that on the street.

A 55-foot deck girder, which is part of the Seneca-Smith Street Viaduct in Buffalo, New York, is paved with Medina sandstone blocks. The blocks are supported on a concrete base which is filled in over brick, arches between I beams. The floor of this bridge is on a 4 per cent. grade. The blocks which are about 6 to 7 inches deep were set on a 2-inch sand cushion and the joints were filled with gravel and asphalt cement. The surface was laid in 1898 at a cost of $3.32 per square yard. It is in fair condition at the present time, any necessary repairs being made as needed by the city's force at a cost of about 75 cents per square yard. The surface is subjected to a light business traffic of medium density.

The Cambridge Bridge in Boston, Massachusetts, has a roadway floor composed of granite blocks resting on a 1:2:5 concrete base formed on a buckle plate floor. The bridge is a series of steel arch spans, varying in length from about 101 to 188 feet, and the floor is built on 3 per cent. grades. The blocks are made of Cape Ann granite and were bedded in a sand cushion on the concrete base, the joints between the blocks being filled with pebbles and pitch. This surface was laid in 1907, and is in good condition at the present time except for slight depressions at the expansion joints of the bridge, which can probably be accounted for by the sand cushion working out or the copper flashing giving way at these points, thus allowing a slight settlement of the blocks. The cost of the surface above the concrete was $3.09 per square yard and no money has been expended to date for maintenance. The floor is subjected to a heavy teaming traffic.

The Charlestown Bridge in the same city is a deck plate girder viaduct consisting of 10 spans of 85 feet each and has a roadway 80 feet wide on a 3 per cent. grade. In this case the support for the granite block paving is a 6-inch yellow pine sub floor resting on spiking pieces which are bolted to the steel stringers. The sub floor was waterproofed with successive layers of pitch and roofing felt, a total of four layers of felt being used. On the last layer of felt was placed a 1-inch layer, compacted, of sand mixed with pitch in the proportions of 1 gallon of pitch to 1 cubic foot of sand. A sand cushion was spread over this surface on which the granite blocks were laid. Rockport granite blocks were used and the joints were filled with pebbles and pitch. The cost of this pavement, which was constructed in 1899, was $5.20 per square yard above the steel stringers. The surface is in excellent condition at the present time and no repairs have been necessary. A traffic census taken between the hours of 6 a.m. and 7 p.m. shows that the roadway is subjected to a traffic of 4,600 teams, including numerous heavy loads, and 1,500 street cars.

Brick Surfaces

The Huntington Avenue Bridge in Boston, Massachusetts, which is a 89-foot deck plate girder with a 75-foot roadway, is surfaced with this type of pavement. The reasons for using brick were that the bridge is in a locality surrounded by numerous hotels and a less noisy surface than granite block was desired; the large amount of traffic was such as to require a good wearing surface, it being chiefly light in weight except at times when loads may be very heavy. The sub floor in this bridge is concrete arches between I beams. The surface of the concrete was waterproofed by mopping it with a heavy coat of waterproofing asphalt upon which was placed four layers of roofing felt, each layer being mopped with the same waterproofing material. A thin sand cushion was spread on this surface upon which the bricks were laid. Expansion joints were left at the curbs and these joints as well as the joints between the bricks were filled with asphalt. "Mack" brick were used in this pavement and the cost of the surface above the concrete exclusive of the waterproofing was $1.80 per square yard. The surface was laid in 1909 and is at present in excellent condition, no maintenance work having been necessary. The old bridge in this same location and therefore subjected to the same traffic had a 2-inch wearing surface of spruce plank laid on a 4-inch spruce sub floor. The 2-inch surface had to be frequently renewed and patched and at intervals of five to six years, the 4-inch sub floor had to be replaced.

Concrete Surfaces

The use of concrete as a paving material has led to its use on bridges which have a sub floor of concrete. Usually a concrete wearing surface is constructed on the surface of the sub floor. This surface is sometimes further protected by a bituminous surface formed by coating the concrete with from about ½ to ¾ gallons of bituminous material per square yard and then covering this surface with a coating of screened stone chips or coarse sand. No data has been received relative to the cost and wear of this type of surface.

Other Surfaces

Instances may be found where bituminous pavements and asphalt blocks have been used but the writer has not received any information as to the cost and wear of such surfaces. These surfaces are usually laid on concrete sub floors. Macadam and gravel surfaces are more frequently found on structures that have an earth fill over them.

Conclusions

With a very few exceptions the choice of the type of surfacing to be adopted is independent of the type of structure on which it is laid. In all movable bridges it is desirable to keep the weight of the floor down to a low limit since this will reduce the cost of the machinery necessary to operate the bridge and the cost of upkeep on same. In the case of movable bridges that assume a vertical position when open, as the rolling lift type, the floor besides being light must be of such construction that it can be rigidly attached to the bridge and thus eliminate any danger of movement when the bridge is in the open position. In long span important bridges the consideration of weight of the floor may be of importance in its effect on the cost of superstructure and thus have a bearing on the selection of the type of surface. The same consideration of weight has to be taken into account in the reconstruction of floors on existing structures where it is evident that a change from the original surfacing is desirable. It may frequently be found that if any other type than the original is to be used, it will be necessary to strengthen the floor system and sometimes the main members of the bridge may not be of sufficient strength to carry safely any increase of load over and above which they were originally designed for. That there is a great difference in the weight of the different types may be seen from the following figures: plank floors having a total thickness of about 4 inches weigh from 20 to 30 pounds per square foot; wood blocks on a subplank floor weigh from 40 to 50 pounds per square foot; concrete slabs are variable depending upon thickness but may be as much as 140 pounds per square foot; stone block surfaces on concrete may weigh over 200 pounds per square foot.

Outside of the considerations which have just been given the selection of the type of surface is largely based on the same factors that would govern the choice in the case of street surfaces. Briefly stated these factors are amount and character of traffic, grade, cost, maintenance, availability of materials, noise, and comfort of those using the surface.

The construction of one layer plank floors is not recommended since from the standpoint of cost they would be economical under a very light traffic and the seepage of the water through the floor is very liable to cause serious deterioration of the supporting members underneath. In constructing a two-layer floor there is no economy in making the wearing surface over 2 inches in thickness since the wear over the surface is not uniform and if a thicker wearing surface was used, it would become so uneven that its removal would be desirable even if not entirely worn out. Spruce, since it is cheap, is very frequently used for the wearing surface and, while the sub floor is sometimes of the same material, yellow pine is often used. The sub floor should be built of treated timber, but this is not so important in the case of a wearing surface, which is subjected to a heavy traffic, since it will wear out much more rapidly than it will rot out. The life of a 2-inch wearing surface under heavy traffic is about one year and under extremely heavy traffic is from four to six months. The life of a treated sub floor is probably from fifteen to twenty-five years. The cost of renewing a 2-inch spruce wearing surface is from 70 cents to $1.00 per square yard. The disturbance to traffic where frequent renewals are required should be thought of. Where the construction of some other type of wearing surface is feasible, a comparison of the cost of the plank wearing surface should be made with that of other types to see which is the more economical. No trouble seems to have been experienced from the standpoint of corrosion of members underneath the floor when a two-layer floor is built. Further work should be done in experimenting with bituminous surfaces on plank floors and in investigating the economy of this treatment. New short span highway bridges, particularly those outside of built-up districts, in the writer's opinion are best constructed with some type of concrete sub floor on which any kind of wearing surface desired may be constructed.

A wearing surface of creosoted wood blocks is thought by many prominent engineers to be the ideal surface for bridges where the grade and traffic conditions will permit or warrant its use. This is the type now recommended by the Chicago Bridge Department for all bridges of both fixed and movable spans in that city. It is also recommended by the Illinois Highway Commission as a wearing surface on long span steel structures. It makes possible the attainment of a very durable and noiseless surface without increasing the weight of the floor to any extent over that of a plank floor. The success of constructing the block wearing surface on a creosoted sub floor seems to have been pretty well established. The blocks should be treated and the waterproofing of the sub floor is advisable since it will prevent corrosion of the supporting members underneath and hence a disturbance of the sub floor to remedy such a defect. One instance was cited where this type of surface is still in excellent condition after being subjected to a heavy mixed traffic for seven years and no maintenance work has been necessary. The pavement on the Williamsburg Suspension Bridge, New York City, is another example of long service of wood block, this surface having been down for nine years and outside of some repairs due to expansion and the settlement of the supporting members, has required no other maintenance. Untreated blocks on Rush Street Bridge, Chicago, which takes a very heavy traffic, lasted three, five and nine years. Considering the cost of the block wearing surface above the sub floor to be from $2.50 to $3.00 per square yard and if we assume that its life under heavy traffic may be only ten years, it is apparent that, even with a reasonable maintenance cost, it would be much cheaper than a plank wearing surface which in this same time would probably have to be renewed ten times.

Asphalt surfaces under a light traffic seem to have been fairly successful, the oldest surfaces of this type cited being those in the City of Newton, several of which have been down for seventeen years and have not required any substantial repairs. In this instance, however, the surfaces were laid on solid floors. In another instance cited the wear of an asphalt surface on a solid floor under heavy traffic was estimated to have been double what it would have been under simliar traffic conditions on the street. If laid on a sub floor of plank and there is any vibration in the floor good results cannot be expected. No conclusions as to cost can be drawn due to lack of definite data.

For short span bridges stone block pavements on both concrete and timber sub floors from the instances described seem to be entirely successful for heavy teaming traffic. It is economical in first cost, wears well and on gradients gives a good foothold for horses. In the bridges described the maintenance costs have been either very slight or nothing at all and the surfaces are in good or excellent condition. The writer believes that the joints should be filled with a soft filler rather than a cement grout. The plank sub floors on some of the Boston bridges, waterproofed with several layers of felt and a 1-inch layer of bituminous mastic, have been found in certain instances to be in perfectly good condition after twenty to twenty-five years service.

Brick surfaces also seem to have been successful. The meagreness of data, however, concerning this type as well as some of the other types not described prevents drawing any definite comparisons.

The final conclusions of the writer are that if the support furnished the surface is unyielding, the wear of the bridge surfaces of wood block, sheet asphalt, stone block, brick and other similar types is not any different than it is under the same conditions on the street; that the construction of plank surfaces is rarely economical and their use should be generally abolished, where it is possible to use any other type.

Bituminous Surfaces and Bituminous Pavements

By A. H. Blanchard, M. Am. Soc, C. E., Prof. Highway Engineering, Columbia University, Consulting Engineer, New York City.

Bituminous concrete pavements which have been used in the United States during the past three years and of which broken stone forms an integral part may be grouped in three classes dependent upon the character of the mineral aggregate.

Type A consists of so-called one size crusher run broken stone mixed with bituminous material. This description of broken stone refers to the product obtained at a crushing plant, which passes over a screen having holes of one size and through a section of screen having the next larger size holes, or which passes through a screen of one size of holes and is retained upon a screen having smaller holes.

Type B consists of one size crusher run broken stone as defined above and sand or other fine mineral matter mixed with bituminous material.

Type C consists of a predetermined graded aggregate usually composed of broken stone and sand, with or without other mineral matter mixed with bituminous material.

The types of bituminous concrete pavements described will be considered from the standpoints of all of the topics listed in the "Program of Questions." The discussion of bituminous surfaces will be limited to those topics which refer to this class of construction.

1. Foundations and Drainage

The following statements contained in the 1912 Report of the Special Committee on "Bituminous Materials for Road Construction" of the American Society of Civil Engineers embody the underlying principles of the best current practice relative to foundations, subdrainage and surface drainage.

"Sub-Grades and Foundations.—Your Committee believes that the use of any form of a bituminous wearing surface does not preclude the necessity for the construction of a well-drained, thoroughly compacted, and adequate sub-grade. In fact, such improvement of the road surface frequently attracts heavier traffic, and thus increases the stresses in the sub-grade."

"Crown.—The investigation and observations of the

Committee to date have convinced it that the crown generally used in the construction of macadam roads is excessive when bituminous materials are used, and that a crown of even one-half inch to the foot should be avoided when a lesser crown can be secured without detriment to the surface drainage."

The above report will hereinafter be designated as the "Am. Soc. C. E. 1912 Report."

2. Sizes and Shapes of Broken Stone for Bituminous Bound Surface Crust

Bituminous surfaces have proved more efficacious when constructed on macadam roads composed of well compacted and thoroughly bonded broken stone ranging from ¾ inch to 2 inches in the wearing surface than when the stone is of smaller dimensions. The size of stone is usually obtained by passing over a screen having 1¼ inch holes and through a screen having 2¼ inch holes.

Bituminous concrete pavements. Type A. The best results have been secured by using a mineral aggregate composed of broken stone varying in size from stone passing a 1¼ inch laboratory screen to a small amount passing a ¼ inch screen. This product is usually obtained from the ordinary type of crushing plant, from stone passing over a ½ or ⅝ inch screen and through a section of a screen having holes 1¼ inch in diameter. A typical analysis of such a product follows:

Per cent. passing ¼ inch screen	25.1
Per cent. passing ½ inch screen	24.3
Per cent. passing ¾ inch screen	10.7
Per cent. passing 1 inch screen	17.3
Per cent. passing 1¼ inch screen	2.0

The following excerpt from the "Am. Soc. C. E. 1912 Report" bears especially upon the construction of Type A: "Your Committee recommends that trap rock in sizes greater than that passing a 2-in. screen should be used with caution in the construction of the upper course, unless the voids of the same are properly reduced, because of the liability of the individual stones to rock under traffic."

Type B. The mineral aggregate has been composed of a combination of one size crusher run broken stone and one or more grades of sand or stone screenings. The mechanical analysis of a typical combination covered by the description, two parts trap rock passing a one and one quarter inch ring with a maximum of five per cent. dust and one part sand, follows:

Per cent. passing 200 mesh screen	3.3
Per cent. passing 80 mesh screen	6.9
Per cent. passing 10 mesh screen	29.7
Per cent. passing ¼ inch screen	25.1
Per cent. passing ½ inch screen	24.3
Per cent passing ¾ inch screen	10.7

Type C. One class of mineral aggregate which has been used to a considerable extent during 1911 and 1912 is known as the "Topeka" grading and is usually composed of broken stone and sand, with or without a filler of fine material. The grading for this mixture is covered by the following limitations in the mechanical analysis

Per cent. passing 200 mesh screen from	5 to 11
Per cent. passing 40 mesh screen from	18 to 30
Per cent. passing 10 mesh screen from	25 to 55
Per cent. passing 4 mesh screen from	8 to 22
Per cent. passing 2 mesh screen less than	10

Many bituminous pavements of Type C with proprietary names are laid in the United States. Among these may be mentioned "Bitulithic" and "Warrenite."

3 . The use of Partially Worn Materials in Bituminous Bound Surface Crusts

The universal practice has been to condemn the use of materials, which have been previously employed, for the mineral aggregate in the construction of bituminous concrete pavements.

4. Thickness and Composition of the Strength Crust and of the Super or Wearing Crust Under Different Conditions

Bituminous Surfaces. A thin coat of the proper kind of bituminous material has given better satisfaction than the formation of a comparatively thick carpet, especially when the surface is subjected to excessive horse drawn vehicle traffic.

Bituminous Concrete Pavements. Type A is usually laid upon a foundation course (strength crust) of broken stone having a thickness varying from four to eight inches. Type B is laid on a broken stone foundation course as indicated for Type A or a cement concrete foundation, five to six inches in thickness. Type C is laid on a broken stone or a cement concrete foundation as mentioned for Type B. It is being recognized as a fundamental principle that where Type C is used under conditions which render it economical and suitable, only the cement concrete foundation should be employed. The necessity for constructing strong foundation courses due especially to the rapid development of motor truck traffic is apparent. For Types A and B the thickness of the wearing surface has varied from 1½ inches to 3 inches, the average being 2 inches. For Type C, when a fine material aggregate is employed, 1½ to 2 inches has been used, the best practice favoring 2 inches. Pavements with mineral aggregates having larger broken stone are generally laid 2 inches in thickness, although 3 inches has been used in some cases.

5. Life of Surface Crust Under Different Conditions of Traffic, Weather, Subsoil, Etc.

Bituminous Surfaces. The life depends primarily upon the character of the material and the amount and kind of traffic. Bituminous surfaces on macadam roads have a life of from one to three years and on bituminous concrete pavements from one to five years.

Bituminous Concrete Pavements. As with all types of bituminous pavements, the life of the wearing surface depends, to a large extent, upon the character of maintenance. Granted proper construction, including adequate foundations and drainage, and continual maintenance, which includes the use of seal coats applied periodically, the life of bituminous concrete pavements, based upon such information as is at hand, may be estimated as from twenty to twenty-five years. This estimate is based upon the supposition that the various types of bituminous concrete pavements are used under conditions for which each is suitable. More definite information is at hand covering the life of pavements which have not been maintained. The following estimates cover average life without maintenance: Type A, four to ten years; Types B and C, seven to fifteen years.

6 and 7. Relative Importance of Patching, Repairs and Periodical Renewals of Surface Crust. Extent to Wear Permissible Before Renewal of Surface Coating

All types of bituminous surfaces and pavements are liable to develop weak spots. Patching in these cases is found to be economical and practical as it is comparatively simple to replace a portion of a bituminous concrete pavement or a bituminous surface on a macadam road. Likewise periodical renewals of bituminous surfaces are efficacious. This method of repairing will be economical until such time as the pavement begins to generally wear out or disintegrate.

8. Measurement of Wear and Appliances Used for this Purpose

Work of this character on bituminous concrete pavements has been limited to that of a few investigators, all of whom have used the method of periodically taking accurate elevations in order to determine the amount of wear.

9. Various Methods of Bituminous Treatment

Mixing Methods. In 1910 practically all of the bituminous pavements of Type A were constructed by hand mixing methods. In very few cases was the broken stone heated. During 1911 and 1912 there has been a general abandonment of hand mixing methods and a substitution therefor of various machines especially designed for the heating of the mineral aggregate and the mixing of it with bituminous materials. The introduction of these machines has made possible the use of the most suitable types of bituminous materials. Generally this type of mineral aggregate is mixed in portable mixing plants at the road side.

The mineral aggregate of Types B and C of pavement has during 1911 and 1912 been universally mixed in a special machine designed to heat the mineral aggregate and mix with it the bituminous material. The location of the machine depends upon local conditions. In some cases the mixing plant is located at a railroad siding at which both the broken stone and the bituminous material are available, and in other cases, near the road to be constructed. In some instances large mixing plants have been installed in municipal yards. Type C is also manufactured in the form of asphalt blocks at factories. The following reference to heated aggregates in the "Am. Soc. C. E. 1912 Report" is pertinent:

"Your Committee recommends that in the use of a heated aggregate for the construction of a bituminous pavement, non-uniformity or excess in the heating of stone, such as usually occurs with the use of flat plates or similar crude appliances for this purpose, should be avoided."

All of the above types have been constructed with and without a seal coat of bituminous material. The best practice, however, favors the use of a seal coat.

Carpeting Methods.—In the case of macadam roads, the mode of procedure is to clean thoroughly the surface by sweeping with hand bass brooms or horse sweepers or a combination of these methods. The bituminous material, which is generally heated, is applied to the surface with the aid of pouring cans, hose attached to gravity tanks, hand drawn gravity distributors, horse drawn or power driven gravity distributors and pressure distributors. After a varying interval, some kind of mineral coating is generally applied to cover the bituminous material. The construction of bituminous surfaces on bituminous concrete pavements during the construction of the latter is usually accomplished by the use of brooms, squeegees or hand drawn gravity distributors. For the periodic application of bituminous materials all the above methods are used.

10 and 11. Relative Advantages and Use of Tar, Tarry Compounds, Asphalt, Bitumen, and Other Materials. Tests and Chemical Analysis of Tarry, Bituminous and Asphaltic Compounds

Bituminous surfaces.—Since 1910 there has been slowly crystallizing an objection to the use of bituminous materials on macadam roads which require from one to three weeks to "set up" to such an extent that tracking will not occur. Refined coal tars and water gas tars, combinations of asphalts and tars, and certain asphalts have given satisfaction in this respect as they have "set up" satisfactorily within six to forty-eight hours. Usually about one half gallon per square yard has been used which has been applied either in one or two applications. In the construction of bituminous surfaces at the time of the building of macadam roads, it has been found possible to employ the same grades of asphalt as are employed in the construction of bituminous pavements by penetration methods, provided large stone is used in the surface and the latter is dry and thoroughly broomed.

Bituminous Concrete Pavements.—In the construction of both the mix and the seal coat of Types A, B, and C, asphalts, possessing the proper physical and chemical properties, have given excellent results. Coal gas and water gas tars have been used in the construction of Type A and to a very limited extent in the construction of Types B and C. In the construction of Type A, coal tar has been used in the mix and an asphalt for a seal coat with satisfactory results. The use of high carbon tar of a certain consistency does not appear to give satisfaction as a seal coat when the traffic includes many horse drawn vehicles. Compounds of asphalt and tar have been used in the construction of Type A and to a limited extent in the construction of Types B and C.

The amount of bituminous material used is expressed as either so many gallons per square yard of wearing surface or as a given per cent. by weight of the mix. In the various types mentioned, the amount of bituminous material used varies from five to ten per cent. by weight.

12. Climatic Effects Causing Slipperiness of the Roadway. Remedies.

In some cases bituminous concrete pavements with seal coats of tar and certain grades of asphalt have been slippery, especially in cold weather. Many types of bituminous pavements are rendered non-slippery by the application of an additional covering of stone chips or pea gravel.

13. Effect on Public Health, Fish Life, or Vegetation

The effect of using bituminous surfaces and bituminous pavements has been beneficial from the above standpoints except that the odors characteristic of certain asphaltic oils are obnoxious.

14. Specification of the Methods of Construction

Detailed specifications have been drawn up covering the construction of bituminous surfaces and the various types of bituminous concrete pavements referred to above. These specifications generally cover the quality and size of the various components of the mineral aggregate, the physical and chemical properties of the bituminous material and detailed descriptions of the methods to be used in mixing and in the laying of the wearing surface. Typical detail descriptions of methods are covered by the following references. Bituminous surfaces: Trans. Am. Soc. C. E. 1911, vol. LXXIII, pages 44-73, and 1912, vol. LXXV, pages 548-571. Bituminous concrete pavements. Types A, B and C: Trans. Am. Soc. C. E. 1911, vol. LXXIII, pages 99-135, and 1912, vol. LXXV, pages 572-648. Type A: Borough of Queens, N.Y., Special Report, 1912. Type B: 1911-1912 Specifications, Washington, D.C.; 1912 Specifications, Lincoln Park, Chicago, "Good Roads" April 6, 1912. Type C: 1911 Specifications, Borough of Richmond, N.Y.; 1912 Specifications, Borough of Queens, N.Y.; 1912 Specifications, New York State Highway Commission; 1912 Specifications, City of Philadelphia.

15. Cost Data

Bituminous Surfaces.—The average cost of constructing a bituminous surface, using 0.5 gallons per square yard with either an asphaltic or a tar product or a combination of the two, is 7 cents per square yard.

Bituminous Concrete Pavements.—Besides variations dependent upon local conditions, the cost varies with the kind and quantity of the bituminous material used, the character of the aggregate and the type of construction employed. Type A.—Using an aggregate of one size crusher run stone mixed with 1.5 gallons of bituminous material per square yard of 2-inch wearing surface and a flush coat of 0.75 gallons per square yard, the cost varies from 25 to 35 cents in excess of water bound macadam. Types B and C.—The cost of pavements with mineral aggregates of broken stone and sand, with or without other fine material, varies from $1.00

to $2.25 per square yard including the foundation course and light grading.

16. Cleansing and Watering

Bituminous surfaces and bituminous concrete pavements constructed on highways outside built up districts when subjected to considerable motor car traffic are found to remain clean and practically free from dust. When subjected to excessive horse drawn vehicle traffic in suburban or urban districts, the practice of periodical flushing at night has proved efficacious. Sprinkling with water bituminous surfaces and bituminous concrete pavements is universally condemned as tending to shorten the life of pavements and as being characteristic of uneconomical administration of street cleaning.

Bituminous Pavements—Penetration or Grouting Method

By Major W. W. Crosby, M. Am. Soc. C. E., Chief Engineer Maryland Geological Survey, Consulting Engineer, Baltimore, Md.

With the construction in open country of macadamized roads bound with tarry, bituminous or asphaltic materials by the "Penetration" or "Grouting Method," it seems (says the author, whose paper we reproduce in extenso) that the best modern practice in the United States of America has now crystallized along the following lines:

1. Foundations and Drainage

The necessity for firmer and stronger foundations, and, to this end, for the best possible sub-drainage, seems to be fairly widely and generally accepted, especially by those whose vision into the future is keen enough to permit them to recognize the probable increase in the demands on the foundations, to be brought about by better surfaces and by the consequent growth in both the amount and weight of traffic as well as in its severity. This necessity is even more apparent when the penetration method of constructing the crust is used, because of the fact that such a crust appears to have frequently less inherent rigidity than many built by the Mixing method.

2. Sizes and Shapes of Broken Stone for Bituminous Bound Surface Crust

While the mixing method may require a combination of different sizes of broken stone for the best results, with the penetration or grouting method under discussion, this is not the case. The unscreened product of a crusher is often used quite satisfactorily for the bottom course of the crust, though this course is frequently just as satisfactorily built of the coarser portions of this product. The choice depends on local conditions. It is considered inadvisable, however, to allow any particles over three inches in length in this course.

In the second or wearing course, it is the best practice to pay considerably more attention to the screening and sizing of the stone particles. Very good results have been obtained by the use for the second course of cleanly screened stone passing a 1¾ inch round opening and not able to pass a ¾ inch. Apparently better results have been secured by the use of pieces passing a two inch and retained on a one inch screen, and very good results seem to have been secured, where the pieces were most cubical, by the use of stone passing a three inch, and retained on a two inch, screen. More uniformity of grouting, together with longer wear, seems to be secured by the use of the larger sizes, and, further, a surface built of the larger sizes seems better able to withstand without damage the crushing strains of the heaviest loads carried on hard tyres.

It has not been the best practice to permit too great a difference between the sizes of the screens used for separating the material for this course, about one inch being the customary difference in diameters of holes and one and one-half inches, the maximum. A greater difference seems to contribute toward lack in that much-to-be-desired uniformity of grouting and this is especially noticeable in stone breaking into scaly pieces.

The writer believes that with a fairly cubical broken stone the best results have been obtained by the use of screens 2½ inches and 1½ inches in diameter of openings and that in the case of shaley rock 2 inches and 1 inch have given the best results. Reference has been made to "cubical" and "scaly" or "shaley" stone. There is general agreement that stones breaking cubically, without glassy fracture—that is, with fairly rough surfaces—and with sharp angles are most desirable.

3. The Use of Partially Worn Materials in Bituminous Bound Surface Crusts

From the foregoing (2) it will be seen that partially worn materials are usable for the bottom course of the crust, and they are frequently so used. Experience shows that such use should be accompanied by proper regard for the segregation, by harrowing or screening, of the fine material and detritus generally present with the coarser sizes. But the use of even the carefully separated coarser sizes of the old worn material is not generally permitted for the upper course of the crust as it is considered dangerous to successful results.

4. Thickness and Composition of the Strength Crust and of the Super or Wearing Crust Under Different Conditions

So much depends on the particular conditions of the individual case that a general statement on this point is, with difficulty, made of any value. In addition to what has already been stated regarding sizes and shapes of the pieces of stones, it may be further said that the bottom course varies from a minimum thickness of perhaps two inches to a maximum of eight inches, measured after compaction. The average is probably from four to five inches. This course is built both with and without the addition or presence of fine material (passing a ¾ inch or ½ inch screen) as local conditions seem to determine, though it seems that the proper use of a moderate amount of the smaller material generally produces a firmer and stronger first course. Occasionally the completed bottom course has been given a coat of pitch before spreading the upper course stone, but ordinarily this use of the pitch is not followed, nor does it generally seem to be considered necessary to endeavor to secure any penetration of the pitch to the bottom course through the upper course stones.

The super or wearing course, it may be said, is generally from two to three inches in thickness after rolling. For the proper penetration and adherence of the bituminous material or pitch of whatever nature, it is now generally agreed that the particles of stone must be clean and free from coats of stone-flour, dirt or dust. Apparently a general preference exists that they should also be dry but there is still much discussion on this latter point, and it is by no means determined what lack of dryness can be permitted without detriment to the results. A very few have even advocated the presence of a certain amount of moisture on the stone before the application of the pitch, but the writer prefers a dry condition, though he agrees that, in most cases, a moderate amount of moisture is not as objectionable as dirtiness or dustiness.

Another most important factor affecting both the courses of a bituminous as well as of a water bound road crust is the sufficiency of the rolling given them. So generally is it now accepted that with water bound macadam the utmost possible compaction and interlocking of the stone by rolling is necessary for first class results, that the truth of the saying that "Rolling is the life of the road" is everywhere recognized. With bituminous macadam built by the penetration method, the concordance on this point seems to be as yet less complete. Some road-builders actually insist on a minimum of rolling before the application of the pitch and others do not require a maximum. With the writer's work, however, there is no question but that the quality of the results has been in direct proportion to the amount of compaction or interlocking secured by proper rolling, and it is his opinion that results generally show that the proper rolling of the stone before the application of the pitch is of the greatest importance.

5. Relative Advantages and Use of Tar, Tarry Compounds, Asphalt, Bitumen and Other Materials

The proper selection of the bituminous material or pitch for use under the penetration or under any method, is a most serious one and is influenced by many conditions other than method of use. Such, like price, soil, weather and traffic conditions, desires of users of, and abuttors on, the road, the conditions likely to prevail regarding after-maintenance and cleaning, etc., etc., are largely local, and are probably not germane to the discussion in this paper. Confining the statements to the subject (5) and considering only the penetration method of use, it may be said:

The use of unrefined tars has been found unsatisfactory and has been practically abandoned. The extent and character of the refining seems to depend largely on the peculiar conditions to be expected in any case of the use of the material, but some points in this connection are still unsettled. It seems generally agreed that the presence in the tar of more than a minimum of water or amoniacal liquor renders it undersirable for this method of use, that certain amounts of "light oils" are necessary for giving to the pitch the desired fluidity in handling; that a generous proportion of "middle" and "heavy" oils—especially the latter—is demanded, in order that the tar may retain the longest possible "life" or elasticity after use and under the aging or weathering effects of weather and traffic as well as for giving the "body" to the pitch demanded by this method; and that a limited amount of "free carbon" may be advisable in order to help to give body to the tar and to assist in reducing its susceptibility to changes in temperature. This "free carbon" (matter insoluble in carbon bisulphide) may be either the natural fraction of the tar or it may be added foreign material such as Portland cement or finely powdered limestone. Some crusts built by the penetration method with a low carbon tar have seemed to improve as fine material was supplied by traffic.

As first an opinion existed widely that the value of a tar for road work was in inverse proportion to its percentage of "free carbon" content, but the writer was loth to accept this view because of his knowledge of the proved great value of certain tars in which this fraction was unusually high. Results of practice with the penetration method to date seem to indicate that it is not the simple proportion of the "free carbon" fraction to the whole tar which was of use as a criterion in passing on the value of the tar for the penertation method, but rather the ratio between the "free carbon" fraction and one or more other fractions (the heavier oils) on which depends the worth of the whole tar.

The use by the penetration method of tars with a "free carbon" content of less than two per cent. has resulted in an objectionable susceptibility of the road surface to summer heats, while the use of tars whose "free carbon" fraction was greater than the percentage of the heavier oils in the same tar has shown a too great hardness or friability under extreme cold.

In the use under the penetration method of the native asphaltic materials and of the oil residuums, a certain amount of "light oil" seems desirable for the sake of fluidity, and a limited amount of "middle" and "heavy" oil fractions for the sake of "life" and elasticity. The "pitch" fraction, being the base in those cases, must possess the desired characteristics of adhesiveness, cohesiveness, lack of brittleness and resilience. The proper proportions of the lighter fractions depend on the characteristics, in these particulars at least, of the "pitch," as well as upon the conditions of traffic, etc.

Early practice under the penetration method condemned the use of "cut back" products—i.e., those artificially prepared by the addition of oils to previously reduced pitches—probably because in many cases such pitches had not been carefully prepared with this end in view but were by-products or wastes from processes arranged for the production from the raw material of the portions other than the pitch.

The writer believed that not only was it possible to make satisfactory road compounds for use under this method from a pitch by cutting it back with lighter materials, but also that it was quite possible that, in many cases, a far more satisfactory product could thus be obtained than by simple reduction, to the desired consistency, from the raw material.

Subsequent experience has seemed to confirm this theory and some of the most satisfactory results under the penetration method have been secured by the use of pitches compounded by adding the necessary oils to a previously, and purposely prepared, fairly hard, asphaltic pitch.

In such cases, the harder pitch possessed all the usual qualities of a good asphaltic paving pitch and the flux, those of a proper flux for making asphaltic cement, except that perhaps more volatile oils were included to permit of easier and better use under the peculiarities of the penetration method. Experience seems to have proved that there is a limit to the amount of "greasiness" that can safely be permitted in the flux so—as above—used and that an excess of this characteristic may ruin the results under this method by permitting, if not encouraging, internal motion between the coarse particles of the crust, especially in the usual case of a deficiency of the smaller sizes.

In the use of the materials referred to, so much depends on the peculiarities of the local demands that brief general statements are again somewhat difficult. A few such may, however, be justified. For instance, experience has seemed to prove that in the use of tars or tar-compounds under the penetration method, better results have been secured where the softer materials have been used provided such softness was not secured by an excessive proportion of volatile or light oils. This seems especially true when considering the tendency of certain pitches to produce surfaces slippery in wet or cold weather.

As regards asphaltic materials (including oil residuums) it seems that in many cases where softness has been given by a generous amount of the middle oils (non-volatile) the resulting surfaces under this method have shifted under traffic in warm weather and evidenced "lubricating rather than the necessary binding" characteristics of the pitch compound.

Regarding the quantity of pitch to be used under the penetration method, while the character of the wearing course (as to sizes, kind, etc., of the material) will affect the decision, it may be stated that ordinarily the successful amount of bituminous material per square yard of surface seems to have been between 1½ and 2 gallons. The writer has built entirely satisfactory work with as low as 1¼ gallons per square yard, but under exceptional conditions. He has also seen instances where as high as 4½ gallons per square yard of tar were used, but with little dissatisfaction with the resulting surface. In fact, the main objection that appeared in those latter cases came from some bleeding of the pitch over the road surface during the first summer after construction, and this was readily obviated by one or two additional coatings of stone chips.

It has been suggested that an excess of pitch in the crust, provided it is located well down in the latter, may be of some decided advantage in that it may furnish a reservoir from which additional life will be given to that pitch exposed on the surface to deterioration by traffic and weather. However, penetration of the pitch to the bottom of the larger sized stone in the surface seems ordinarily to be sufficient for success.

Practice has varied in the application of the pitch under the penetration method, some applying the bulk (say, ¾ of the total amount) at first and then, after spreading a coating of chips and rolling, applying the balance with another coat of chips and more rolling. Others apply all the pitch at once. The writer concludes from his observations and experience that the latter way generally gives more satisfactory results.

With the mixing method, where the quantity of pitch may be reduced to a minimum, certain conditions may render advisable a "flush coat" of pitch and chips. But "in open country" where even slight dustiness may not be objectionable and where slipperiness may be decidedly offensive, the omission of the flush coat is generally, under the penetration method, better because of the longer freedom from unnecessary smoothness. And the writer has not found that the omission of the flush coat has, where the road crust was properly built by this method, rendered the crust visibly more susceptible to the destructive effects of either horse-drawn vehicular or motor traffic.

It seems generally admitted that with the penetration method the use of a "flush coat" is mainly for "insurance,"—i.e., to overcome or make good any defects from previous poor workmanship or inequalities in the earlier processes.

Uniformity of grouting has been referred to as desirable, and is now generally so recognized. Toward this end as well as for the sake of economy, efforts have been made to supplant the early system of hand-pouring by some mechanical distribution of the pitch. Some very successful machines have been devised for the purpose and it seems generally agreed that the best results under the penetration method are secured by the use of such appliances distributing the pitch under pressure of from twenty to seventy pounds per square inch.

6. Cost Data

The usual variation in cost, resulting from different local conditions, have been omnipresent with the penetration as with any other method. However, it may be stated that with labor at 15 c., single horse carts at 27½ c., two horse carts or wagons at 50 c., foremen at 30 c. per hour, stone at $1.75 per ton delivered on the work, and pitch at from 7 c. to 10 c. per gallon delivered at a railway station within one mile of the work, the cost for building by the penetration method a pitch bound macadam using from 1¼ to 2¼ gallons of pitch per square yard averages between 15 c. and 25 c. per square yard over and above the cost of building water bound macadam under the some conditions. A decrease in this cost has quite steadily occurred and it seems may be looked for further as proficiency in practice and as mechanical appliances for the work are developed.

Tests of Materials Used in Construction of Macadamized Roads

By Logan Walter Page, Director U. S. Office of Public Roads, Washington.

Assuming that a macadamized road has been the proper selection of pavement for the conditions of traffic which it is to carry (says Mr. Page in introducing his paper), and assuming that proper constructive methods have been used in its completion, there remains no element more contributary to its success or failure than the ability of the rock entering its construction to resist the destructive influences to which it is subjected.

There are two methods for judging of the suitability of a rock for use in the construction of a road. Either, observations may be made on a road constructed of the same material and subjected to approximately the same conditions of traffic, or the rock may be subjected to artificial conditions designed in the laboratory to approximate those met on the road. The first method, that of the observation of a road already constructed, is, however, not of positive value unless assurance can be had that the material to be used in the new construction is of the same character as that in the road under observation, and this assurance can only be had by a comparison of the physical characteristics of the rocks obtained through laboratory tests. From past general observations of the behavior of different kinds of rocks in service, and by a comparison of these observations with the physical qualities of the rock obtained in the laboratory, very convenient means are furnished for judging from the results of the laboratory tests of the probable adaptability of the rock for use in the road under construction.

Road Destroying Influences

The rock in a macadam road should be selected to successfully combat the agencies which attack it with destructive effect. The three main classes of destructive agencies are: (a) Mechanical; (b) Chemical, and (c) Physical.

A.—**Mechanical Agencies.**—Subjected to the impact and grinding action of traffic, the individual particles of rock are disrupted and their surfaces are ground away with a consequent formation of dust. At the same time there is a tendency to loosen the road surface through the rolling and shearing action of horses hoofs and wagon wheels. To withstand these influences, the rock must be tough in order that it may not break into smaller particles, and it must be hard in order that it may not grind to dust too readily. The dust formed by traffic serves as a binder or cementing agent to hold the larger particles together and is a necessary part of the material in the body of the road. This fine material is carried away to some extent by the winds and rains, while part is retained on the road. Should the rock be too soft, more fine material will be formed than can be carried away by the mechanical action of the winds and rains and in a short time the surface becomes muddy and dusty. On the other hand should the rock be exceedingly hard and tough, too little fine material will be formed to replace that dispelled by the winds, and washed away by the rains; the road is thus deprived of its binding material and in consequence the surface becomes loosened, or the road "ravels." Automobile traffic exerts a severe shearing action on the surface, loosening it and failing to supply, by abrasion, fine material to replace that lost in the clouds of dust raised by this class of traffic. Plain macadam roads are therefore not suitable for automobile traffic and recourse must be had to bituminous or other binders when many automobiles are to be carried.

B.—**Chemical Agencies.**—All rain water and surface water contain carbonic acid and act, to some extent, in dissolving the carbonates of lime and iron in the materials of the road. The humus acids of animal and vegetable decay are likewise effective, to some extent, in dissolving some of the rock forming materials containing magnesia, potash, soda, lime, iron and silica. In comparison with the destructive effect of traffic however, chemical action is practically negligible.

C.—**Physical Agencies.**—If the surface of the road is porous or if poor drainage is provided, the disrupting influence of frost on the body of the road may be quite severe although its effect on the stone itself, in comparison, is of small moment. It is thus evident that a dense impervious surface should be the aim in construction, and this can only be obtained by the use of a material, the dust of which, possesses inherent cementitious qualities.

Physical and Mechanical Qualities of Road-Building Materials

The mechanical agencies are by far the most severe in causing the disintegration of the macadam road surface, and the laboratory tests are therefore designed to approximate the destructive effects of these agencies. The traffic pounds up the rock to dust and the winds and rains wash away this dust depriving the road of its binding material and enabling traffic to exert further destructive effect in loosening the unbound stone. Moreover the surface, thus loosened, is subjected, particularly if it is poorly drained, to soaking from long rains, and frost action is thus permitted to work with increased disrupting effect on the body of road.

No. of samples.	Name.	Specific Gravity.			Weight-Pounds per Cubic Foot.			Water Absorbed-Pounds per Cubic Foot.		Per cent of Wear.		French Coefficient of Wear.		Hardness.		Toughness		Cementing Value.		Name.
		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
16	Amphibolite....	3.10	2.70	3.00	193	168	187	1.65	0.04	10.3	1.0	41.7	3.9	19.0	13.5	40	7	235	11	Amphibolite.
63	Andesite........	2.95	1.85	2.65	184	115	165	12.50	0.05	17.4	1.5	26.0	2.3	19.4	5.0	44	5	500+	9	Andesite.
183	Basalt..........	3.05	2.30	2.85	190	143	178	6.40	0.02	16.6	1.3	30.4	2.4	19.3	5.7	40	5	500+	2	Basalt.
52	Chert	3.00	2.00	2.55	184	125	159	11.10	0.25	29.2	2.7	14.9	1.4	19.7	12.7	26	5	500+	2	Chert
9	Conglomerate...	2.65	2.00	2.62	165	156	163	3.71	0.26	12.7	3.5	11.6	3.2	18.4	9.3	10	10	500+	20	Conglomerate.
217	Diabase.........	3.20	2.60	2.96	200	162	185	2.73	0.03	6.3	1.1	36.4	6.4	19.4	12.3	54	4	500+	2	Diabase.
72	Diorite.........	3.35	2.70	2.86	209	168	179	1.03	0.05	12.0	1.6	25.0	3.3	19.4	16.6	38	4	148	5	Diorite.
183	Dolomite	3.00	2.30	2.73	181	143	170	9.49	0.07	18.6	1.2	33.3	2.2	18.8	1.8	27	3	179	9	Dolomite.
6	Eclogite........	3.65	2.95	3.20	228	184	200	0.28	0.10	2.9	1.8	22.7	3.8	18.7	17.4	31	14	130	10	Eclogite.
11	Epidosite.......	3.30	2.70	3.04	206	168	190	1.65	0.22	7.4	2.0	19.6	5.4	19.3	10.7	23	8	83	3	Epidosite.
11	Felsite.........	2.80	2.50	2.65	175	156	165	3.43	0.02	3.4	1.9	21.5	11.8	....	....	....	....	.....	....	Felsite.
91	Fieldstone......	....	...	....	....	...	..	.....	...	10.3	2.1	19.0	3.8	....	....	....	....	15	12	Fieldstone.
42	Gabbro..........	3.65	2.75	2.97	228	172	185	0.97	0.04	5.9	1.3	30.8	6.8	18.8	13.3	23	8	134	6	Gabbro.
152	Gneiss..........	3.20	2.60	2.75	200	165	172	1.24	0.02	16.4	1.7	23.0	2.4	19.3	9.0	25	2	110	1	Gneiss.
219	Granite.........	3.00	2.00	2.66	187	122	166	2.77	0.04	24.6	1.1	37.0	1.6	19.6	13.6	33	2	255	2	Granite.
136	Gravel	....	...	....	....	....	....	...	...	...	....	....	..	....	....	....	....	500+	3	Gravel.
718	Limestone.......	2.85	2.00	2.66	178	125	166	13.22	0.02	34.2	1.8	21.7	1.2	19.1	0.0	25	2	500	9	Limestone.
37	Marble..........	2.85	2.65	2.76	178	162	172	2.19	0.10	14.0	2.3	17.5	2.8	17.3	7.1	23	3	85	10	Marble.
9	Marl............	...	....	....	....	....	....	.....	...	...	....	....	....	....	....	..	...	500+	96	Marl.
19	Mixed stone.....	....	....	...	....	....	....	.....	..	10.3	2.1	19.1	3.9	....	....	..	....	....	....	Mixed stone.
5	Peridotite......	3.55	2.65	2.95	221	165	181	1.02	0.27	5.3	3.0	13.2	7.6	15.0	13.3	12	9	91	25	Peridotite.
90	Quartzite.......	3.15	2.35	2.67	196	147	167	2.95	5.05	7.6	1.6	24.5	5.3	19.7	15.3	30	5	45	0	Quartzite.
42	Rhyolithe.......	2.90	2.05	2.56	181	128	160	7.15	0.03	9.7	1.7	23.0	4.1	19.7	15.3	42	6	500+	9	Rhyolite.
340	Sandstone.......	3.25	2.00	2.61	203	125	163	11.60	0.02	41.7	1.0	40.8	1.0	19.5	0.0	60	2	500+	1	Sandstone.
136	Schist..........	3.20	2.65	2.94	200	165	183	1.35	0.06	23.3	1.3	31.7	1.7	19.0	0.9	44	3	232	5	Schist.
9	Shale...........	2.70	2.50	2.65	168	156	165	4.84	0.50	16.2	3.2	12.6	2.5	17.7	13.0	12	3	367	28	Shale.
55	Slag............	3.90	2.00	2.97	243	125	185	4.40	0.04	13.5	2.5	15.7	3.0	18.3	10.7	21	2	500+	1	Slag.
59	Slate...........	3.35	2.60	2.78	209	162	173	2.10	0.05	12.4	1.6	24.4	3.2	19.7	1.1	56	1	500+	1	Slate.
27	Syenite.........	3.05	2.15	2.65	190	134	165	4.21	0.08	14.4	1.6	25.6	2.8	19.2	17.3	34	8	375	10	Syenite.

Maximum and minimum results on rock samples corrected to January 1, 1912.

The three prime requisite qualities to be possessed by road-building materials are, as has been indicated, those of (a) hardness; (b) toughness, and (c) high cementing value.

(a) By hardness of a rock is meant its ability to withstand the displacement of its surface particles through friction.

(b) The toughness of a rock is a measure of its ability to resist fracture from the effects of impact.

(c) The cementing value of a rock dust measures the ability of that dust to hold the individual particles together to form a firm impervious road surface. These physical properties of hardness, toughness and cementing value are of primary importance. Other physical properties to be investigated are those of specific gravity and absorption. The latter property is of especial value where frost action is very severe.

Mr. Page then gives particulars of the various tests for determining the hardness, toughness, resistance to wear and cementing value of road stones, and describes and illustrates a number of machines. We return again to the report.

Interpretation of Physical Tests

1. Hardness.—Rocks having a coefficient of wear below 14 are called soft; from 14 to 17 medium, and above 17 hard.

2. Toughness.—The results of a toughness test are interpreted so that the rocks which run below 13 are called low; from 13 to 19 medium, above 19, high.

3. Resistance to Wear.—In interpreting this a per cent. of wear above 5 is called high; from 3.1 to 5, medium; from 2 to 3.1, low, and below 2, very low.

4. Cementing Value.—Cementing values below 10 are called low; 10 to 25, fair; 26 to 75, good; 76 to 100, very good, and above 100, excellent.

The average results of all of the tests conducted on characteristic road building rocks up to January 1, 1912, are given in the following table:

		Hardness	Toughness	Cementing value
	Limestone................	14.4 (517)	8 (524)	54 (560)
	Sandstone................	15.0 (237)	12 (242)	62 (257)
	Granite..................	18.5 (131)	12 (131)	18 (138)
Trap	Andesite..............	17.1 (54)	18 (54)	196 (58)
	Basalt................	17.3 (150)	18 (148)	108 (161)
	Diabase	17.7 (134)	20 (132)	101 (138)
	Diorite	18.2 (40)	16 (45)	28 (43)
	Gabbro	17.8 (26)	15 (26)	44 (29)

		Per cent of Wear	French Coefficient
	Limestone................	5.2 (597)	7.7 (597)
	Sandstone................	5.7 (232)	7.0 (232)
	Granite..................	4.5 (166)	8.9 (166)
Trap	Andesite..............	3.8 (56)	10.5 (56)
	Basalt................	2.9 (153)	13.8 (153)
	Diabase...............	2.7 (126)	14.8 (126)
	Diorite	3.3 (44)	12.1 (44)
	Gabbro	3.0 (25)	13.3 (25)

Note . Numbers in parenthesis indicate number of test averaged.

Considering the question of practical tests in road building materials (says Mr. Page in conclusion), it must be acknowledge that these are extremely difficult to conduct in such a way as to obtain results of very definite value. Even though observations be made on roads built of material, the physical tests of which are on record, these observations because of the varying conditions of traffic and climatic conditions with different amounts of rainfall and different velocities of wind make them almost impossible of comparison with similar kinds of observations taken on another road. Much valuable information, however, has been obtained by a general observation from year to year of roads constructed of different types of materials. In this way the method of interpreting the physical qualities obtained in the laboratory has been devised and it is believed that, although it is impossible to give rocks a numerical grading of excellence from the results of the physical tests, a very accurate idea of the suitability of the rock for the purpose intended may be obtained by considering the tests in conjunction with the probable character of the traffic that the proposed road is to receive, the quantity of that traffic, and the climatic conditions.

Road Administration

By W. A. McLean, Chief Engineer of Highways for Ontario.

Road-building for a nation is, proportionate to each country's size and population, a great public work. The repair, maintenance and improvement of roads is not an ephemeral service, but extends over the lifetime of the nation. The expenditure is constant, in a term of years is exceedingly large, the opportunity for waste is startling, and for economy is an equivalent. This work and service is a business enterprise based on the possible development of a country's varied resources, and with these qualities should be governed by the best principles of business organization.

Efficient system and organization form the key to highway improvement. If laws, and their administration are properly arranged, all details will be taken care of. If the system is well designed, ratepayers and citizens will have at their service a powerful machine, perfect in all its parts, that will produce finished highways, durably built, adapted to the service they are to perform, well maintained, and at a minimum cost.

System implies an effective means of procuring necessary funds, a fair and just method of distributing the cost, a general management based on good business principles, the application of engineering skill to design, and construction carried on with the best utilization of power and labour.

Road administration, the apportionment of responsibility for construction and maintenance, the functions of central authorities and local authorities, the division of areas of mileage, staff arrangement and inspection are details which should be considered in their relationship to recognized rules of efficiency.

The creation of a thoroughly efficient system of highway construction and maintenance, is a task which, in Canada, and the Canadian provinces, is being actively considered and dealt with. While some satisfactory progress has been made, measures to the present time have been those of the formative stage. Evolution rather than revolution has been the history of legislation in Canada, and highway systems and measures are following the general rule. In England, Germany and other countries of Europe, public opinion is well informed in the matter of roads, and excessive cost or inferior service are quickly recognized. In Canada and the newer countries, road requirements have outgrown organization and public knowledge in this regard, with the result that road construction and improvement is a fertile field for unfortunate conditions of cost and management.

Road-building is now, or has been, a local function in Canada as in the majority of countries, but there is an evident tendency toward centralization of administration. A portion of the problem before us thus largely resolves itself into the question:—Does such centralization, wholly or in part, produce more efficient organization? Does centralized authority through a process of selection and higher renumeration, secure leadership and personality of a more influential and outstanding type, through which, order and discipline, standards, public confidence, expert service, and other features of good business organization are most readily focused and applied?

Special Road Conditions

In regarding road administration as a business unit, certain factors at once become apparent.

Conditions are not the same in all countries,—such conditions as area, traffic, taxation, governmental authorities, constitutional limitations, local divisions, and national customs—so that, while the principles of organization are universal, yet varying circumstances must make the answer to our problem an individual one for each nation.

In Canada and the United States, the pressing need is to build roads and afterwards to create a system of maintenance. In England, France, Germany and other European countries, the roads are already built, and the system of maintenance is the prominent feature.

Road Classification

Roads admit of classification, so that, while centralization may be beneficient for one class, it may not be so for all. In general three broad classes will exist:—

1. Roads of least travel, those of exceedingly limited and local service, such as may be described as parish or township roads.

2. Roads which are the main arteries of a moderate area, radiating from market towns, which collect the traffic of the district, and which may be termed county roads.

3. Roads which carry traffic between large centers of population, direct routes across a large territory, which may be classified as of state or national importance.

Labour Efficiency

The cost of road-building is created chiefly by the cost of labour. Comparatively little is spent for crude material alone. Grading and draining are almost wholly a matter of labour. Stone in the quarry is of little value—its value grows out of the cost of quarrying, crushing and transportation, and afterwards putting it in place and rolling. Crude asphalt and tar are cheap. The cost grows out of refining and applying to the road. To build roads cheaply and well means a wise direction of labour to which the best principles of military organization, of the organization of great contracting, or mercantile, railway, or industrial concerns should be applied.

A Definite Conception

A board and definite conception should be established, of the work as a whole, and the objects to be reached. A perspective view, a view from a height, is necessary in order that relationships may be understood and effectively ar-arranged; in order that all details and features may be co-related. A narrow outlook, one which sees only from close range, has a magnified sense of some features, while others are wholly obscured. Details must not be overlooked, but they must be kept in their place, and all parts adjusted so as to serve their proper purpose. The broad ideal so determined, should be made to exercise a proper influence throughout the entire business organization.

A central or national authority is more remote from local or petty issues and affords opportunity to view the country's road question from the higher view point, so that administration is from a broad but definite conception of the service and traffic requirements as a whole.

True Economy With Sound and Convenient Finance

Regarding the nation's system of road organization as a unit, true economy of operation is to be sought. True economy does not seek the least expense of administration alone, not greatest durability and efficient service of roads alone, not minimum cost of roads alone, but rather the most effective combination of all factors, so as to produce maximum returns for a minimum or available expenditure. If state administration will produce better roads, or will reduce the cost of all roads or one class of roads, an added expenditure for a central administration may readily be a measure of true economy.

Certain roads are of more than local service. They serve the requirements of national or even international traffic. The motor vehicle has overcome all former distance limitations, and for one local user of a road there may be hundreds from a distance passing over a main or interurban road daily. Central administration permits the application of national or state funds to the construction and maintenance of such roads, thereby more equitably levying the cost upon those who are benefited. Not only for purposes of just taxation, but in order that certain roads may be maintained to a fit standard for traffic is it essential that state expenditure be made, as the upkeep of certain roads is exceeding the ability of local muncipalities to defray the cost.

Roads of a national character under central authority, can be treated throughout with uniformity, and substantial construction with large expenditure can be made, commensurate with the needs of a great work, whereas under local authorities these qualities are lacking or exist in a less convenient degree.

Leadership

Leadership and personality is a strong factor in good organization. The chief officer of a national or great corporation can exercise a marked influence throughout all minor departments. He is in a position to speak with the best facts at his disposal, and through his position a unity of purpose can be created that will focus all energy available upon the one object and result.

Order and Discipline

Order, "Heaven's first law," must be created, if maximum efficiency is to be attained. Each individual in the service should be so guided that he will move in his proper place. Subordinate divisions should operate in unison with one another. There should be no friction or discord in their movement. Like a great machine, each part, and each aggregation of parts, should serve its purpose under a control and discipline that is beneficent, but firm. Energy should not be wasted by useless motions and methods, but like the railway system of despatching, there should be provision for orderly, definite, and well-adjusted movement of every kind.

Without combined effort to reach a well defined end, chaos, not order, is more apt to exist. With each local municipality exercising sole jurisdiction over all the roads within its area, unity of purpose, and uniformity of results are impossible.

Intelligence and Skill

Intelligence and skill, born of instruction and experience, should be created. Each officer, every labourer in the service should be led to exert his best individual effort with his mind as well as his body. Subordinate divisions should, through mutual understanding, be led to co-operate in harmony for the benefit of the work as a whole. It is human nature to dislike and to shirk the study we do not understand or the difficulty of a new task in which we are unaccumtomed and awkward. When the subject is familiar and is understood we read intelligently and with pleasure. When the art is mastered we practice it with ease and pride, and the sense of labour vanishes. The larger organization is capable of imparting better instruction, of affording more permanent employment, and of offering better rewards for ability and long service than is a small local corporation. From this source central responsibility derives an advantage, creating a skilled body of workmen, inspectors and officers to an extent that is impossible with a minor body.

Standard Practice

Standard practice should be established. Standard designs of roads and bridges, standards of materials, of machinery, implements and methods should be created. Uniformity is not merely pleasing, but is conducive to economy, good workmanship, and best results. It reduces the difficulty of supervision, it simplifies organization, and is essential to order and discipline. Without standards, wisely flexible but nevertheless clearly existent and unavoidable, a degree of chaos must exist.

Such standards, extended over a wide area, create a more depenable staff of officers, and a larger body of workmen to draw upon. A central authority, by long experience, careful study and selection is able to establish and create the best standards obtainable.

Expert Advice

Expert advice must be secured, based on scientific study, observation and investigation. With many problems of administration, construction and maintenance still to solve, with constantly changing conditions, there is every need that technical progress should be given encouragement, and that its application should be immediate and well-placed.

Under central authority investigation can be carried on for a nation, state, or other wide area, without the duplication of many local units, with a greater expenditure and the greater efficiency that should grow from larger salaries, better equipment, and less strict economy, thereby producing the best of expert advice, and providing standards for uniformity in practice. While not necessarily a factor of administration, it is most efficient when closely associated with practical work, but an office of road investigation is a function of national government. In a great area such as Canada or the **United States, National may properly be supplemented by** State or Provincial investigation.

Records and Cost-Keeping

The system of records and cost-keeping should be accurate, adequate and prompt, and methods of accounting should produce a clear and intelligent statement of expenditure. Cost-keeping is essential to a proper handling of business. A good system of cost-keeping enables one to determine the relative values of materials and methods, and by fixing a standard of production, will indicate the efficiency, or the reverse, of labour, supervision or other feature involved. To be reliable, records and cost data must be accurate, otherwise they may be indefinite or misleading; they should be adequate, covering all operations involved, otherwise their interpretation may be useless; unless they are prompt, they will fail to suggest a remedy at the time the remedy is demanded or when it would be most effective. Unless a clear and intelligent statement of expenditure is given, public distrust and suspicion is created. Central administration with its broader field, is capable of exercising a most beneficial example and influence in this regard.

Public Confidence

Public confidence must be maintained. To this end the cost should be justly distributed among all citizens according to benefit, visible organization should be efficient, and results should be commensurate with honest expenditure. All business organizations seek public good will, and government efficiency is particularly dependent upon the support and co-operation of the people. Responsibility should be definitely placed, and should be responsive to public requirements.

Fixed Responsibility

Divided and uncertain responsibility is wholly at variance with good discipline and orderly operation. To give directness for blame or praise in this regard, those in charge should be answerable to the portion of the public served. The authority in charge of local roads should be answerable to the ratepayers of the locality; those in charge of more important roads serving a wider area, should be responsible to the opinion of the people using such roads; and the authority in charge of roads of state or national value, should be answerable to the people of the state or nation.

Such an arrangement might be reached by installing one central or national authority with complete power and full responsibility for all roads. Or it may be accomplished by giving the parish or township jurisdiction over local roads; the county council jurisdiction over main roads of the country; and if necessary creating a state, provincial or national department for roads serving travel or transportation of the widest or national area.

The writer's observation has led to the opinion that, under widely diffused authority as in England, the local or less important roads are apt to be maintained in an excellent manner, but at the expense of the main roads which are lacking in a desirable continuity of treatment. Under highly centralized authority as in France, the tendency is to bring the main roads to the highest perfection, while the little travelled roads may show less evidence of careful maintenance.

Seeking the reason, it may be safely inferred that under diffused responsibility, local roads receive the careful and constant supervision of good resident engineers or superintendents, who give daily attention to the individual roads at all seasons of the year, to local traffic, drainage, road metal and similar details. Under highly centralized authority, this power to act promptly, and incentive to observe, may be lacking; and in a desire to avoid criticism of the more influential public, the treatment of main roads may be given first place in apportioning expenditure, while the lesser roads are starved.

It becomes apparent that neither widely diffused authority nor highly centralized authority is faultless for all conditions. A wise union offers a solution, thereby utilizing all public opinion, and fixing responsibility to the best advantage. By this means, local responsibility would be confined to roads of local importance, developing local influence as far as possible for the benefit of such roads. County authority would then be utilized in its sphere for roads of greater radius; while national or state power should be focused on roads having through traffic so great that their upkeep is an unfair charge upon local authorities, and from whom uniformity of treatment cannot be expected.

Moving on lines of least resistance, the existing governing bodies should be utilized as far as possible, without creating new boards or corporations. Lines of centralized authority can, the writer submits, in Canada or the United States most rapidly and effectively converge in the state or provincial governments for main roads. England has no intermediate organization between the county council and the national government, as has the United States where each state has its own legislature, or as in Canada where the provinces are between the local and federal administrations.

Resume

A brief resume of the views advanced by the writer leads to the conclusion that centralized administration is in accordance with, and essential to, the best principles of organization, but that its adaptation should be carefully adjusted to special conditions of each country. Such centralization should place subordinate responsibility where it properly belongs—in the body exercising jurisdiction over the area served. To state or national authority properly belongs responsibility for state or national roads, and also branches of investigation, general instruction, and good leadership. Such a policy of state co-operation creates unity of purpose and effort, and produces the ultimate efficiency that commands public confidence, and support.

Improvements in Road Machinery Since Second Congress

By Arthur W. Dean, M. Am. Soc. C. E., Chief Engineer Massachusetts Highway Commission, Boston.

Mr. Dean is of the opinion that the changes and development in machinery used in the construction and maintenance of roads in the United States during the period that has elapsed since the last road congress held in Brussels, are confined almost entirely to improvements tending to make more perfect the types of machinery previously in use, thereby securing greater economy and accomplishing more perfect results in the work performed.

Manufacturers learn by experience the weak points or deficiencies in their apparatus, and if they have a good reputation which they desire to sustain, aim to strengthen the weak points and all new parts to overcome the deficiencies. Contractors desire to reduce costs to the lowest possible figures, and use their minds to invent methods and machines that may assist them in securing such reduction. Road officials, having the same desires as the contractors, but with the additional desire to secure the best results obtainable, and some having also the incentive of personal ambition and even of pecuniary gain for themselves, have given such thought to new and improved methods and machinery that would assist them in securing their desires.

Rollers, tractors and crushers are built to-day exactly as they were three years ago. Some advance has been made, however, in the motive power for these machines, due to the development and improvements in the gasoline engine. Gasoline motor rollers however, have not superseded the steam roller to any great extent. While it may be possible that gasoline motors may become quite universally used, it is improbable that such will occur in the immediate future, as there are many features regarding the steam engine that cannot be readily equalled with the gasoline engine, and furthermore, there has to be overcome the prejudice of machinery users against the gasoline engines, due perhaps to the many examples of what might be termed the fickleness of these engines when used to propel automobiles.

As the construction of mixed bituminous roads becomes more universal, there is an increase in the demand for suitable mechanical driers for drying the aggregate, and mixers for mixing the aggregate with the bitumen. The old method of drying stone gravel or sand, by spreading on sheet iron under which a fire is kept burning, has many times been demonstrated to be unsatisfactory, and it is quite the universal practice at this time to use some form of dryer that will mechanically keep the material in motion and thus prevent one portion from becoming extremely hot and another portion insufficiently warmed.

A form of drier which has become quite generally used is similar to a large concrete mixer, the material to be dried being kept constantly in rotation, and heated and dried by means of a blast of hot air created by means of oil burners, the burners of course much magnified in size and volume.

Improvements have been made also in mixers for incorporating the bituminous material with the dried mineral aggregate. These mixers are an adaptation of the long used standard concrete mixers, and are almost identical with them except that a blast of hot air is constantly forced into the mixer in the same manner as outlined above in the case of the dryers. Several devices for heating bitumen have been evolved, but they are all improvements or enlargements on forms of heaters that have been in use for the purpose for many years. Labour and time-saving devices have been added.

One marked improvement in heating kettles is the addition of a chamber above the reservoir containing the heated material, in which chamber the barrels in which the bituminous material is shipped, are placed, so that the heat that might otherwise be wasted, passes into the chamber and warms the bitumen in the barrels to a sufficient extent so that it will flow into the hot reservoir, thereby keeping up a much more constant supply of hot material than could be kept by the old method, wherein the reservoir was filled and drained intermittently.

Perhaps more attention has been given by road men to oil and tar distributors than to any other form of road machinery, and there have been placed upon the market more than a dozen forms of distributors, each claimed to be unique and of such superiority over any other distributor that it warrants securing patent rights. They all appear however, to be only improvements over old devices, or adaptations of machinery used for other purposes to the distribution of bituminous material.

The writer has carefully observed many machines of all types used in connection with road construction, and has also examined carefully the catalogues, descriptions and claims issued and made by manufacturers, and has concluded that the machinery in use in the United States to-day is substantially identical with that in use three years ago, the new features being principally the increase towards perfection that always continues where there is a desire to secure the best results with proportionate economy.

Qualifications of Engineers and Surveyors in Charge of Roads

By Harold Parker, Vice-President Hassam Paving Company, Worcester, Mass.

As Mr. Parker points out, the present stage of development in the construction of roads, is the result of a long period of evolution, beginning at the time when roads were merely paths in the wilderness, developing gradually with the needs and requirements of society as such needs and requirements indicated or demanded. Such paths were, of course, the outcome of local use, and no scheme or plan was employed either in their location or preservation, except in so far as necessity demanded.

By degrees the continued and increased use of such ways required further attention on the part of the users, and so by slow steps the modern road was reached. It is quite easy to picture man, as he emerged from the primitive state, using step by step, improved methods and more efficient means, to reduce the labour of transporting his food or other supplies from place to place. It became, therefore, a logical consequence that those persons were placed in charge of the work of preparing new transportation conveniences where such became necessary by reason of the increasing population of the developing needs of growing civilization who were best fitted therefor.

The care of the ways already in use became of greater importance, and the need of men whose skill in such work was more and more felt. These men must have been of course, in the beginning, without knowledge or experience but their knowledge increased and their experiences and trials and experiments led to gradual improvement and the semblance of a standard of excellence. This process of evolution in the building and maintaining of roads, of necessity developed the actual builders themselves, and the crude hands that shaped the first rude highways gradually became skilful engineers, who possessed all the accomplishments that enabled them to produce the most satisfactory results.

All civilized countries are at present and have been for generations trying to solve the problem of constructing and taking care of roads, both from an administrative and a constructive point of view. An examination of the method of highway administration and construction in different countries, indicates the value of these main considerations, the relation one to another may be varied, but the seven points may be considered as fundamental.

First.—The concentration or centralization of road information.

Second.—The classification of roads in accordance with their importance.

Third.—The distribution of finances, including cost of maintenance.

Fourth.—The character of those having the road in charge.

Fifth.—The means of educating road engineers.

Sixth.—Organization of skilled men.

Seventh.—The process of acquiring land.

It is apparent, from observation of the methods employed in almost all civilized foreign countries, that, under these seven heads may be epitomized all the principles of modern road construction and maintenance, and they are valuable as indicating what the evolution of the modern road has led up to in the countries that have been engaged in attempting to scientifically solve the problem, for the greatest length of time.

Under the seven heads that have been indicated, which comprise all the features connected with roads, "The character of those having the road in charge," is fourth. This is, of course, upon the assumption that all the other features are present; for it would be plainly absurd to proceed to the construction even with the first three problems satisfactorily solved, without having the trained men to devise and execute. Therefore in one sense the character and requirements of the men in charge is of the first and not the fourth importance. What the qualifications of these men are, is the subject under consideration.

There appears to be no question that the engineers in charge should be, first, graduates of technical schools or with field training and experience sufficient to give them a thorough knowledge of principles of general engineering practice. This can be obtained in the field, but in view of the fact that a man who has obtained his education in this way has been ordinarily confined to particular lines of work and that therefore his knowledge is so limited that outside of such experiences he knows nothing except by analogy, his education in consequence is not complete, and in so far as it is incomplete he lacks in efficiency. Having therefore acquired, either by school training or by sufficient actual experience and study, a technical education on general principles, it is desirable, if not necessary, that he should specialize and devote a year or more to the practice of highway engineering as such, under teachers fitted to instruct. This implies in addition to the civil engineers knowledge of location and construction, the chemist's knowledge of chemical and physical analyses and the method of testing materials used in modern road construction. Having thus prepared himself he is ready to take up the actual construction of roads and their maintenance, but not without the leadership or direction of those whose actual experience have taught them wisdom.

It is the unqualified opinion of the writer of this paper, based upon many years of observation, that a long period of actual practice on the work is requisite to entirely equip a man as an ideal road designer and builder and to qualify him to maintain them after completion. It is true, of course, that we have many good road builders who have not graduated from technical schools and whose experience has been limited to a narrow line of work; these are, however, exceptional, and their complete usefulness would undoubtedly be curtailed by their limited education. It is true, also, that with the same education, one man will far surpass his fellow in one or all the qualifications that make up the ideal,—this is, however, inevitable, for the personal equation is as manifest here as everywhere else. Instances are by no means uncommon where men of the most thorough technical training and many years of field work are wholly incompetent to design plans for construction or maintenance. No training would qualify such individuals. On the other hand it is not infrequent that instances of men well fitted to build and maintain the most important highways may be found who have had no academic education whatever.

Theoretically, therefore, the highway engineer should not only be able to locate or re-locate a given road and to design and construct the necessary bridges and culverts and make all necessary calculations, but he should have such scientific knowledge as would enable him to maintain it in the most economical manner after it is built. This means a thorough technical training and years of experience. Until these facts are absorbed and acted on, the public will suffer to the same extent that they are neglected.

The qualifications of the engineers in charge of the construction of roads must be such as to fit them by education and experience to secure such results as have been already intimated or stated in this paper and should be graded in the actual operation after having secured the technical training in accordance with their experience and personal qualities.

The organization on work of any extended character, should consist of the chief engineer, resident or division engineers, according to the area of the territory covered, and such subordinate inspectors of construction and maintenance as the amount of work requires, each grade being filled by men who have shown by trial to be fitted for the official duties that may be assigned to them, and all, of course, reporting ultimately to the chief engineer and under his direction.

In a general way it may be said that preliminary or locating engineers, that is, those who make surveys for the location or re-location of proposed roads or old ones respectively, may with greater propriety be classified as surveyors who should be confined particularly to this class of work, as this class of work requires the service of men whose work is specialized. Estimates of cost after the surveys have been made by the locating engineers, may properly and preferably be worked up under the supervision of the division or resident engineers, who, from the nature of things have intimate knowledge of the cost of labor and material in any given locality within their jurisdiction. Trained men in any of these capacities will produce the most accurate and reliable results, and probably under a system briefly described above, will accomplish in the most economical manner the results that are being sought the world over. It is, however, necessary that interested motives or political influence in the organization of such a force must be absolutely eliminated.

If it were possible to have in all countries an organized bureau under the governmental direction such as the Department of Roads and Bridges in France, it is probable that the best results would follow, but in most countries such a plan cannot be carried out for the reason that the territory to be treated as a whole is too large and too complicated to be embodied under one head.

It is undeniably a fact that in the public service smaller salaries are paid than where private or corporate interests are involved: the plea of patriotism and love of country is given as the reason why a man should give his life and best efforts to public service with small remuneration. This view is, of course, unwarranted. A man is entitled to the full value of his services, whether given to public or private interests. Governments are parsimonious in questions relating to salaries, and as a result their best servants are constantly taken away to serve individauls or corporations who are willing and anxious to pay full value for the work they do. The public therefore is the loser, for it is undeniable that, in their astuteness, the great corporations pay no more than the service rendered is worth. From these considerations it is sufficiently evident that, ultimately the government will have to pay in salaries the market value of their servants, or lose them.

Removing Sponge from Pipes

An interesting announcement was recently made at a meeting of the Cardiff Waterworks Committee, when the waterworks engineer, Mr. C. H. Priestly, said that he, in conjunction with Professor Parker, had succeeded in overcoming the difficulty experienced with regard to the growth of sponge in the pipes in the filtering area at the Llanishen Reservoir. The agent employed was a solution of common salt, and so successful had it proved that up to the present week there was no sign of the reappearance of the growth. Mr. Priestly added that Professor Parker himself was so impressed with the result of the experiment that he proposed writing a paper on it for the Geological Society, as a record might prove of assistance to other waterworks encountering similar trouble.—The Engineer.

The channel tunnel idea is once again attracting attention both in England and France. In France the channel tunnel has always been looked upon with approval. The British Chamber of Commerce in Paris has decided to support a resolution in favor of the construction of the tunnel which is to be submitted in September at a conference of associated Chambers of Commerce at Antwerp. The matter is to be discussed in the British Parliament, the Premier has been asked to receive a deputation on the subject. From the engineering point of view there are no serious difficulties in the way of carrying on to completion, the abandoned works.

A wash for concrete consisting of a dilute solution of hydrochloric acid, one part of commercial 30 per cent. acid to five parts of water, has been found effective in cleaning the stains from the lock walls of the Panama Canal, according to the "Canal Record." The surface of the concrete was brushed over with the solution, and afterward was rinsed with clear water. The application and subsequent rinsing freed the concrete of all discoloration. The process has proved satisfactory.

The Life-Work of Sir Robert Perks, Bart.

Distinguished British Engineer of International Reputation—His Connection with Canada in the Contemplated Georgian Bay Canal

(Staff Article)

SIR Robert Perks, Baronet, engineer and contractor, was born at Kensington, London, Eng., in 1849. His father was a well-known Methodist preacher and became the President of that powerful nonconformist church. Throughout his life Sir Robert has been a prominent leader of British nonconformity and when in the House of Commons was the Chairman of the "Nonconformist Two Hundred." Politically, Sir Robert Perks is an Imperialist, a Free Trader and an Individualist. He represented North Lincolnshire in the British House of Commons from 1892 to 1910, but then retired temporarily from political life in order to give his undivided attention to the large public works with which he is associated.

Sir Robert Perks

He was educated at King's College, London, where so many English engineers have been trained for the engineering profession, but entered the law in 1878 and soon became a prominent Corporation lawyer. On the nomination of Sir John Hawkshaw and Sir John Fowler, two eminent engineers, he was elected an Associate Member of the Institute of Civil Engineers. In 1879, when only thirty years of age, he was appointed legal adviser of the underground railways of London. In later life he became Chairman of the Metropolitan District Railway, in which capacity he had to direct the conversion of that densely-crowded London railway from steam to electricity. He, together with Messrs. Speyer & Company, of London and New York, and also Mr. Yerkes, of Chicago, was mainly responsible for the enormous system of electric railways in London which now plays such an important part in the transit arrangements of the great metropolis.

In the year 1880, Sir Robert Perks formed a close business alliance with the late Mr. T. A. Walker, of Westminster, and subsequently with Mr. C. H. Walker, a connection which lasted for thirty years. During that period the firm built many great works in England and abroad. Among these were the Inner Circle London Railway, the Barry docks and railways, South Wales, the Manchester ship canal, and the gigantic port works at Buenos Ayres, which are the largest, the finest and the most remunerative docks on the American continent. His firm also constructed the Transandine railway and tunnel through the Andes, connecting the capitals of Chili and Argentina. Later on they were entrusted by the Brazilian Government with the construction of the magnificent quay wall around Rio Janeiro Bay and the vast land reclamation. This work, costing about $25,000,000, was entrusted to Sir Robert Perks and his partner, Mr. Walker, without competition. He is now interested with the Walker firm in the extension of the Port at Buenos Ayres, a work which is costing some $35,000,000, and which his firm secured in competition with the leading contractors of Europe and America. Among other important works built by Mr. Walker and Sir Robert Perks were the Preston docks in England, the Alexandria docks in Egypt, and the Bahia Blanca port works, and the Southern Pacific Railway Docks, Buenos Ayres.

In 1910, Sir Robert Perks retired from his old firm at Westminster and in conjunction with Messrs. MacArthur Bros., of New York, formed the firm of MacArthur Perks & Company, Limited. This firm are now building extensive docks at Havana and are dredging out Havana Harbour. They are also building for the Southern Pacific Railway Company an important railway along the Pacific coast of Oregon, from Portland, through Eugene, to Coos Bay, a beautiful harbour in Oregon which is destined, so its friends think, to play an important part in the commercial future of the Pacific coast. This line will probably form part of a through low level route from Portland, Oregon, to San Francisco.

So far as Canada is concerned, the great work to which Sir Robert Perks is giving his sole attention is the much-talked of waterway from the St. Lawrence to Georgian Bay by way of the Ottawa, the Mattawa and the French rivers. This is an enterprise of great magnitude. The main features of this vast undertaking are well known; it involves a canal—22 ft. deep, wide enough to allow ocean-going vessels to pass in perfect safety, and 440 miles long, with 24 great locks—from the east end of Montreal Island, by way of the Back River and the Lake of Two Mountains, to Ottawa, and thence to North Bay, across Lake Nipissing and down the French River to Georgian Bay. The promoters of this enterprise estimate that they will carry at least 16,000,000 tons at a cost of 50 cents a ton, and wheat at 1½ cents a bushel. They assert that they will be able to put wheat into the elevators or steamers at Montreal at a price with which no other route can possibly compete. There is no doubt, in the mind of Sir Robert Perks, that if these results are achieved, Montreal will become the greatest grain shipping port on the American continent. Ottawa also will have all the advantages of direct access for ocean-going steamers. The United States ports of Chicago, Milwaukee and Duluth, as well as Fort William and Port Arthur, will have direct access for large ocean-going steamers to the ports of Europe. Canadian coal and steel from Nova Scotia will contribute largely to the trade of the canal. The charter for building and operating the canal is in the hands of a British company who have spent very large sums upon the vast amount of preliminary engineering and other work incidental to such a gigantic enterprise. Steps are likely to be taken to reconstitute the directorate of the Canal company and revest the control of this enterprise in Canadian hands. The history and progress of the Canadian Pacific Railway, compared with that of the Grand Trunk Railway, is sufficient to show the advantage of controlling a Canadian enterprise from Canada and not from London, although the capital for so great an enterprise must be found in England. Sir Wilfrid Laurier's Government appointed an Engineering Commission to report upon the engineering details and cost of this enterprise. This enquiry lasted four years and cost the Canadian Government $850,000. Mr. Borden recently appointed a Commission to report upon the commercial necessitay and the financial prospects of such a work. Upwards of one million horse power of electricity will be generated in the canal. With three essential advantages, namely; the cheapest form of transit, the cheapest for of power, and abundant supplies of raw material, it is not unreasonable, we are told, to believe that the route of this great waterway will be peopled in years to come with a great industrial population and busy factories.

Sir Robert Perks has frequently said that the two greatest public works now remaining to be done are the Channel tunnel, between England and France, which will carry passengers from London to Paris in five hours without change, and the Georgian Bay canal, which, "for the first time," to quote Sir Robert, "will take the ocean-going steamers of the world into the vast inland seas of Canada and set free the steamers, which are now ice-bound in the Great Lakes for five months of the year, to get out and trade in the winter in temperate seas."

British Firms Looking to the Canadian Trade

THE CANADIAN "BITUMASTIC" ENAMELS COMPANY

This firm are the patentees and manufacturers of the well known "Bitumastic" Specialities for the protection and preservation of iron and steel structures (see advertisement on page 42).

It is obvious that had engineers and architects in the past always adopted the simple means of preservation afforded by such materials, much of the reconstructing and repair work now in hand would have been unnecessary. It is not pleasing to see cable-troughs alongside the underground railways of London and ironwork in numerous constructions corroding because they lack the requisite treatment. Prevention is invariably better than cure, and when it is considered that the expense of replacement is sometimes out of all proportion to the actual worth of the parts involved, it is to be regretted that more foresight has not been used. For example, it should be easier to protect the link-pins of a suspension bridge from corrosion than to renew them. The manufacturers of the "Bitumastic" solution, claim for their product that it is a first-class anti-corrosive with a large covering capacity; further, that it dries quickly, and does not crack or peel off, and that it is not affected by chemical fumes, hot smoke, salt or fresh water. It is used by railway companies, municipal authorities, government offices, collieries, etc., for the protection of great bridges, girders, iron tanks, pipes, viaducts, water carts, concrete roofs and tanks, manhole covers, corrugated roofs and buildings, sewage and sludge tanks, gasholders, smoke stacks, iron staircases, and numerous other concrete and iron structures.

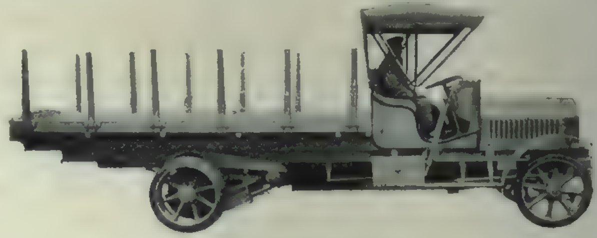
Unlike their "Bitumastic" Solution, which is supplied in a liquid form ready for application, cold, "Bitumastic" Enamel is applied in a hot state by the company's workmen to the iron, steel or concrete surfaces (after these surfaces have received a primary coat of the "Bitumastic" Solution) hardening immediately it is put on. Thus applied, it forms a permanent coating, with a hard, bright surface.

"Bituros" is a specially prepared composition introduced by the same firm for iron and steel fresh water tanks. Being of an elastic and strongly adhesive nature, it does not crack or peel off, nor does it impart to the water any disagreeable flavor or discoloration.

The Canadian "Bitumastic" Enamels Company, of 720 Traders Bank Building, Toronto, Ont., are represented throughout the various parts of Canada as follows: Maritime Provinces, The General Contractors Supply Company, Halifax, Nova Scotia; province of Quebec, H. H. Hebron & Company, St. Nicholas Buildings, Montreal; province of Manitoba, Grose & Walker, Winnipeg; British Columbia, N. Thompson & Company, Limited, 847-63 Beatty Street, Vancouver.

ALBION MOTOR TRUCKS

The Albion Motor Car Company, Limited, Glasgow, Scotland, takes a place among the pioneer motor truck builders. For thirteen years they have been putting their product on the market and are to-day one of the largest, if not the largest, motor truck builders in the Empire. The Albion Motor Car Company of Canada was formed to handle the goods of the Scotch company in Canada. They have fully equipped service stations at Montreal, Toronto, Ottawa and Vancouver, and it is the intention in the immediate future to build a Canadian factory for assembling the parts manufactured in Scotland.



Five ton Albion-Chassis.

In describing their output the company lay stress upon several features; that the Monablock engine which they use is sturdy, substantial and as light as is consistent with great strength; that their patent automatic lubricator provides nine pumps which give a positive feed of oil, in quantity exactly suited to the requirements of the cylinders, valves and bearings; that the patent single disc clutch makes it impossible for an inexperienced or careless driver to strain the car, as it eliminates all jerkiness of control; that the spring drive saves wear on the tires by introducing a slight elasticity, which serves to compensate the sudden strain from the car tracks, ruts, rocks or other irregularities of the road.

The kind of tire best adapted to the requirements of any particular sort of vehicle is always an important matter, and in these days of highway improvement is bound to become more and more a consideration. The Albion motor truck is provided with steel road wheels, these being considered by the makers more serviceable for use in Canada than wooden wheels. For the sake of economy they are provided with tires of unusually large capacity. The company claims that the automatic governor with which the car is fitted prevents the waste of gasoline and automatically regulates the speed and is hence a device of considerable economy. The long easy spring used in building the truck is intended to give comfort to the driver, safety to the load and to lengthen the life of a car. The British preferential tariff of 12 per cent. enables the makers to quote their trucks at attractive prices.

Four-and-one-half ton tipping wagon.

The Canadian company has already placed 75 of these motor trucks in commission in Canada, some 15 of which are in use in Montreal. Among the users may be noted the Canadian Pacific Railway, the Phoenix Bridge and Iron Company, Limited, the Ottawa Car Company and the Dominion Textile Company, Limited.

GENT & COMPANY LIMITED

Messrs. Gent & Company, Limited, Faraday Works, Leicester, Eng., whose advertisement appears on page 38 are one of the oldest established firms manufacturing electrical apparatus in England. The firm was established in 1865, when even the modest electric trembling bell was a novelty. Since that time they have progressed steadily and perseveringly, building up a reputation for reliability of manufacture. Today they stand among the important manufacturers of two ranges of apparatus of special interest to the municipal engineers of our rapidly growing community.

These two lines of manufacture are electric impulse clocks and water level and sewage recorders. There can be no doubt that the electrically driven clock will come, as time advances, more and more into use, especially for large municipal or turret clocks and for church towers.

Among the advantages claimed by this firm for their electrically actuated clock is the absence of weights, the small space taken by the movement and the fact that no winding is required. They further claim that the largest electrically driven clock in the world is to be found in the tower of the Royal Liver Building, Liverpool, and that it is marked by reliability and correctness. This massive time piece with its four 25 ft. dials was constructed and erected by Gent & Company, Limited.

To municipal engineers contemplating the construction of reservoirs for water supplies or who are building sewage disposal plants, the products of this company should be of interest. Their water level indicators and recorders have come into quite common use. These instruments show locally or at a distance the level of the water in the reservoir, even though the latter may be many miles from the engine room or pumping station. In sewage disposal plants the outfall may be measured in the same way, though the record is usually required locally so that this type of apparatus is purely mechanical.

Messrs. Gent & Company, Limited, claim for their recorder that it will work reliably in the most exposed positions and indicate on a regular and even scale the quantity of liquid passing over a sill or through a notch.

SEWAGE DISPOSAL EQUIPMENT

Ham, Baker & Company, Limited, Municipal Engineering Works, Langley Green, Birmingham, and 13 Grosvenor Road, Westminster, London, are a well known firm of English manufacturers of equipment for sewage disposal. This firm has recently completed the installation at Dalmarnock of large disposal works for the city of Glasgow, Scotland. The plant consists of four of their patent electrically driven, travelling, sewage distributors, covering a total area of one and one-half acres and disposing of a daily flow of 4,000,000 gallons.

The following are some of the special features emphasized by the company concerning the equipment which they manufacture:—

1.—The dispersal of aerial nuisances and the dissemination of disease germs are inhibited.

2.—The heat of the sewage is conserved and the effects of low temperatures minimized.

3.—The distribution is rendered more uniform, and at the same time capable of a wider range of variation than in the usual form of dirtributing apparatus.

4.—The rate of travel is constant under all conditions.

5.—The quantity of sewage discharged is uniform.

6.—The effluent resulting is sufficiently purified to be discharged into any river without fear of pollution.

7.—The solidity of construction and the engine finish of the distributor.

Messrs. Ham, Baker & Company have a large institution in the vicinity of Birmingham, consisting of well equipped foundries, machine and erecting shops where they produce all kinds of machinery for water supply, water works, sewerage plants, sewage disposal plants, as well as sluice gates, gate valves up to 60 inches in diameter and penstocks of all sizes up to 12 feet.

That their goods have become widely and favorably known is attested by the fact that they have now under construction sewage disposal equipment for Auckland, New Zealand; Allahabad, India, and Cairo, Egypt. They also have in hand street hydrants for the Metropolitan Water Board, London, Eng., and orders for the British Admiralty and H. M. War Department, as well as gate valves and fittings for a water works system under construction in the East, ordered by the Crown Agents for the colonies.

To irrigate the valley of the Guadalquiver, in Spain, a company has built a dam at a cost of $180,000, and is now planning the construction of a canal. About 24,700 acres will be irrigated. The total length of the canal system, which will cost about $720,000, is estimated at 25 miles.

MIRRLEES-DIESEL OIL ENGINE

The Mirrlees-Diesel oil engine is manufactured by Messrs. Mirrlees, Bickerton & Day, Limited, at their plant at Hazel Grove near Stockport, Eng. The firm known as the Mirrlees Watson Company, Limited, of Glasgow, claim the distinction of being one of the first to recognize the possibilities of the Diesel engine and the first to undertake its manufacture in Great Britain. In designing their engine, the company aimed to take the best features of the Diesel engine as produced on the continent and to combine with these, patent improvements of their own and British solidity and sound construction.

Works at Hazel Grove near Stockport.

This firm gives an interesting description of the manner in which their design was developed for the market. The Mirrlees Watson Company, Limited, spent some years in purely experimental work, during which time, step by step, the difficulties were overcome. Several engines were then installed in their own plant and made to give regular service for two years, under conditions such as would prove trying to any engine. Having satisfied themselves as to the efficiency of their product, a new company was organized to handle this engine. Equipped with all the patterns, tools and drawings, and the members of the staff experienced in the manufacture of Diesel engines, the new company, Mirrlees, Bickerton & Day, Limited, commenced the manufacture of the new design. The enterprise has met with success.

The Mirrlees-Diesel engines are all of the vertical type, and the valves, which are mechanically operated, are arranged in the cylinder covers. Each valve has a removable seat. This is an important improvement, according to the company, as it enables the engine attendant to grind in the spare valves at his leisure, instead of having to do this while the engine is stopped. Then, when a valve on the engine requires attention, all he has to do is to simply pull out the valve and seat and replace them by the spare valve and seat.

The engine is single-acting and operates upon the well-known 4-stroke cycle, one stroke in every four being a power stroke. The cycle is as follows:—

1. On the first down-stroke of the piston, air is drawn direct from the atmosphere into the cylinder, air only, not a mixture of air and gas or oil vapour, is drawn into the cylinder.

2. On the first up-stroke this air is compressed; this compression causes the temperature of the air to rise sufficiently to ignite fuel sprayed into it.

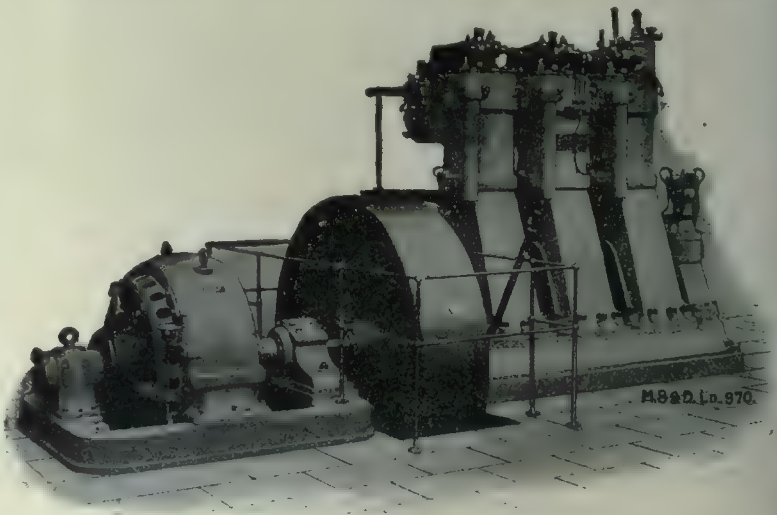
3. At the end of the compression stroke, and during the first period of the succeeding down stroke, fuel oil is blown into the cylinder by compressed air; the oil is sent into the cylinder in a finely divided spray, and is not injected suddenly, but over a measurable period of time, thus avoiding any rise of pressure after the completion of the compression stroke. The amount of oil thus delivered to the cylinder is controlled by the governor so as to suit the variations of load.

4. The next up-stroke is the exhaust stroke, during which the products of combustion are expelled to the atmosphere.

From the foregoing description it will be seen that there is no explosion or sudden rise of pressure in the working cylinder, hence greater smoothness in running and absence of concussion; also that as air only is compressed, there is no possibility of premature ignitions. Further, as the oil is ignited by the heat produced by the compression of the air, no sparking or ignition devices are required. It will also be noted that no carburetter or vaporiser is required.

The compressed air required for blowing the fuel into the cylinder, also for starting the engine, is supplied by a two-stage air pump which forms part of the engine, being direct-driven from a crank formed at one end of the crank shaft. A feature of the compressor noted by the makers is a patented device for reducing the consumption of lubricating oil.

For their Mirrlees-Diesel oil engines the company claims a number of quite important features. That the engine has a high thermal efficiency and that while any oil may be used, a cheap oil will answer every requirement; that the engine starts quickly, taking its full load within one or two minutes. That the absence of a sparking device, carburetter or vaporizer removes many difficulties. That the exhaust is free from nuisance and that the use of oil for fuel removes largely the expense of carting fuel and ashes. And furthermore, that the engine is suitable for varying loads and may be installed in small space.



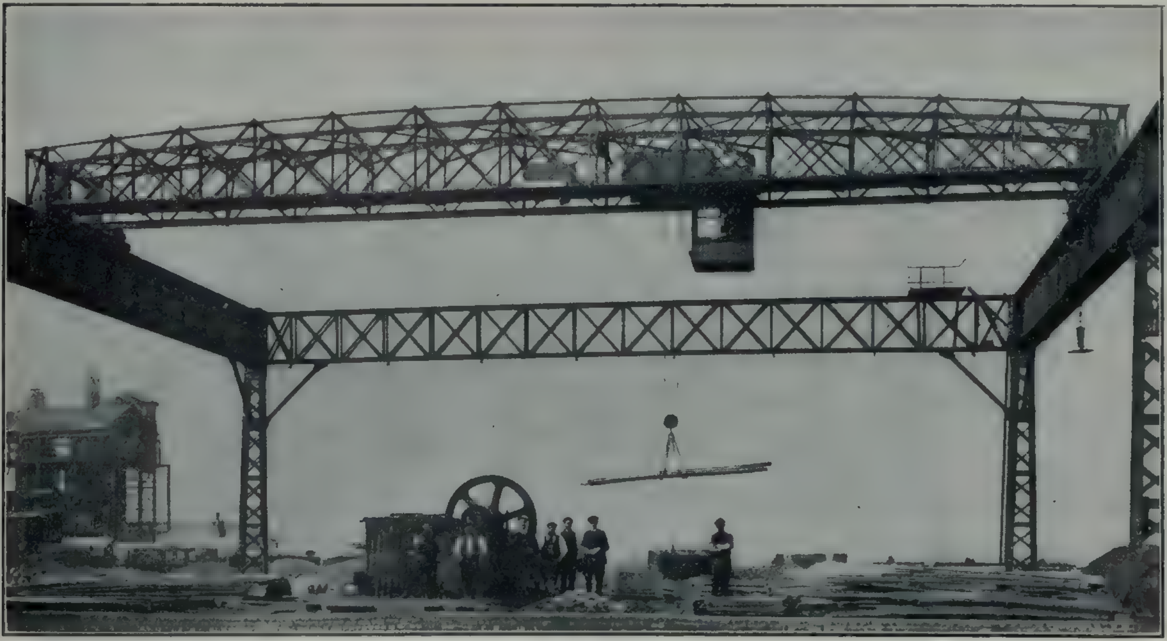
150 H.P. English crude oil engine.

The Boving Company of Canada, 164 Bay street, Toronto, are the Canadian agents for the Mirrlees-Diesel oil engines.

ROYCE, LIMITED

Royce, Limited, Trafford Park, Manchester, Eng., are the manufacturers of electrical cranes which have come into quite general use. Orders have been placed with them by the British Admiralty, War Office and India Office. Among the other users may be noted the railway companies in Canada, Japan and South America. The Hydro-electric Power Commission of Ontario and the Calcutta Electric Supply Corporation of India are also included in the list. In Valparaiso are to be found two cantilever loading stages with the Royce crane equipment.

The company claim to be pioneers in this field of engineering and describe the development of their electrically driven crane as follows: The first step consisted in dispensing with the flying rope and substituting a shunt wound motor, fixed on the crane and supplied with a current collected from two longitudinal wires running the length of the shaft. By this means the power formerly required to move the flying rope was entirely saved, effecting at the lowest estimate, a saving of from 6 to 7 h.p. They assert that the Goliath crane of 25 tons capacity was the first electrically driven 3-motor crane working in the British Isles. It was constructed for the Great Central Railway Company, who later ordered three of the same design for use in their yards at London, Leicester and Nottingham.



Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire.

In these days of rush orders and rapid construction, when it is necessary to expedite labor to the greatest possible extent, a fast travelling crane is an important part of the equipment, and Royce, Limited, claim that their crane answers this requirement.

Some of the points which they consider of importance in the electrically driven device which they manufacture, are given below. Where three motors are employed they are almost invariably of the series wound type, that is to say, they will run at a constant speed, with a constant load, but with a lighter load will accelerate in a certain ratio. From this it will be seen that if a full load is lifted at a specific speed, very light loads will be lifted much more quickly. Further, the motors are constructed so as to be enclosed and dust proof, as in the majority of cases they are required to be protected from dust and dirt. Even under the most favorable circumstances crane motors are called upon to operate under very trying conditions, such as frequent starting and stopping, reversing, variations in speed due to changes in load, vibration due to the armature being directly connected to gear wheels, application of the brake too suddenly and lowering the load so quickly as to revolve the armature at an excessive speed. The company claim that the machines which they design and construct are to a large extent free from the difficulties just enumerated. By means of an automatic governor lowering gear which can be adjusted (once and for all) the loads are taken charge of when being lowered and the speed is controlled within reasonable limits.

In speaking of the details in the construction of their cranes the company state that the frame or body of the crab is built of rolled steel plates pressed and stiffened by means of angle pieces and gussets rivetted together; that the gear is all cut, except in special cases on large cranes, the blanks, being turned on their faces and sides in order to ensure true running; that the bearings are all of swivel type, thus avoiding the excessive wear involved in the use of rigid bearings; that the pinions are of high class carbon steel, in some cases forged solid on the shaft and that the barrel is of cast iron, turned all across its face with two spiral grooves to form a bed for the steel wire rope.

Royce, Limited, claim that they prefer to use a large number of falls of rope because in cranes above medium size, say 10 tons and upwards, having eight falls or more, as there are only two falls on the barrel it follows that the load on this particular part is only a small portion of the whole, and consequently the load to which the gearing is subjected is correspondingly reduced; but a still further advantage arises from the fact that a smaller rope is required which allows of proportionately larger pulleys, thus ensuring the longest possible life to the rope. The crane hook is constructed of wrought steel and is carried by a cross head in the bottom block and between this cross head and the nut of the hook is fixed a gun-metal cage containing a large number of hardened steel balls and two hardened steel plates between which the balls run, thus allowing the heaviest loads to rotate with perfect freedom.

In order to procure what they consider the proper operation of their machine, the motor used for actuating the hoisting and lowering gear is what the company terms their standard slow speed multipolar type, securely fixed in an accessible position on the frame work of the crane. The cross traversing arrangement which forms part of the crab consists of a motor of similar construction to the hoisting motor. together with the necessary gearing for actuating one of the axles. The manufacturers state that they have solved the difficulties incident to longitudinal movement by driving the cross shaft from the centre of the crane span, thus ensuring an equal turning moment at each end, and preventing one end lagging behind the other.

In designing their crane, Royce, Limited, state that they have aimed at a machine that will start, attain full speed, and stop in the shortest space. In order to do this they have introduced a patent slipper drive between the longitudinal motor and cross shaft which enables the crane driver on starting to give full speed current without risking damage to the motor. For stopping he can actually reverse the running of his motor and consequently have at his command a formidable and powerful brake. The girders are constructed so as to ensure rigidity under high travelling speeds and when brought to a standstill quickly. Cradle end carriages are adopted so that in the event of the crane becoming derailed or an axle or wheel breaking, the crane cannot fall more than a very short distance, not sufficient to do any appreciable damage.

The motive power is conveyed from the source of supply by longitudinal wires which must run the length of the gantry or shop and may be fixed in many positions along side the gantry rails or girders or pillars supporting the roof. Collectors take the current from the wires and convey it by cables to the emergency switch fixed in the cage or cabin. From the emergency switch the current is conducted to the controllers by cables, in which are inserted safety fuses. On the 3-motor crane there are three controllers. These are conveniently placed in the cage so that when he is seated, the driver has all three controllers within reach. From one of these controllers the current is led to the longitudinal motor direct and for the hoisting and cross traverse motors, solenoid brake and over-winding safeguard, it is necessary to have bare wires stretched across the crane, usually between and under the top flange of the girders, and to these wires are connected the two remaining controllers. To collect the current from the cross wires a special bracket depends from the under side of the crab on either side, carrying collecting gear consisting of small projecting arms which slide along the wires or small revolving pulleys from which the current is led direct to the cross traverse motor. Before reaching the hoisting motor the current passes through an overwinding safeguard which is so placed that in the event of a hook being run too high, the current is immediately shut off, the hoisting motor stopped and the brake applied.

THOS. PIGGOTT & COMPANY, LIMITED

The development of agriculture, manufactures, railways, gas and water works has rendered the collection and storage of water a matter of great importance. Messrs. Thomas Piggott & Company, Limited, Birmingham, Eng., in anticipation of a demand for storage tanks, designed and patented a pressed steel tank which they thought especially adapted for erection in out-of-the-way places.

While the tank met with favor, it was soon found that the plates were not sufficiently rigid to suit all requirements, consequently the design was improved by the addition of diagonal pressed ribs, which strengthened without increasing the weight or the cost. A later improvement has been made by pressing a further strengthening rib into the plates.

The tanks are composed of the following members:—plates, lugs, stays, gusset plates, bolts, joining material and stay plates.

The plates are in standard 4 x 4-ft units, 5/16-in thick, flanges 3-in. wide, holes 5/8-in. diameter, weighing approximately 2-cwt. There are three kinds of plates, A, B and C; A plates, flanged on all four sides; B plates flanged three sides and bevelled one side; C plates, flanged two sides and bevelled two sides. The A and B plates are used for the bottom and side of the tank, and the C plates for corner plates only. The plates are drilled ready for bolting up and for stay bar lugs or plates. The joints are made with strip lead, 2½ x ⅛ in., laid between the flanges before they are bolted up and caulked tight from the inside of tank. The lugs are malleable iron castings bolted to the bottom and sides of tank, and designed with jaws to receive stay bars, which are secured by bolts at both ends. The stays are made in standard lengths from flat bar 2½ to ⅜ in. and are interchangeable. The short stay is connected from bottom to first flange joint, the long stay to the upper tiers of plates.

The manufacturers claim for their tank simplicity, lightness and strength, and cheapness. The simplicity they assert arises from the fact that all the parts are standard sizes, no skilled labor is required for erection, as the parts are bolted not rivetted. The plates are made of steel and therefore lighter than if made of cast iron. Strength is said to be obtained by pressing the plates solid without welds, and by the use of the diagonal ribs which make the plates rigid for transport and when in place.

Messrs. Thomas Piggott & Company, Limited, intimate that among the orders recently received from Canada is one from Messrs. Beardmore & Company, Acton, Ont., for a tank 28 ft. x 12 ft. x 12 ft., and one from the Canadian Pacific Railway for a tank 12 ft. x 12 ft. x 12 ft. to be used with a water softening plant.

Steel Water Mains

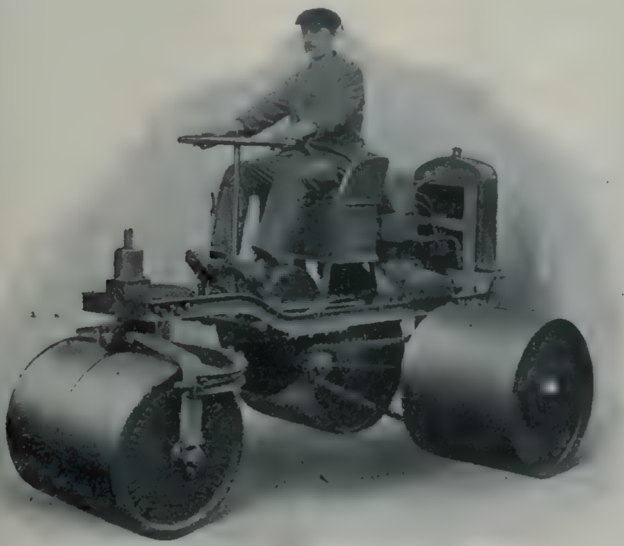
In addition to the tanks mentioned above, this English company are extensive manufacturers of steel pipes supplying any diameter over 12 inches. The pipes are fitted with flange, loose collar or expanded socket joints as required. The Canadian agents for this firm are Heap & Partners (Canada), Limited, 215 Dominion Express Building, Montreal, for the Maritime Provinces; B. & S. H. Thompson & Company, Limited, Montreal, for the province of Quebec; G. H. Tod, 213 Manning Chambers, Toronto, for Ontario; Ruttan & Chipman, Garry Court, Winnipeg, for Manitoba and Saskatchewan; Gorman, Clancy & Grindley, Limited, Calgary and Edmonton, for Alberta and Crow's Nest Pass Territory.

WATER BALLAST MOTOR ROLLER

About eight years ago Messrs. Barford & Perkins, Peterborough, Eng., placed on the market their first motor roller and this roller is still in regular use in the county of Surrey.

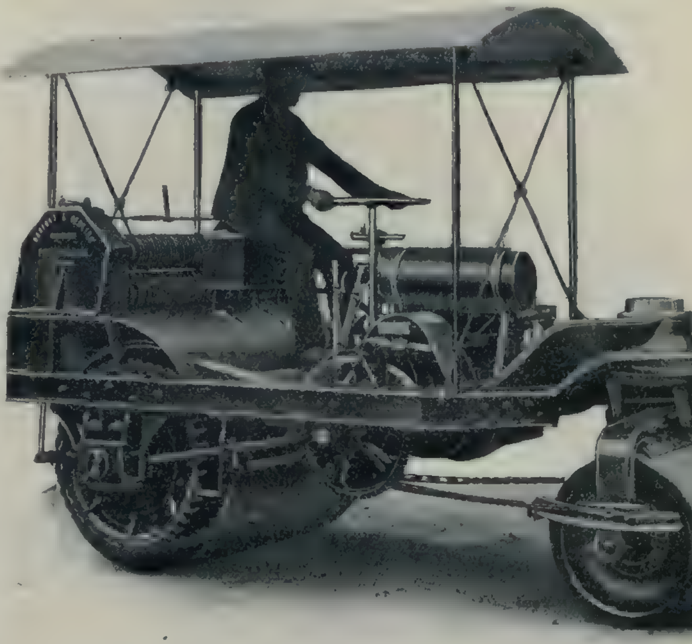
The intervening period has been one of progress on the part of this firm. They have taken an advantage of suggestions from their clients and incorporated them in their later designs. Among these may be noted the spring device now being fitted in the head reducing vibration and providing the advantage of a spring drive. The diameter of the front rollers has also been increased. The machine is a combination of the Barford & Perkins water ballast roller with a motor of the same class as is used in heavy motor vehicles. The hind roller is made of hard cast metal and the smallest size holds about half a ton of water. The channel iron frame is stiffly braced together, the fore part being coupled to the front rollers by a patent spring steering head and bridge. Springs are also used over the hind axle to minimize vibration and strain on the frame. The motor is of British make of heavy design and is especially suitable, according to the makers, for this kind of work and running at moderate speed. The cylinder is water cooled, a sufficient body of water being carried in the circulating tank to enable the cooling to be efficiently done without the aid of a fan or pump. The tank or gilled radiator is placed over the hind roller so that its weight is in a useful position while at the same time its height renders a pump unnecessary, the circulation being automatic. A leather-faced cone clutch on the motor spindle allows the engine to run free for starting. The fuel used is paraffin, and Messrs. Barford & Perkins assert that this independence of coal and water is an important feature.

Two speeds, either forward or backward, are arranged for, usually one mile and three miles an hour, the change being conveniently made from the driver's seat. The reversing is readily accomplished by means of machine cut steel gear wheels combined with a clutch moved by a lever within easy reach of the driver's seat.



Water ballast motor roller for paths, private roads and grass.

Ease in steering and facility of control is provided the driver by a hand wheel placed in front of him, the wheel being connected by means of a chain to the steering head. The bridge spanning the front rollers allows for the oscillation of these rollers when passing over obstructions without affecting the level of the main frame. This, the designers claim, reduces the strain on the frame. The rollers when full vary in weight from 1¾ tons up to 14 tons, according to the design. Among the users of this motor roller may be noted various governments, including the British, German, Russian, Austrian and Italian, and the county councils of Essex, Gloucester, Northumberland, Sutherland and Peterborough, England.



Water ballast motor roller for roads, petrol or paraffin.

BUHRING'S PATENT WATER PURIFYING COMPANY

The absolute importance of pure water cannot be over estimated. With the general advance in the knowledge of sanitation and hygiene, this fact is becoming more and more recognized. Nature provides abundant supplies of water, but owing to the means of supply, countless impurities are collected, such as vegetable and animal substances, drainage, sewage and numerous other kinds of impurities. Municipal authorities in many cases are doing what lies in their power to eliminate these sources of contamination, but even after being purified in the local plant, the water is still liable to receive impurities through standing in pipes or reservoirs of any sort used for collection. Refiltration in any case would be most helpful in obtaining standard purity.

The Buhring's Patent Water Purifying Company is one of the oldest established filter manufacturers. After years of careful study, experiment and labratory test, they claim to produce a filtering medium that collects and retains impurities, organic or inorganic matter, and deodorizes the water.

Among the filters which they manufacture may be noted small gravitation filters, pressure filters, household pressure filters, and large supply gravitation and pressure filters. The small gravitation filter has a body of glass enamelled iron and within is supplied with patent filtering block. This filter may be fitted to any jug, decanter, bottle or reservoir, and is very convenient where space is important, particularly in travelling or at the seaside or in the country. The makers claim for it that it not only filters the water, but reoxygenates and reinvigorates water which has been distilled or boiled.

The pressure filter is manufactured in three sizes and is suitable for domestic, factory or steamship use.

The household pressure filter is a new rapid type made in two patterns, single and double.

The large supply gravitation and pressure filters have been specially designed to meet colonial requirements. They are light in weight and the manufacturers claim that they treat efficiently every kind of fresh water. The body is of strong galvanized iron with valves of bronze. No cocks are used, and there are no moving parts, and hence no wear. A special by-pass pipe and valve ensures the cleaning of the filter medium by means of a reverse flow of water, and specially provided outlet directs to the sewer that water with impurities collected on the filtering bed. The Buhring's Patent Water Purifying Company claim for their filtering medium that it is of such nature that it retains the chemical compounds, such as permanganate of potash, etc., sometimes used to purify raw water.

Among the numerous users of plants provided by this company may be noted the leading steamship and railway companies throughout the world, including the Royal Holland Lloyd Steamship Company, and the Hamburg-America line, the Societe Generale De Paris, and the great shipbuilding firm Messrs. Harland & Wolff.

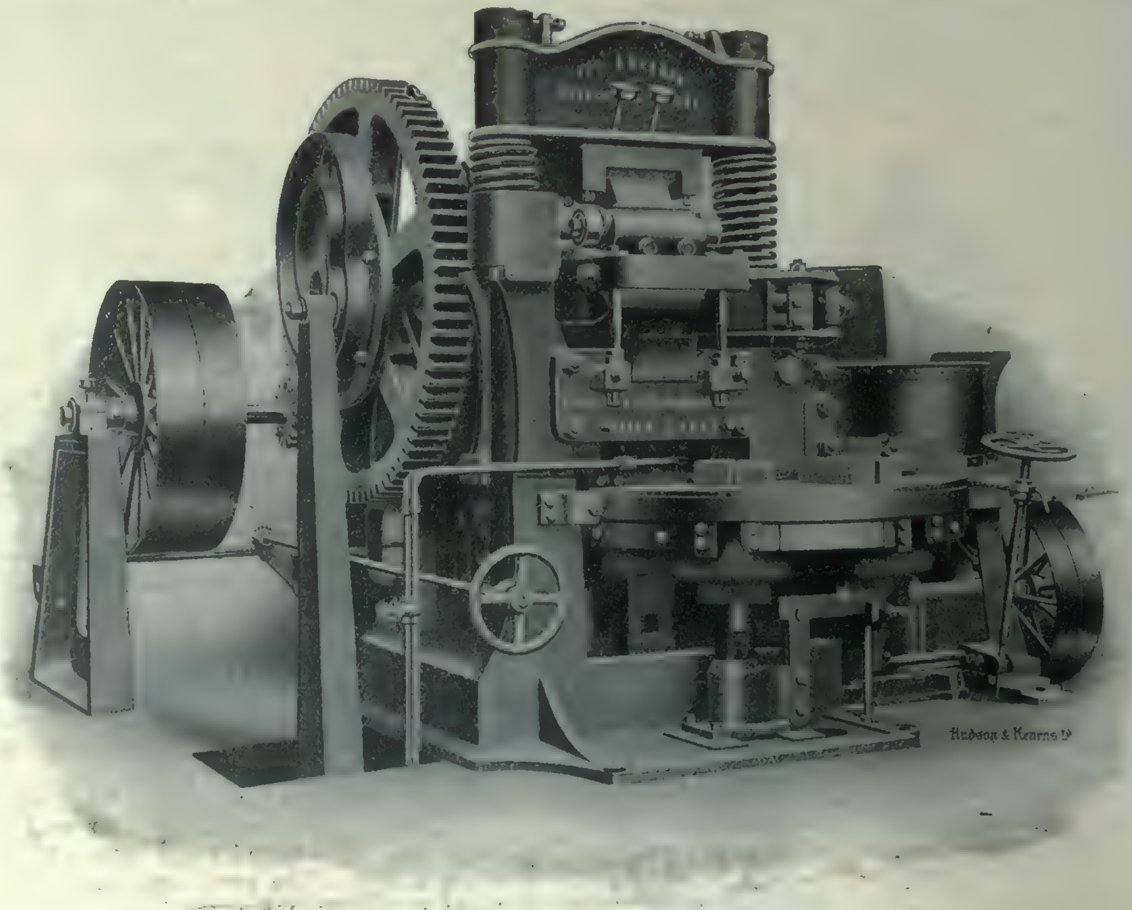
SUTCLIFFE, SPEAKMAN & COMPANY

Building, in the present day, demands a great variety in material, and economy in manufacture requires the utilizing wherever possible, of what was formerly waste products.

Messrs. Sutcliffe, Speakman & Company, Limited, Leigh, Lancashire, Eng., are the designers and manufacturers of a brick press which they claim will make bricks from material of every description, whether it be sand, refuse, clinker, slag, or any material akin to those enumerated.

The press is built on lines of strength and is so designed that parts subject to wear may be easily gotten at and replaced with the least possible loss of time. The bricks which are the product of the press have uniformity of size, correctness of shape and an evenness of surface which requires only one coat of plaster, while the tests made upon them for porosity and strength prove that they have excellent wearing properties. In addition, coloring matter may be added to produce any required color.

The machine has met with a wide sale. Mr. Sutcliffe who is the managing director of the firm, will visit Canada early in August for the purpose of thoroughly investigating trade prospects in this and other lines related to their business. The press mentioned is but one of the lines manufactured by the company. They design and construct machinery for the briquetting of iron, copper and other ores, and make all the necessary plant for such work. They have placed in operation works of this nature in Europe, Africa and America.



Brick press designed by Messrs. Sutcliffe, Speakman & Company, Limited.

PATERSON SYSTEM OF WATER PURIFICATION

The Paterson Engineering Company, Limited, 12 Norfolk Street, London, W.C., who are represented in Canada by Messrs. Laurie & Lamb, Board of Trade Building, Montreal, have been successful in securing some of the most important contracts for a rapid filtration and purification plant placed in Britain during 1913. This firm specialises in all types of water purifying and rapid filtration plant for municipal and industrial supply. In this brief notice, however, we shall confine our remarks to their system for the purification of drinking water and to the installation of Paterson plant at the Cheltenham waterworks, Gloucestershire, where the water as pumped from the Severn river is at times very turbid and highly discolored from marl, peat and decaying vegetable matter in the upper reaches of the stream.

The water is measured and the necessary reagents (alumina for the removal of the colouring matter and coagulation of suspended impurities, and hypochlorite of lime for sterilization) are added in precise ratio to the amount of water passing. This is effected by metering the water by passing it over a weir. A large float controlling the position of a tapered valve gives an annular orifice which discharges the weight of chemical solution in accurate proportion to the amount of water passing. The water so treated, after three hours subsidence, passes on to the six Paterson gravity type filters, the quartz sand beds of which are cleansed in place in a very few minutes by agitating with sterilised compressed air, the loosened impurities being floated to the drain by a reverse current of cleansing water. This process of cleansing thoroughly scours the sand grains and keeps the bed fresh and wholesome, the lowest possible proportion of wash water being required. Further, the special construction of the Paterson manifold strainer system ensures uniform agitation of the filter bed, both the air and wash water reaching the most remote parts.

A feature deserving of special note is the Paterson automatic outlet controller, patents for which have been secured in all the important countries of the world. This controller—(a) prevents the maximum rating of the filter from being exceeded; (b) steadies the flow; (c) ensures a uniform rate of filtration; (d) prevents furrowing of the filtering surface; (e) maintains a constant head of water above the sand bed so that it is never drained below the sand level; (f) starts the filter gradually to work after the cleansing process and while the filtering film is forming, so ensuring that all water entering the service mains is of the highest degree of purity.

A report made by Dr. Samuel Rideal, the eminent authority on drinking water supplies, on samples of the untreated and treated water, proved that the total organisms were reduced from 2,500 to less than 1 per c.c.; and the coli organisms from 50 (or more) per c.c. to entirely absent from 100 c.c.

MANUFACTURERS OF STEEL AND WIRE ROPE

The Excelsior Wire Rope Company, Limited, Cardiff, South Wales, are among the largest manufacturers of steel and iron wire rope found in Great Britain. Their output includes ropes for mining operations, for ship hawsers, for dredging, lumbering and oil boring machinery and for the construction of suspension bridges, aerial railways and in fact, wire rope for all sorts of mining, shipping and engineering purposes. Their works cover an area of over three acres and while they are equipped for the manufacture of all sorts of wire rope, if they have any specialty, it is probably steel and wire cable for mining plants. The fact that the works are situated in the neighborhood of the Welsh collieries has doubtless caused them to specialize somewhat along this line.

Upper works of the Paterson rapid gravity filters installed at Cheltenham, Eng.

SURVEYING INSTRUMENTS

In most things the best are the cheapest in the end, but there is nothing in which this is so marked as in surveying instruments, as the very essence of their utility is that they should be absolutely reliable, and to be so, every part must be made with the greatest care and skill, and of the greatest accuracy obtainable. Consequently careless methods cannot obtain with the really high-class maker, as no matter what it costs to bring an instrument to the greatest possible accuracy, it should be done before it is allowed to leave the final adjusting shops, and this is a rule which the W. F. Stanley & Company, Limited, of Great Turnstile, London, England, claim is always carried out in their workshops and they further claim that by strictly adhering to this principle, and always being the leaders of nearly every improvement that has been made, they have justly become the largest manufacturers of surveying instruments in the world. Not only have they improved them, but they have also simplified them, and thus have made them more reliable and stronger than heretofore, and by the aid of special machinery, so many parts that were previously made in separate pieces screwed together, are now made in one solid piece, that the number of parts is reduced to about one-third, consequently with the extra strength thereby attained, and the smaller number of parts, they will last in adjustment much longer and stand much harder wear.

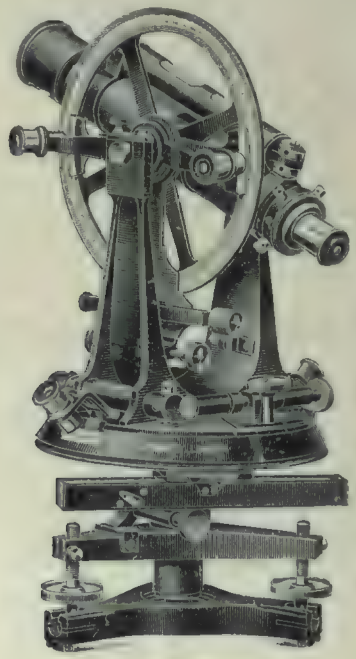


Fig. 1—Theodolite.

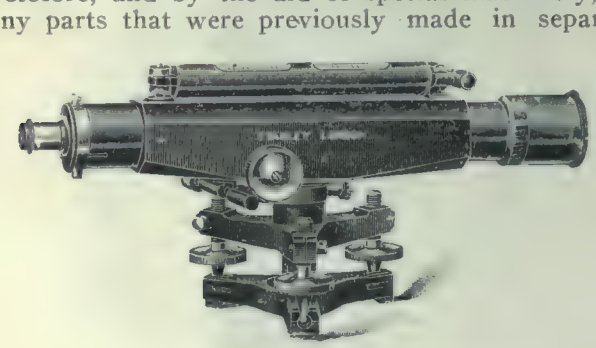


Fig. 2—Level.

As an example of two of the most ordinary instruments used in surveying, we give an illustration of a theodolite and of a level made by this firm, which show the simple, yet graceful strength of construction.

But notwithstanding their strength, every part is so carefully and mechanically designed that they are marked by their lightness in weight. Every part is made from special alloys of gunmetal, carefully worked out to the best for its particular purpose. These instruments being so solid and rigid, carry exceedingly sensitive bubbles. The lenses used are the finest that skill can produce, and last, but not least, the greatest care is taken in packing each instrument in its case, so that although it is held firmly at all necessary parts, it drops into its place without the slightest trouble. Every part of these instruments is made at the works of W. F. Stanley & Company, Limited, under special supervision from the alloying and founding of the metals to the finished instrument, including the levels, lenses, dividing, engraving and the hundred and one other processes. Although their own patterns are the result of over sixty years' practical experience, they are quite alive to meeting any demand for other patterns, and as the Canadian market demands, in many instances, the American pattern, they are now making these, and the work in them is of the highest class. An example of one of the simple transits is given below.

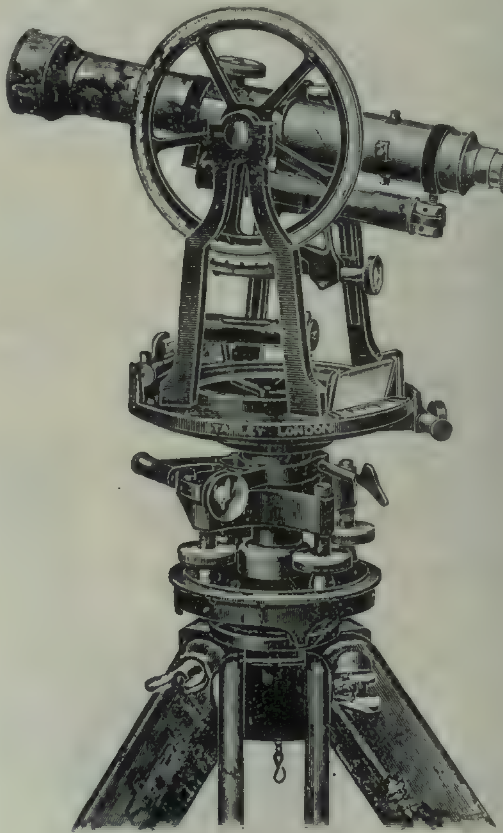


Fig. 3—Transit.

Some of the up-to-date mining outfits are masterpieces of completeness.

In their No. 1 outfit the instrument and targets have interchangeable centres for working the three tripod system; all have mechanical centering stages and quick setting lower plates, and the same transit is fitted with auxiliary top and side telescope for shaft work, etc.

The company would be pleased to send their latest catalogue to any one interested. It contains every item that a surveyor can want in field or office.

Sewage Disposal Plant Constructed at Lethbridge, Alberta

THE question as to the proper method of treating its sewage is one of vital interest to every community. Engineers and municipal administrators have given much thought to the solution of this problem and a great deal that is both interesting and valuable has been evolved. The method of sewage treatment by means of sewage disposal plants, while only in its infancy in Canada, is, nevertheless, growing in favor. The Adams Hydraulic, Limited, York, England, through their agents, Francis Hankin & Company, of Toronto, have either installed or have under construction, plants for sewage disposal at Regina, Sask.; Lethbridge, Alta.; North Toronto, Weston, Oshawa, Napanee, Guelph Prison Farm, Ont., and the Jordan Sanitorium, Moncton, N.B.

The Lethbridge plant may be taken as a standard installation and a description of its method of operation will give a general idea of the method of operating the plants constructed by this company.

The sewage disposal works at Lethbridge were designed to handle a daily minimum of 400,000 gallons and a daily maximum of 2,000,000 gallons. A very good idea of the general layout of the plant may be seen in Fig. 1.

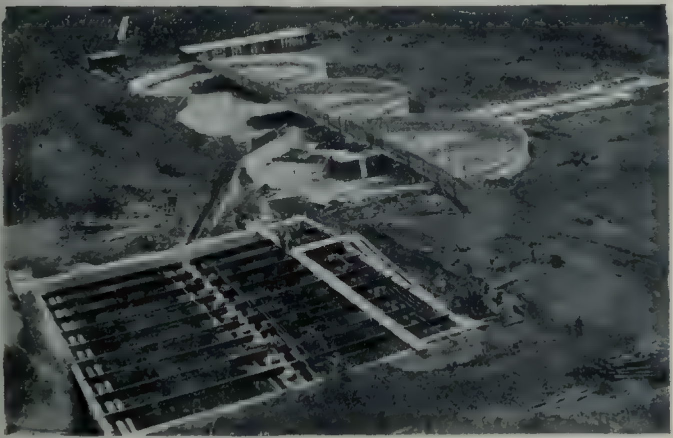


Fig. 1—General layout of the plant.

On entering the disposal works, the sewage first passes through screens and detritus tanks. These are simply primary settling tanks where the grosser solids are eliminated. It then passes on to the sedimentation tanks which are two in number, and so constructed that either may be shut off at any time for cleaning purposes. These tanks are each 100 feet long, 31 feet wide and 18 feet deep. They are of the two-storey type which allows the sewage to be kept fresh and completely separate from the solids which settle into the lower compartment of the tank.

The sludge is removed from the tanks about once every three months. This operation is easily accomplished by opening special sludge plugs which are placed at the lowest point in the compartment and are provided with an extension spindle carried up above the water level.

The tank effluent is discharged directly into three revolving sprinklers which distribute the effluent over the filter beds. These latter are each 108 feet in diameter and 7 feet in depth. The liquid is carried off to the main channel by means of ordinary field drains laid on concrete floor as illustrated in Fig. 2. The same bed with distributor and filter media in place ready for operation is shown in Fig. 3.

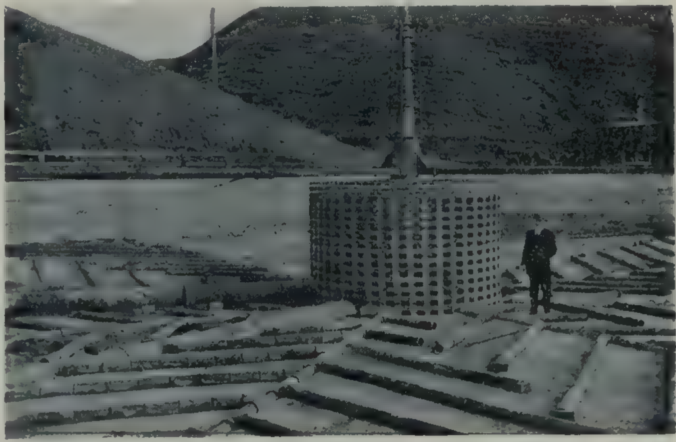


Fig. 2—Centre well and field tile in the bottom.

The clarified effluent passes to the humus tanks which are in duplicate. Each of these tanks is 80 feet long, 15 feet wide and 4 feet deep. Finally, before entering the river, the effluent is disinfected by adding a small percentage of chlorine.

The revolving sprinklers used in these plants are of the Adams' patent Cresset type. They are provided with a patent air lock cell which practically eliminates all friction and will revolve with so low a maximum head of sewage as 14 inches and finish off with 2 inches and require no other motive power.

In the past some doubt has been expressed as to whether revolving distributors were suitable for the Canadian climate, fear being expressed that they would freeze up. The Adams Hydraulic Company, Limited, claimed that if the filters were roofed the natural heat of the sewage would dispense with any need of artificial heat. This contention has been borne out by experience and in Lethbridge the machine actually ran all winter without a roof. Leaving the plant in this condition is, of course, taking serious risks.

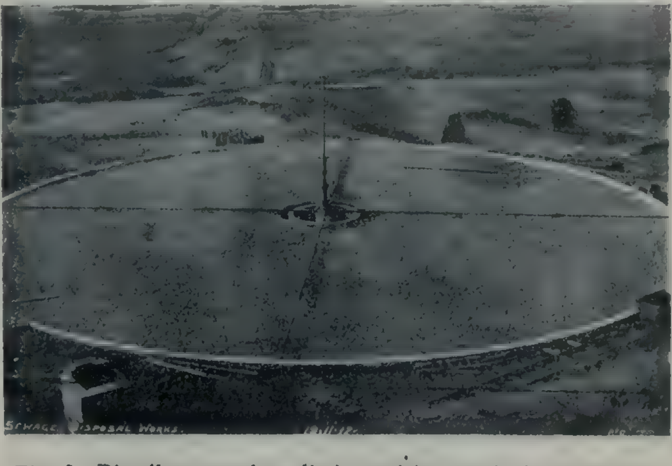


Fig. 3—Distributor and media in position ready for operation.

Canadian Railroad Development

It is reported that arrangements are being made whereby the C. N. R. will take over and build the Alberta and Great Waterways Railway.

Investigations are being made so as to locate the most advantageous point at which to make the junction with the C. P. R. from the line of the Lake Huron and Ontario Railway.

The Canadian Northern Railway's issue of $7,500,000 five per cent. secured notes at 98 has been oversubscribed, the lists being closed in advance. The scrip was quoted at 1-4 premium for special settlement.

The Montreal and Southern Counties Railway Company are engaged on a policy of expansion, with a view to opening up the southern shore of the St. Lawrence. Recently an electric line to Richelieu was put into operation, and a line to Marieville, four miles beyond, and 22 miles from Montreal, is now completed. A substation has been built at Chambly.

The Railway Commission has given judgment approving of the plans for the new Toronto viaduct which were agreed upon by the city railway companies and Toronto Harbor Commissioners, after prolonged negotiations. This practically settles the question of grade separation in connection with the viaduct. Work must be completed by July 29, 1916.

Canadian Pacific's preliminary income account for 1913 showed an increase of $14,076,000 in gross earnings, but only $46,245,000 of gross remained for net, showing an increase of $2,947,000 over 1912. The statement does not show how much of the increase in operating expenses went into maintenance, but the figures do indicate an increase of 3 per cent. in the operating ratio, 1913 figuring out 66 per cent., against 63 per cent. for 1912.

The dispute concerning the freight rates of the Intercolonial Railway will probably be settled within a few days. Conferences have been taking place between the Minister of Railways and Canals, the railway officials, and representatives of shippers. Concessions have been made by the railway authorities, mainly in the direction of making allowance for contracts based on lower rates. Other rates have been slightly modified, but the general increase will be about ten per cent.

The first estimate for the Union Station and viaduct, Toronto, was $10,000,000, but the original scheme has been so much amplified that the final cost will be much in excess of this figure. It will take three years at least to complete the work. It is interesting to note that the operating scheme to be included in the new Union Station arrangement will adhere to the plan first outlined. Mr. E. R. Ambrose, who has had charge of the grade separation at Sunnyside, will be entrusted with the responsibility of the Union Station and viaduct work.

The C. P. R. bridge at Highlands, across the St. Lawrence, will be completed by the Fall. One of the spans, 480 feet long, is erected on the up-stream side, and work has been commenced on the second span. When this is in position the bridge will be finished, thus giving the C. P. R. another double track into Montreal. The double track into St. Johns, P.Q., has been open for some time, and the extension to Farnham is proceeding. The whole of the work will, it is anticipated, be very shortly completed with the exception of the new bridge which has to be thrown across the river at St. Johns, the concrete foundation for which has been carried out.

Although only a year has elapsed since the first gang of men commenced work on the three and a quarter miles tunnel the Canadian Northern Railway is driving through Mount Royal to its extensive terminal property in the centre of the city of Montreal, sufficient progress has been made to enable the builders to predict the probable date of completion for the bore, and the date of its being opened, to handle its transcontinental traffic. Of the total length of 16,668 feet, 12,438 have been drilled. The heading—the primary bore—is 9 by 12 feet. The drill runners are expected to meet down in the depths of the mountain before the end of the present year, and there seems to be no doubt that they will meet and the daylight will be filtering through the historic old mountain, which has held up the expansion of Canada's eastern metropolis for so long.

Twenty-five thousand men and three thousand teams are at work on the grade of the main line of the Canadian Northern Railway, west of Edmonton, with a view to doubling the mileage now in operation before the close of the season. It is planned to have the line between Edmonton and the Pacific coast completed before the end of 1914. Sir William Mackenzie announces that the company has placed orders for the necessary rolling stock. Steel has been laid to the Albreda summit, through the Yellowhead Pass, 350 miles west of here. Westward from Port Mann, the terminus on the Pacific coast, the work is well advanced, and it is given out that the head of steel should reach Kamloops, B.C., at the end of the year. The company has 594 miles of line in operation in this province. This will be increased to more than 1,000 miles at the beginning of 1914. Progress is also reported on the branch lines south of Edmonton.

It is understood that the Department of Railways and Canals is about to take over the International, formerly the Restigouche and Western Railway, running from Campbellton, N.B., on the I. C. R., to St. Leonard's on the St. John river, a distance of 112 miles. This transfer will be made on the authority received from Parliament by the Hon. Frank Cochrane to take over all roads connected with the government system, the International being one of the first to be required under the act in question. This important railway, which is about to be operated by the Intercolonial, was built by Mr. Thomas Malcolm, the well-known New Brunswick contractor, and a very large business has been worked up between Baie des Chaleurs and the St. John river and extending into Maine. It is looked upon as one of the best feeders the I. C. R. could secure. The road-bed is in first class shape and an up-to-date passenger and freight service has been given by the road during the past year and a half.

Mainly Constructional

The News in Brief—From Coast to Coast

Mr. F. L. Fellowes, city engineer of Vancouver, is now sufficiently convalescent to return to his office.

Messrs. Cloutier & George, Rapid City, Man., recently started the manufacture of brick in their new brickyard there.

Mr. R. V. Holland, who has been connected with the Canadian Light & Power Company, Montreal, as superintendent, from September, 1911, when the company commenced operating, ceases his connection with the company August 1st.

Good progress is being made by the night and day shifts on the Rideau Hall improvements, Ottawa, and they are expected to be completed by the time the Duke of Connaught returns on October 25. A new entrance and a partially new front are the principal changes made.

Mr. W. A. Elliott, the well-known Brandon architect, who was recently appointed chief inspector of the new provincial parliament buildings in Winnipeg, has now taken up his quarters in Winnipeg. Work has commenced on the buildings and the caissons are now being put in. They are placed on the bed-rock which, in some cases, is fifty-four feet below the surface.

It is announced from Ottawa that plans are well advanced and tenders will shortly be called for the Dominion Government interior storage elevator to be constructed at Saskatoon. Work will be commenced during the fall. The elevator, which is to be the initial unit of the government's scheme, will have a capacity of 3,000,000 bushels and will cost about $2,000,000.

According to Mr. M. P. Davis, the contractor for the substructure of the Quebec bridge, the work will be completed by November 15. The St. Lawrence Bridge Company, which has the contract for the superstructure, will then commence work. Mr. Davis expressed the opinion that it will take another four years to complete the bridge and that it will not be ready for operation until 1917.

Mr. Leigh Hunt, of the Hunt Engineering Company, recently took out four engineers and their supplies to the site where the Canada Cement Company's plant is being built at Medicine Hat. Permanent construction work on the cement plant has been started and is being rapidly pushed. Mr. Hunt stated that from ten to fifteen men are being added daily to the permanent construction force.

The Industrial Engineering & Machinery Company, Limited, located in the Shaughnessy Building, Montreal, have taken the agency for Chain Belt Concrete Mixers, manufactured in Milwaukee, Wisconsin, and will act as exclusive agents in this territory. The officers of The Industrial Engineering & Machinery Company are Theo. J. Mullen and J. C. Grant, formerly engineers of the Allis-Chalmers-Bullock Company.

The building record by provinces shows that only the Maritime and Ontario cities showed an aggregate increase during July. An 87 per cent. advance made by the two chief cities of the Maritimes and a 38 per cent. increase by nineteen cities of Ontario bespeaks a substantial development in these provinces, while the remainder exhibit a marked tendency to ease up. In British Columbia cities the decrease for the month was 77 per cent.; that for Saskatchewan cities, 63 per cent.; Manitoba, 51 per cent., and Alberta 23 per cent.

The annual convention of the Canadian Society of Stationary Engineers held at Owen Sound on July 29-31. A very successful meeting was held and the citizens of Owen Sound extended a warm welcome to all those attending the convention. The following officers were elected: Past president, J. A. Robertson, Stratford; president, S. E. Cosford, London; vice-president, W. A. Heath, Hamilton; conductor, R. Dyson, Guelph; doorkeeper, E. Hooey, Owen Sound; secretary, A. Kastella, Ottawa; treasurer, W. E. Archer, Toronto.

The London, Ont., Pressed Brick and Tile Company, in which a number of local capitalists are interested, have secured property eighteen acres in extent, on the line of the London and Lake Erie Railway in Westminster Township, just south of the city limits, and will proceed at once with the installation of a plant for the manufacture of all classes of clay products, viz.: brick, roofing tile, floor tile, wall sheathing, paving bricks, terra cotta, ornamental designs and moldings. The plant will have a capacity of about twenty thousand bricks a day, the clay for their manufacture being found on the premises.

The Ontario Commission on Highways Improvement held the first meeting recently at the Parliament Buildings, Toronto, and organized. The commission will thoroughly investigate the highways of Ontario, and prepare a report on the best means of improving them. The meeting to-day was taken up entirely with preliminary organization, and the actual investigation will not start for some time. Mr. Chas. A. Magrath, C.E., was made chairman of the commission. Mr. W. A. MacLean, Provincial Engineer of Highways, vice-chairman and secretary.

Application is being made to the Department of Public Works by the Amalgamated Drydock and Engineering Company of Vancouver for a subsidy for the construction at Vancouver of a floating drydock to cost $2,500,000. The dock will be capable of accommodating the largest class of vessels plying on the Pacific Ocean, and the promoters will doubtless receive the encouragement of the Dominion Government if their plans are suitable. The chief engineer of the Department of Public Works will make a report on the plans before the usual subsidy of 2½ per cent. is granted.

The Ambursen Hydraulic Construction Company of Canada, Limited, have just closed the following contracts: A concrete steel dam of the Ambursen type for water supply purposes, for the town of Swift Current, Sask. The dam is approximately 840 feet in length over all, 180 feet of this being spillway of the full apron type, and the balance, concrete core wall and earth embankments. The dam is about 25 feet high in the centre; estimated cost of the work is $86,000. Construction has already started. Also a concrete steel dam of the Ambursen type for the Maritime Coal, Railway & Power Company at Maccan, N.S., for water supply purposes; the total length of this dam is about 200 feet, height about 22 feet; the estimated cost is $11,100. Construction will start immediately.

It is officially announced from Ottawa that the contract for the completion of the first unit of the north jetty at the Fraser river sandheads has been awarded to Broley & Martin, of New Westminster and Vancouver. The contractors agree to complete the jetty for $83,500, the aggregate of the bids for finishing the various parts of the work. Lead piling must be driven for 300 feet, 1,100 feet of sheet piling, 2,400 feet of mattressing and 2,400 feet of rock work must be done, and included in the contract is 1,400 tons of rock to be placed on the completed portion of the work. The contractors are given twelve months to complete the work in, and thirty days in which to assemble plant and begin it. It is expected, however, that the contract will be completed within less than six months so that the contract can be let for the second unit and work on it commenced next spring.

The world's highest head water power plant is being constructed at Martigny, Switzerland. The fall is 5,400 ft. and the pipes conveying the water from the head of the fall to the power house, a distance of three miles, are specially remarkable. The pressure gradually increases with the fall till the lowest part is reached, where the pipe, having to withstand 2,500 lbs. per square inch, had to be made of special ingot-pressed steel. The turbines, which are of the Pelton type, have a total rating of 15,000 h.p., and it is of interest to note that, with the 5,400-ft. head, only about 30 cu. ft. of water per second will be necessary to develop the full 15,000 h.p. output of the station.

What is your aim in life? What have you thus far accomplished worthy of commendation? Answer yourself honestly. It may surprise you.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brockville, Ont.
One mile of pavement on King street planned by Town Council. Mayor, R. McKenzie. Clerk, Geo. Dewey. Engineer, Geo. Bryson.

Tenders received by Clerk, Geo. Dewey until August 22nd, for construction of cement walks on about 12 streets in different parts of town. Plans, specifications, etc., at office of Engineer, Geo. Bryson.

Burlington, Ont.
8,403 feet of sidewalks of either cement concrete or granolithic construction planned. Reeve, M. C. Smith. Clerk, J. S. Allen. By-law has passed council.

Twp. of Brantford, Ont.
Cement sidewalks. Engineer, Alan Muir, Jackson Temple Bldg., Brantford, for construction of 7,810 lin. ft. of 4-in. cement sidewalk. Plans, specifications, etc., at office of Engineer. Tenders received by Clerk, J. A. Smith, County Bldgs., Brantford, Ont., until Aug. 30th.

Dorval, Que.
Grading of streets. Address Alp. Decary, Quebec Bank Bldg., Montreal. Plans, etc., at office of engineer, V. H. Dupont, 125 St. James Street, Montreal. Tenders will be called shortly.

Dundas, Ont.
Town Council is looking into matter of erecting pumping station and filtration plant at canal to replace or augment present waterworks system. Reeve, Chas. Collins, is Chairman of Committee.

Dundas, Ont.
600 feet cement walk, Mountain, planned by Town Council. Clerk, J. S. Fry. Chairman Board of Works, A. B. Wilson.

Hull, Que.
Surveys have been made by City of Hull and Provincial Government for 2½ miles macadam roadway, cost $25,000. Mayor, Mr. Dupuis. City engineer, J. A. Laforest.

Kincardine, Ont.
Waterworks planned by Town Council (Waterworks Commissioners). Chairman, Ex.-Mayor Patterson. Operations commenced on Waterworks extension. Masonry and roofing to be let.

Lethbridge, Sask.
Town Council contemplate constructing 30-in. and 54-in. sewer for storm water purposes. Engineer, W. S. Harvey.

London, Ont.
New cement walks will be laid on Bathurst street from Waterloo to Colborne and on York from Wellington to Colborne. Tenders to be called shortly. Chairman, B. W. Bennett. Engineer W. N. Ashplant.

Morris Twp., Ont.
Tenders received by Clerk, A. McEwen, Bluevale, Ont., until August 25th. for construction of complete new Black & Ellis tile drains.

Redcliffe, Alta.
By-law passed providing for the expenditure of $100,000 for the extension of water system.

Richmond, Ont.
Concrete walks. Tenders received by clerk until August 30th, for construction of 1,881 feet of sidewalk, 5 ft. wide; price wanted per square foot. Specifications at office of clerk, John Reilly.

St. Catharines, Ont.
Rocmac roadway, 30 feet wide, St. Paul. Clerk, J. A. Pay. Engineer, W. P. Near. Plans drawn.

Bitulithic pavements planned by City Council. Clerk, J. A. Pay. By-law passed first reading. $34,599, Queenston St., from St. Paul to Vine. $19,810, King St. from Ontario to Mary. $54,398 for various local improvements.

Toronto, Ont.
Tenders received by H. C. Hocken, Mayor, until August 26th noon, for supply and erection of three motor-driven centrifugal sewage pumps, automatically controlled, for main drainage works. Plans, etc., at office of Commissioner of Works.

Wingham, Ont.
Council plans to lay new 4-in. water drain on Edward and Victoria streets.

CONTRACTS AWARDED

Barrie, Ont.
Pavements planned. Clerk, Elijah Donnell. General contractors, Curran & Clement, Orillia.

Huntingdon, Que.
General contractors, O'Conner Bros., for macadamizing 4 miles of roads. Sec.-treas., R. S. Feeny.

Montreal, Que.
Paving, Board of Control. Secretary, L. N. Senecal. General contractors, Quinlan & Robertson, Galt ave., for laying of granite blocks on Cote St. Paul Road at $1.80 per square yard. Blocks supplied by city.

Pump station No. 7, cost $10,000, foot of Atwater. L. N. Senecal, Secretary, Board of Commissioners. Builders, Murray & McRitchie, Coristine Bldg. Brick construction, felt and gravel roofing. All work done by builder.

North Battleford, Sask.
Water main. Engineer, J. B. Sterling, City Hall. General contractors, Cookson Bros. 600 ft. of 12-in. lapwelded steel pipe wrapped and cased.

Ottawa, Ont.
Pavements. Mayor, J. A. Ellis. City Engineer, Archibald Currie, City Hall. Contracts awarded to Union Construction Co., Bank street, for pavements on Rochester street between Somerset and Ellen street, including curb, gutter, headers, and sidewalk. To Ottawa Construction Co., Central Chambers, for asphalt pavement on Centre street between Bank and Craig streets, including curb, gutters, headers, setts, etc., and for work on St. Andrew street from King Edward ave. to St. Joseph street.

St. Martin, Que.
Macadamizing roadways. Secretary, Nap. Mallette. General contractors, R. T. Smith & Co., 175 Metcalfe ave.

Toronto, Ont.
Grading planned by York Township Council. Clerk, W. A. Clarke, 40 James street. General contractors, International Contracting Co. Grading DeGrassi Hill, Todmorden. Highway Commissioners will build macadam roadway after grading is finished.

Railroads, Bridges and Wharves

Harbor improvements, cost $50,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders called shortly.

Canoe, B.C.
Wharf. Tenders received till Sept 11 by Secretary, R. C. Desrochers, Ottawa. Dom. Govt., Dept. of Public Works. Specifications, plans, etc., at offices of F. W. Aylmer, Dist. Engineer, Chase, B.C., J. S. McLachlan, Dist. Engineer, Victoria, and Postmaster, Canoe.

Chambly, Que.
Steel bridge, cost $4,000. Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Jones, Ottawa. Plans, specifications, etc., at office of chief engineer, Dept. of Railways & Canals, Ottawa, and Supt. Engineer, Marceau, New Birks Bldg., Montreal. Tenders will be called shortly.

Cogagne, N.B.
Wharf, cost $10,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders called shortly.

Dundas, Ont.
T. H. & B. Rly. Co. are preparing plans for spur into premises of Jones Bros. Length about 700 ft.

Deer Island, N.B.
Wharf extension planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Work at Chocolate Cove. Tenders will probably be called early in September.

Edmonton, Alta.
Car barns, cost $3,000, Algonquin ave. for Edmonton Interurban Railway, C. P. R. Bldg. One storey, 34 x 64, frame

construction and foundation, shingle rfg. Plans ready. Excavating started.

Haldimand County, Ont. (Near Indian Line

New bridge has been ordered by County Council in accordance with report of Committee. Plans in progress. Clerk, T. A. Snider, Dunnville. Engineers-in-charge, Jackson & Kyd, Dunnville.

Little Dipper Harbor, N.B.

Breakwater, cost 12,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders called shortly.

Montrtal, Que.

Tenders received by Sec., L. K. Jones, Dom. Govt. Dept. of Railways and Canals, until noon September 2nd, for construction of concrete foundation and floor St. Gabriel shed No. 1, Lachine Canal. Plans, etc., at office of Chief Engineer, Dept., Ottawa, and Supt. Engineer of Que. Canals, New Birks Bldg., Montreal.

Wharf, Marlborough, contemplated by Harbor Commissioners, 57 Common St. Chief Engineer, F. A. Cowie. Land purchased and plans will be prepared.

New entrance to Lachine Canal, Twin lift lock from basin above Black's Bridge to Windmill Point basin, planned by Dom. Govt., Dept. of Railways & Canals. Secretary, L. K. Jones, Ottawa.

Morinville, Alta.

Canadian Northern Railway Company have been ordered to enlarge present station at Morinville to provide a waiting room at least 30 x 30 ft. with seats for accommodation of the public. Lengthen platform to accommodate four passenger trains, and erect a freight shed independent of the passenger station.

Sandwich, Ont.

Steam railway three miles long, planned for Essex Terminal Railway. Plans and specifications at office of Manager, Wm. Woollatt, Walkerville.

Shelter Point, B.C.

Wharf, Gillies Bay. Dom. Govt., Dept. of Public Works. Secretary, R. S. Desrochers, Ottawa. Specifications, plans, etc., at C. C. Worsfold, District Engineer, New Westminster, Postmaster, Vancouver and Department, Ottawa. Tenders received till September 15th by Secretary.

Victoria, B. C.

Harbour improvements, cost $2,000,000, Ogden Point, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders to be called shortly. Two piers, one 1,000 ft. long, one 870 ft. long, concrete and cribwork.

Victoria Harbor, Ont.

Tenders received by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, until September 8th for construction of wharf at Victoria Harbor, Ont. Plans, specifications, at offices of J. H. Armstrong, Dist. Engineer, Midland, Ont., J. G. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, and Postmaster at Victoria Harbor.

Westbourne, Man.

Bridge planned by Prov. Govt., Dept. of Public Works, Winnipeg. Minister, G. R. Coldwell, Winnipeg. Tenders received for removing and replacing of bridge over Whitemud River between sec. 30 and 31, Twp. 14, Range 10 west in municipality of Westbourne by Minister till August 22nd.

CONTRACTS AWARDED

Batiscan, Que.

Improvements to wharf, cost $15,000, planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractors, Gruniyer & Dalton.

Blandford Twp., Ont.

Drain. Clerk, W. G. Henderson, Bright, Ont. Engineer in charge, F. J. Ure, Woodstock. General contractors, B. Blair & Co., Woodstock. "Silcox Drain," 5,993 ft. 6-in. to 14-in. tile. "Colder Drain" 5,314 ft. 12-in., 14-in., 18-in. tile.

Dundas, Ont.

Bridge, for T. H. & B. Rly. General contractors, Ontario Bridge Co., Crown Office Bldg., Toronto. One span, 30 ft., on line of spur into Jones Bros. factory.

Port Stanley, Ont.

Cement breakwater, 300 ft. long. for residents of Orchard Beach. General contractor, Mr. A. E. Ponsford, 605 Talbot St., St. Thomas, Ont. Work will start as soon as possible.

Essex Co., Ont.

Three bridges planned by County Council. Clerk, John Milne, Sandwich, Ont. General contractors, Sarnia Bridge Co., Sarnia. Two bridges over Belle River and one over Russell River, in Rochester Twp. One and two spans, 120 ft., 85 ft. and 80 ft. long.

Fort William, Ont.

Electric shop, cost $15,000, planned by Canadian Pacific Railway. General contractor, I. H. Simons, Winnipeg. One storey, 32 x 80, brick, cement foundation. Excavating started.

Galt, Ont.

Cement dam across Grand River. Clerk, Jos. McCartney. General contractors, Thomas and Hancock. 280 ft. long, 10 ft. high.

Haileybury, Ont.

Spur for Temiskaming & Northern Ontario Railway. General contractor, Jos. Roycroft.

Harriston, Ont.

Two bridges planned by Municipal Council. Road Commissioner, J. M. Young. Engineers, Bowman & Connor, 36 Toronto street, Toronto. Contracts awarded to Jno. Tilker, Fordwich, Ont., $950, and Jno. Gaffrey, Kennicott, Ont., $735. 22 x 18 and 30 x 20, reinforced concrete.

Five bridges. Reeve, W. C. Dryden. Clerk, W. D. McLellan. Contracts awarded to Jos. Schickler, Deemerton, $1,050, and $240, Mr. Brown, Clifford, Ont., two, $120 each, Jno. Tilker, Fordwich, $120.

Montreal, Que.

Contract for construction of the new pattern shop for the National Bridge Co., has been awarded to A. F. Byers & Co., Ltd., Engineers and contractors, 340 University street, Montreal. Will sublet roofing. Tenders open.

Prov. of New Brunswick

Dredging north and south Miramichi rivers. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Peter England, Chatham, N.B.

Sault Ste. Marie, Ont.

Dredging, cost $62,000, planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractors, Soo Dredging & Construction Company.

Toronto, Ont.

Bridges for County of Halton and County of Wellington. Engineers, Bowman & Connor, 36 Toronto street. General contractor, H. E. Craft, Guelph, for concrete bridge at Eden Mills, $2,000.

Public Buildings, Churches, Schools, etc.

Caledonia, Ont.

Drill Hall planned by Dom. Govt., Department of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. Brick constr.

Cowichan, B.C.

Post office, cost $40,000, Craig and Kenneth. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Three storeys and basement, 66 x 65, stone and brick construction. Plans in progress.

Dorval, Que.

Military school contemplated by Dom. Govt. Dept. of Militia & Defence. Sec., E. F. Jarvis, Ottawa. Plans under advisement at Ottawa. Site has been purchased.

Grimsby, Ont.

Pre cooling plant for fruit and vegetables, cost $12,000, planned by Dom. Govt., Dept. of Agriculture. Secretary, A. L. Jarvis, Ottawa.

Louth Twp., Ont.

School, cost $14,000, for Trustees Union School, Dist. No. 1, Louth and Grantham. Chairman, J. Roland, Power Glen, St. Catharines. Architect, A. E. Nicholson, 46 Queen St., St. Catharines. One storey, brick construction, stone foundation. Two rooms and physical training room. Plans in progress.

Leonardville, N.B.

Tenders addressed to A. Johnston, Deputy Minister of Marine & Fisheries, Ottawa, received until Sept, 2 for construction of a wooden lighthouse tower here. Plans, specifications, etc., at this Dept., Ottawa and St. John and post offices at St. Andrews, Campobello, Leonardville and St. Stephen.

Killooet, B.C.

School. Tenders received by Prov. Govt., Dept. Public Works, Victoria, Hon. Thos. Taylor, Minister, till August 29th. Plans, specifications, etc., at offices of S. A. Fletcher, Govt. Agent, New Westminster, D. C. Webber, Sec. School Board, Haney, B.C., and at Dept., Victoria.

London, Ont.

Mausoleum for International Mausoleum Co., Ltd., 36 King St. E., Toronto. Architect, owners. Cement foundation, Roman stone and reinforced concrete construction. Plans in progress.

McCaluey Twp., Ont.

School addition planned for Union School District No. 2. Plans, specifications, etc., at office of Secretary, Geo.

Yearley, Falkenburg Station, Ont., who will receive tenders. Brick veneer construction.

Maillardville, B.C.
Moving picture theatre planned. Architects, O'Brian & Murphy, Port Coquitlam. If plans are approved work will commence.

Medicine Hat, Alta.
Three public schools, cost $3,000 each, Charles St., Elizabeth St. and Second ave. President, W. Huckvale. One sty., 25 x 45, frame construction, cement fndn. Plans in progress.

Montreal, Que.
Public bath, St. Joseph Ward, Seigneurs St., planned by Board of Commissioners. Sec. of Commissioners, L. N. Senecal.

Fire station, St. Denis Ward, De la Roche St., contemplated by Board of Control. Sec. of Commissioners, L. N. Senecal. Fire chief Tremblay.

Church, cost $100,000, contemplated for Sherbrooke St. Methodist Congregation. Pastor, Rev. A. A. Radley, 6 Sherbrooke St. W. New site will be purchaed when present church is sold. Architect not chosen.

School contemplated by School Commissioners of Notre Dame de Grace, c/o Mr. Duncan, 747 St. Catherine St. W. Plans will be prepared.

Church, Decarie Blvd., planned for St. Luke's Congregation, c/o W. R. Cruikshanke, 115 Drummond. To be built in the fall after new minister comes.

College building contemplated for Union College Board of Governors. Principals, E. Munsen Hill, 60 McTavish; E. I. Roxford, Diocesan College; Jno. Scrimger, 69 McTavish; Jas. Smith, Principal of Wesleyan Theological College. Architect not chosen. Will not be built for a year.

School, cost $80,000 (St. James Parish, St. Andre and St. Christophe Sts.). Owner, R. C. School Commissioners, c/o U. Lafontaine, Com. Academy, 35 St. Catherine W. Architects, Venne & Labelle, 5 Beaver Hall Sq. Heating and ventilating, Canadian Domestic Engineering Co., Ltd., 5 Beaver Hall Square. Plans in progress.

Club and gymnasium, cost $25,000, Maisonneuve. Owner, Club Canadian Champetre, Sault Au Recollect, Que. Architect, C. A. Reeves, 58 St. James street. Forty rooms, dance hall, concrete foundation, frame construction. Plans in progress.

School, Greenfield Park (Patenaude), for School Commissioners of Greenfield Park, c/o Mr. Dawson. Plans in progress.

New Westminster, B.C.
School. Tenders received till September 1st by Minister, Hon. Thos. Taylor, Prov. Govt. Dept. of Public Works, Victoria. Plans, specifications, etc., at offices of A. G. Marshall, Sec. School Board, S. Westminster; S. A. Fletcher, Govt. Agent, New Westminster, and at Dept., Victoria.

Ottawa, Ont.
Tenders received by Dom. Govt., Department of Public Works, Secretary, R. C. Desrochers, Ottawa, for supply of sorting cases for post offices. Plans, specifications, etc., at offices of T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, R. L. Deschamps, Supt., Montreal, General Post Office and Department, Ottawa.

Lavatory, cost $15,000, planned. Architect, F. C. Sullivan, Castle Bldg., Queen street. Plans approved by City Council. Tenders will be called. Concrete foundation, solid brick construction.

St. Genevieve, Que.
School contemplated by R. C. School Commissioners. Plans will be prepared.

Steelton, Ont.
Post office planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, Thos. R. Wilks, 612 Queen St., Sault Ste. Marie. Plans, specifications, at offices of architect and Department. Tenders received by secretary until 4 p.m., Sept 9.

Toronto, Ont.
Church, cost $30,000, for St. Martins Congregation (Ang.). Pastor, Rev. S. D. K. Sweatman, 209 Perth Ave. Site purchased cor. Woodville and Conduit Strets, and plans will be prepared.

Church and Sunday School, cost $50,000, Sunnyside, for Howard Park Methodist Church. Tenders now being received by architect, W. G. Burns, 74 Indian Grove. Two storeys, 54 x 108, steel and stone construction and foundation.

Vancouver, B.C.
Theatre planned, Keefer street. Architect, J. J. Domiellan, 319 Pender St. W. 75 x 120, fireproof construction, seating capacity, 1,700, stage, 32 x 73, heating and ventilating system. Present tenders include everything except mechanical equipment.

Wallaceburg, Ont.
Addition to Sunday School, cost $12,000, for Knox Church Congregation. Secretary, Board of Managers, E. W. Shaw. Architect not yet chosen. Two storeys, white brick construction, brick foundation. Plans will be prepared.

Winnipeg, Man.
School, cost $3,000, St. Boniface, planned by Prov. Govt., Dept. of Education. Architect, V. W. Horwood, 261 Fort St. 40 x 23, concrete foundation, frame construction, shingle roofing. Tenders received by F. Paquin, St. Boniface, for all trades.

Wolfville, N.S.
College residence, cost $30,000, for The Acadia University. President, Dr. Geo. B. Cullen. Architect, Chas. Herbert McClare, Cambridge, Mass. 2½ storeys & basement. Sketches drawn.

Library and museum, cost $30,000, for Acadia University. President, Dr. Geo. B. Cullen. Architect, A. R. Cobb, Halifax, N.S. 2½ storeys and basement, stone foundation and construction, hot water heating, electric lighting, slate rfg., concrete floors in basement. Contract will be awarded in a few days. Private tenders were called.

CONTRACTS AWARDED

Brampton, Ont.
Hockey rink, cost $10,000, for Thauburn, Dawson & Hodgson. General contractor, Wm. Wedgewood. One storey, 200 x 100, brick and frame construction, cement foundation, seating required.

Drill hall, cost $16,000. Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractor, W. A. Thom, Collingwood, Ont.

Edmonton, Alta.
School, cost $3,500, Johnson, for Public School Board. Sec.-treas., M. Brady. Architect, Mr. Turner, Mortlake Block. General contractors, Peppard & Son, General Delivery. Two storeys, 26 x 33 ft. 6 in., frame, brick foundation.

Public school, cost $3,500, Hudson Bay Reserve. Sec.-treas., Mr. Bradey, Mortlake Block. Architect, J. Turner, Mortlake Block. General contractors, Geary & Jamieson, 622 1st street. Two storeys, 26 x 33, frame, brick foundation.

Kemptville, Ont.
Drill hall, cost $12,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, John Dillon, Kemptville, Ont.

Le Pas, Man.
Wireless station, cost $75,000, for Marconi Telegraph Co., 137 McGill St., Montreal. General contractors, Coyle & Hughes, Winnipeg. For operating house, cost $6,000.

Midland, Ont.
Orange hall, cost $7,130. General contractor, Thos. Bath.

Millbrook, Ont.
Drill Hall, cost $11,800. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, R. Gheehy, 269 Rubidge St., Peterborough, Ont.

Montreal, Que.
Alterations to Convent, cost $5,000, Outremont (314 St. Catherine Rd.), for Loewis Missionaires de l'Immaculate Conception, 314 St. Catherine Road. Architect, Chas. Chausse, 17 Pagnuelo. Brick, O. Archambault, 575 Visitation. Masonry, O. Filion & Frere, 869 de St. Valier. Carpenter, Jos. Collette, 202 Chateauguay. Roofing, heating and plumbing, D. Benoit, 1975 St. Lawrence Blvd. Plastering and painting not let Stone foundation, brick construction.

Synagogue, cost $4,000, for L. Shapiro, 3071 Clarke. General contractor, Mr. Salzsky, c/o owner. Two storeys, 40 x 60, concrete foundation, brick construction. Foundation only will be built now. The remainder later.

Port Arthur, Ont.
Church, cost $75,000, Waverley St., for St. Paul Presbyterian Congregation. Sec., treas., W. C. McLean. Architects, Hood & Scott, Ruttan Bldg. General contractors, masonry, carpentry, iron and steel, roofing and painting, Marsh-Hutton-Powers Co., Prince Arthur Hotel Bldg. Heating and plumbing, J. W. Barnes & Co., Park street. 77 x 105 ft. 4½ in., cement foundation, Minneapolis stone and sandstone, reinforced concrete, red clay brick and structural steel.

Ottawa, Ont.
School, cost $85,000, Bronson, planned by Public School Board, Elgin St. Architect, W. B. Garvock, Creighton St. School. Mason, Geo. Crain, Clemow Ave. Foundations in.

Prince Rupert, B.C.
Quarantine station, Dom. Govt. Dept.

of Public Works. Sec., R. C. Desrochers Ottawa. General contractor, E. Kaufman.

Quebec, Que.
Church, cost $14,000, 53 St. Augustin St., for the Presbyterian Congregation. Architect, T. R. Peacock, 76 de Salaberry. General contractors, carpentry & interior fittings, L. H. Peters Co., 10 St. Angele street. Masonry, plastering, Alex. Fackney, 107 St. Joachim. Steel, Eastern Canada Steel Works, St. Maio. Roofing, heating, plumbing, electrical work, F. Gingras, 36 St. Augustin. Painting, B. Leonard, 53 St. John street. Excavating started.

Regina, Sask.
College building, cost $90,339, for St. Chads. Architects, Storey & VanEgmond, 1 Credit Foncier Bldg. General contractors, R. J. Lecky & Co., Ltd., Northern Crown Bank Bldg. Three storeys. Foundations in.

St. Catharines, Ont.
Mausoleum, cost $40,000, for International Mausoleum Co., Ltd., 36 King St. E., Toronto. Cement foundation, Roman stone and reinforced concrete construction, concrete floors, marble finish, sanitary system. Work just commenced under supervision of their own engineer.

South Edmonton, Ont.
Y. W. C. A., cost $12,000, First ave. S. Architect and general contractor, R. H. Bailey, 7 Main St. N. Three storeys, 36 x 62, frame, concrete foundation. Excavating started.

Thamesville, Ont.
Church, oost $10,000, for Baptist Church Congregation. Pastor, Rev. Mr. Irwin. Mason, Prudhomme & Wardell, Chatham. Carpenter, Wm. Best, Thamesville. Other contracts not awarded yet.

Westboro, Ont.
Church, cost $7,000, for Baptist Congregation. Architects, Messrs. Abra & Richards, Sparks St., Ottawa. General contractor, R. A. Kemp, 149 1st Ave., Ottawa. Wire cut brick construction, stone and concrete foundation. Provision made for Sunday School and library.

Wingham, Ont.
Armory, cost $11,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, James Mills, Kincardine, Ont.

Winnipeg, Man.
New wing, Balmoral Lodge, cost $8,000, for Salvation Army, Toronto, Ont. Architect, Major Miller, Salvation Army. General contractor, A. McBain, Winnipeg. Stone foundation, brick construction.

Business Buildings and Industial Plants

Abbotsford, B.C.
Powder factory contemplated for Dominion Powder Co. Manager, Mr. Israels. Plant will consist of ten concrete buildings. Site is being cleared and plans will be prepared.

Brantford, Ont.
66 ft. addition to foundry, for Hartley Foundry Co., Canal Road. Plans drawn.

Factory planned for Watson-Smith Co., Ltd., 161 Geary ave., Toronto. Woodworking, wire screens, etc. Ratepayers granted bonus of $20,000. Building to be erected this fall, 50,000 sq. ft.

Caledonia, Ont.
Bank building contemplated by Union Bank, head office, Toronto. Plans will be prepared.

Calgary, Alta.
Laundry, cost $100,000, planned for Ontario Steam Laundry Co., 5th ave. and 2nd street. Proprietor, Christie Bros. Architect, D. S. McIllroy, 118a 8th ave. west. Tenders called shortly.

Charlotte, P.E.I.
Rolled oats plant, cost $150,000, P.E.I. Cereal Co. contemplate erecting a concrete mill with daily capacity of not less than 300 bbls., concrete grain elevator with storage capacity of 200,000 to 300,000 bushels, concrete dock, abutment 150 ft. long by 75 to 100 ft. wide, also power house and cooperage. Mill to be in operation before end of 1914. City Council recommended that at next session of legislature (about February or March, 1914), authority be asked for the granting to the company free site, exemption from taxation and free water for ten years.

Ford City, Ont.
Bank building, Sandwich St. E., for Merchants Bank, Montreal, Que. Architects, Hoyle & Davis, 80 St. Francois Xavier street, Montreal, Que. Two storeys, cement and brick foundation, pressed brick construction. Plans in progress.

Hamilton, Ont.
Warehouse, cost $40,000, Caroline N., for Hamilton Importing Co., King Wm. St. Architects, Watt & Blackwell, Lister Chambers. Five storeys, reinforced concrete foundation. Contracts will not be awarded for a short time.

London, Ont.
Hardware warehouse, York St., for James Cowan & Co., 127 Dundas Street. Architect, J. Vicar Munro, Bank of Toronto Chambers. 3½-storeys, 50 x 150; white brick construction, brick foundation. Plans in progress.

Hotel and store, cost $15,000, Dundas, for Lloyd Estate, Avey & Dromgole, Merchants Bank Bldg. Tenders received by architect, J. Vicar Munro, Bank of Toronto Chambers, until Aug. 26th. 4-storeys, 15 x 45, white brick construction, brick foundation. Telephone and annunciator system.

Medicine Hat, Alta.
Warehouse, cost $3,500, Main street, planned for Chas. Pingle, 526 Montreal St. Architects, Scanlon & Hull, Main street. One storey, 30 x 50, frame construction, cement foundation.

Melville, Sask.
Alterations to hotel, cost $10,000, for T. Benwell, Waverley Hotel. Plans drawn.

Montreal, Que.
Offices, Notre Dame near Place d'Armes, contemplated for Jos. Versaille, Banque National Bldg. Architect not decided. Building will not be started till the present Versailles building is completed. Ten storeys.

Lumber warehouse, cost $25,000, Outremont (Durocher) for Seaman Kent Co., 970 Durocher. Owner undecided whether they will call for tenders or do work by day labor. Two storeys, 100 x 135, concrete foundation, brick construction. Plans drawn.

Factory and office contemplated by the International Braid Co. of Canada, Ltd., c/o Mr. W. L. Bond, Guardian Bldg. will open offices on Aqueduct street shortly and will build in about a year.

Branch bank, cost $25,000,, Church and Verdun, planned for Merchants Bank, 205 St. James St., Montreal. Architects, Hogle & Davis, 80 St. Francois Xavier, Montreal. Site purchased. Two storeys, concrete foundation, stone or brick construction.

Wire and rolling mill, Victoria St., Emard Ward, contemplated for Canadian Tube & Iron Co., Ltd., Victoria St. Emard Ward. Manager, Mr. Derrick. Plans not yet drawn. Machinery required.

Niagara Falls, Ont.
Business block, cost $20,000, for W. J. Manuel, Baker, Niagara Falls South. Architect, E. D. Pett. Electric lighting, store fixtures and fronts, plate glass. Baker's equipment. Plans in progress.

Ice and cold storage building, cost $50,000, contemplated for Frank Douglas & Henry Campagne, Victoria avenue.

Oakville, Ont.
Paint factory for Jas. Langmuir & Co., 1372 Bathurst St., Toronto. Company has purchased site and exemptions have been granted by ratepayers. Plans will be prepared.

Port Arthur, Ont.
Office building, cost $45,000, for Molsons Bank, St. James St., Montreal. Architects, Turner & Carloss, 116 Board of Trade Bldg., Montreal. Three stys., concrete foundation, Indiana stone, unglazed buff brick and terra cotta construction. Plans in progress.

Prince Rupert, B.C.
Hotel, cost $1,000,000, for G. T. P. Ry., Montreal. Hotel Manager, F. W. Bergman, Ottawa, Ont. Architect, F. M. Rattenburg, 621 Sayward Bldg., Victoria. 10-storeys, with two annexes, each six stys., fireproof construction, terra cotta and facing brick, lounging room, 58 x 62, palm room, 104 x 42, dining hall, 104 x 52, lobby, 52 x 62, 600 rooms. Excavation started. Tenders to be called shortly.

Regina, Sask.
Hotel, cost $1,000,000, for G. T. P. Ry. Co. Architects, Ross & MacDonald, Belmont street, Montreal. General contractors, Lyall Mitchell Co., Union Depot, Winnipeg. Nine storeys, 160 x 160. General contractor will receive tenders for various trades. Foundations will be put in this fall. Steel work erected during winter and building completed next spring.

St. John, N.B.
Remodelling office building, cost $35,000, cor. Germain and King, for C. P. R. Assistant Supt., H. C. Grout, C. P. R., King street. Architect, F. Neil Brodie, 42 Princess. One storey addition, pressed brick construction. Plans in progress.

Sarnia, Ont.
G. T. R. Co. intend to build at once elevator at Point Edward to replace one destroyed by fire July 7th.

Sault Ste. Marie, Ont.
Two stores and residences, cost $12,000 Queen street, for S. W. Fawcett, 145 Church street. Architects, Moran & Mc-

Phail, Queen street. Basement, T. J. Irwin. Two storeys, 27½ x 60, structural steel and pressed brick construction. Plans in progress.

Swastika, Ont.

Stamp mill, cost $100,000, planned. C. A. Foster Company contemplates installing complete permanent plant.

Terrebonne, Que.

Tile plant, cost $18,000, contemplated for Montreal Concrete Works Co., Ltd., 225 St. James street, Montreal. Machinery required.

Toronto, Ont.

Addition to factory, cost $4,000, planned by Conduits, Ltd., Don Esplanade. Architects, Bond & Smith, 19 Wellington St. W. 30 x 48, steel and brick construction. Tenders in.

Furniture warehouse, Chestnut street, contemplated. Architects, Designing & Draughting, 36 Toronto street. Four storeys, 50 x 120, wood construction, 12 in. by 16 in. by 18 in. beams Georgia pine.

Toronto, Ont.

Garage and repair shop, cost $9,000, Winchester. Architect, L. Foulds, 21 Leader Lane. Two storeys, steel, stone and brick construction, concrete foundation. 100 x 60. Sketches drawn.

Walkerville, Ont.

Store and flat, cost $6,000, Lincoln Road, for Fred Laforet. Architects, Smith & Walker, Excise Bldg. Tenders received by owner until Sept. 1st. Two storeys, 36 x 40, brick foundation and construction.

Welland, Ont.

Business block contemplated by Hugh A. Rose. Plans in progress.

Windsor, Ont.

Store and apartments, cost $5,000, Mercer & Brant. Tenders received by Architects, Atchison & Adams, until August 25th. Two storeys, 37½ x 26, brick construction, cement foundation.

Ice plant, cost $20,000, contemplated. Interested, David Brown, c/o Peoples Ice Co., Detroit, Mich.

CONTRACTS AWARDED

Berlin, Ont.

Shoe factory, cost $26,000, for Gourlay & Fogelbury. General contractors, P. H. Secord & Sons, Brantford. Three stys., 150 x 40.

Brantford, Ont.

Sporting goods factory, cost $15,000, for A. J. Reach Co. Architect, L. D. Barber. General contractors, Schultz Bros. Co., Ltd. Two storeys, 147 x 46.

Copper Cliff, Ont.

Hardware store, cost $7,500, for Cochrane Hardware Co., Ltd., Sudbury. Architect, W. Workman, Sudbury. General contractors, Gustiano & Sichetto. Two storeys, 80 x 35, red brick construction, stone foundation. Excavating started.

Edmonton, Alta.

Hotel, cost $300,000, 2nd St. and Jasper Ave., for Empire Hotel Co., Ltd., c/o Geo. Brown, Alexander Block. Architect, James Henderson, 42 Jasper Ave. W. General contractor, Jas. Apprentice, 2nd St. Iron and steel, Man. Bridge & Iron Works, Winnipeg. Roofing, McDermid Roofing Co., 1285 5th St. Heating, Huber Bros., 547 2nd St. Plumbing, Bowcett, Dean & Roberts, 7 College Ave. Electric, Burnham Frith Co., Rice street. Four storeys, 150 x 150.

Alterations to hotel, cost $25,000, Jasper Ave. W., for Robt. McDonald, Yale Hotel, Jasper Ave. Architect, Magoon & MacDonald, Tegler Block. General contractors, Read, MacDonald & Brewster, Tegler Block. Iron and steel, Man. Bridge & Iron Works, Winnipeg. Roofing, Mr. Huber, Windsor Hotel. Heating and plumbing, Edmonton Metal Co. Electric, Purdy & Anderson. Three storeys, 100 x 150, fire escapes.

Warehouse, cost $120,000, 4th street, for Canadian Consolidated Rubber Co., 4th street. General contractors, Canadian Stewart Co., McDougall street.

Store and offices, cost $150,000, 1st Ave., for R. Tegler, Tegler Block. Architects, general contractors and carpenters, G. H. Archibald & Co., 827 Union Bank Bldg. Heating, The Standard Plumbing Co., Athabasca Ave. Mason, Stoba & Wheatley, 10th St. and McKenzie Ave. Steel, Trussed Concrete Steel Co., Walkerville, Ont. Roofing, Charlebois & Edwards, 834 Jasper Ave. E. Electric Burnham Elec. Co., McDougall Ave. Interior Fittings, Cushing Bros., Elizabeth street. Eight storeys, 80 x 100. One elevator.

Fort William, Ont.

Grain drying plant, cost $8,000, Athabasca, for Guy Elevator Co., Graham and Horne Block. Architect and builder, S. J. McQueen. 55 ft., 12 x25, reinforced concrete construction, cement foundation.

Hamilton, Ont.

Storage building, cost $30,000, for Canadian Colored Cotton Mill Ltd., 352 McNab St. N. Architect, Stewart McPhie Bank of Hamilton Bldg. Carpenter, Jno. Vogan, 280 Sherman Ave. N. Roofing, J. E .Riddle & Son, Ferguson Ave. N. Painting, E. B. Turnbull, 224 King St. E.

Medicine Hat, Alta.

Business block, cost $35,000, for T. Mulligan, 613 4th Ave. Work done by day labor. Three storeys, 37 x 70, structural steel, artificial stone and red brick construction, cement foundation. Excavating started.

Cement factory, for Canada Cement Co., Hull Block. Manager, Mr. Leigh Hunt. Architects and builders, Hunt Engineering Co., Hull Block. Two stys., cement foundation, brick and structural steel construction. Foundations in.

Auto showroom, cost $3,000, Main St., for V. Ready & J. Johnston, Medicine Hat Garage. Work done by day labor. One storey, 40 x 50, frame, cement foundation, concrete floors. Excavating started.

Business block, cost $20,000, N. Railway, for Wm. Lowe, Cecil Hotel. Architects and general contractors, Deitrich & Umbrecht, Cecil Hotel. Two storeys, 50 x 50, artificial stone and brick construction. Foundations in.

Montreal, Que.

Store and residence, cost $56,000, Hampton, Notre Dame De Grace. Owner and builder, Felix Dansereau, 1211 Ontario St. E. Two storeys and basement, 22 x 64, cement foundation, brick construction. Work in various stages of progress on different houses. Foundations in.

Offices, cost $80,000, Maisonneuve (Notre Dame and First Ave), for Canadian Vickers, Ltd., 20 Bleury St. Architects, T. Pringle & Sons, Coristine Bldg. General contractor, E. G. M. Cape, New Birks Bldg. Three storeys and basement, 50 x 120, concrete foundation, Montreal stone, fireproof and brick construction.

Department store, cost $35,000, Beaubien. Architects and general contractors, Cycloops Constr. Co., In Trust, 96 Notre Dame W. Four storeys, 40 x 114, stone foundation, steel and solid brick construction, galvanized iron, store fronts and fixtures. Foundations in.

Office building, St. Urbain, for M. I. H. & P. Co., Power Bldg., Craig St. General contractors, masons and carpenters, P. Lyall & Sons Construction Co., Ltd., Transportation Bldg. Iron, Arch. Iron Works, 157 Prince St. Plastering, R. D. Clark & Sons, 26 Lincoln Ave. Painting and glazing, C. A. Sharpe, 234 Craig E. Heating and plumbing, The Garth Co., 28 Craig W. Electric. Power Co. Ka, leimined work, Douglas Bros., 19 St. Maurice. Six storeys, 95 x 91.

Repairs to restaurant, cost $20,000, Clarke and St. Catherine Sts., for North Eastern Lunch Co., 21 St. Catherine W. General contractor and carpenter, D. F. Sheehy, 16 St. Cecile. Mason, Thos. Wand, 326 Laval Ave. Plastering, J. C. Horton, 122 Chatham. Painting, H. Daniels, 139 Fulford. Store fronts and fixtures.

Wholesale grocery warehouse, cost $45,000, 1170 St. Lawrence Blvd., for P Adelstein, 1173 St. Lawrence Blvd. General contractors, masons and carpenters, Gilbert Demers & Sairazin, 861 St. Lawrence Blvd. Roofing, heating, plumbing and electric, Reck Ouimet, 93 Vitre W. Plastering and painting not let. Four storeys, 33 x 70, Excavating done.

Office building, cost $600,000, St. Catherine and Peel, for Island Land Co., 80 St. Francois Xavier. Architect, H. C. Stone, 84 St. Francois Xavier. General contractors, Norcross Bros., New Birks Bldg. Plastering, D. J. Burcan, New York. Painting not let. Ten storeys, 125 x 125. Foundations in.

Office building, Hospital and St. John, for Robt. Reford Co., 25 St. Sacrement. Architects, Ross & MacDonald, 1 Belmont. General contractors, P. Lyall & Sons Construction Co., Ltd., Transportation Bldg. Heating and plumbing, McKnight & Blackadder, 91 Inspector. Foundations in.

Stove foundry, etc., cost $60,000, St. Laurent, for Canada Stove & Furniture Co., Ltd., St. Catherine and Delorimier St., Montreal. Architect, W. A. Mahoney, Guelph, Ont. General contractors, The James Shearer Co., Ltd., 225 St. Patrick. Roofing, Hickey & Aubut, 93 Dominion. Painting, Alex. Craig, 41 Jurors.

Ottawa, Ont.

Addition to store and stables, cost $10,000, Lewis, for Matthews Laing Co., Ltd., Hull and Ottawa. Architect, W. E. Noffke, Central Chambers, Elgin St. Masons, Holbrook & Sutherland, 480 MacLaren. Carpenters, Smith Bros., 448 McLeod. Plumbing and heating, Currie

& Livock, 104 Bank St. Iron work, McFarlane & Douglas, 250 Slater.

Preston, Ont.
Bank building for Merchants Bank of Canada, H. O., Montreal. Architects, Hogle & Davis, 80 St. Francois Xavier St., Montreal. General contractors, P. H. Secord & Sons, Brantford.

Quebec, Que.
Store and warehouse, cost $15,000, for Hubert Moisan, 297 St. Joseph. Architect, general contractor, mason and carpenter, Ed. Gingras, 297 St. Joseph. Iron and steel, Eastern Canada Steel & Iron Co., St. Malo. Roofing, Nap Barbeau, 36 Bridge St. Painting, Gauthier & Frere, 292 St. Joseph. Heating not yet awarded. Three storeys, 30 x 48, stone foundation, reinforced concrete and Scotch brick construction.

St. John, N.B.
Remodelling Bank of Montreal, cor. King and Prince Wiliam. Manager, Mr. Bancroft. Architects, Peden & McLaren, 20 St. Alexis St., Montreal. General contractors, Anglins, Ltd., Montreal. Inside of building to be entirely remodelled with modern bank fixtures. Work to start at once.

St. Johns, Que.
Factory for The Canadian Clarendon Marble Co., Ltd., McGill Bldg., Montreal. General contractor, Pierre Trahan, St. Jean St. Machinery required.

Simcoe, Ont.
Store, cost $6,000, for R. W. Wallace. General contractor, R. E. Gunton. Excavating started.

Toronton, Ont.
One pair stores and residences, cost $8,000, Danforth. General contractor and owner, J. W. Yonge, 21 Danforth Ave. Owner will sublet. Three storeys, 42 x 80, steel and brick construction, brick foundation.

Vancouver, B.C.
Departmental store, for Hudson's Bay Co. Architects, Burke, Horwood & White, 28 Toronto St., Toronto. Engineer, P. R. Moses, New York. General contractors, Bar & Anderson, 1060 Homer street. Excavating started.

Walkerton, Ont.
Sash and door factory, cost $7,000. Architects and builders, R. Truax & Son. Dry kiln about completed. Main building to be started in September. One storey, 105 x 90, brick, cement foundation.

Winnipeg, Man.
Warehouse, Pacific Ave., for A. MacDonald, Vaughan St. Architect, H. A. Irish, Kennedy Bldg. General contractors, Fred Lewis Co., Somerset Bldg. Refrigeration plant will be installed.

Residences

Ford City, Ont.
Residence, cost $6,000, Sandwich St. E., for Theo. Pratt, Walkerville. Cement and brick foundation, pressed brick construction. Plans in progress.

London, Ont.
Apartment house, cost $15,000, Dundas, for J. F. Tennant, 425 Quebec St. Tenders received by Architects, Wyatt & Blackwell, Bank of Toronto Bldg. Concrete and stone foundation, red pressed brick construction.

Residence, cost $32,000, Regent St., for N. McVicar, 984 Richmond St. 2½-stys., 26 x 31, red brick construction, cement foundation. Plans drawn.

Montreal, Que.
Apartment house, cost $250,000, for an American Syndicate. Architect, C. A. Mitchell, 58 Beaver Hall Hill. Concrete foundation, stone and brick construction. Plans in progress.

Apartment house, cost $100,000, Westmount, for O. Lamoureux, 15 St. James St., Montreal. Architect, R. Charbonneau, 15 St. James. Three storeys. Sketches in progress.

Ottawa, Ont.
Residence, cost $8,000, Clemow, for M. M. O'Connell, 212 Gloucester street. Architect, A. L. Weeks, Sparks St. 2½-storeys, 29 x 40, brick veneer construction, stone foundation. Plans drawn.

Residence, cost $10,000, Powell, for John Preston, Stewart St. Architect, A. L. Weeks, Sparks St. 2½storeys, 32 x 40, brick construction, stone and concrete foundation. Plans drawn.

Toronto, Ont.
Apartments, Beverley and D'Arcy, for J. Kennedy, 139 Beverley St. Architect, N. G. Begg, Cosgrave Bldg. Tenders received by owner for masonry and carpentry work at once. Not ready yet for tenders on heating, wiring and plumbing. 2½-storeys, Milton brick construction, stone foundation, shingle.

Residence, cost $8,000, Cedarvale, planned for A. G. Piper, c/o Architect, J. M. Lyle, 14 Leader Lane, who will receive tenders about August 22. Brick foundation, stone and brick construction.

Walkerville, Ont.
Six 7 family flates, cost $5,000 each, Devonshire Road. Owners, Walkerville Land & Building Co. Tenders received by Architects, Smith & Walker, Excise Bldg., until September 1st. Two storeys, 45 x 24, brick foundation, frame and pressed brick construction.

CONTRACTS AWARDED

Calgary, Alta.
Residence, cost $6,000, Elbow Park. Owner and general contractor, W. S. McDonald, Box 1157. Two storeys, 24 x 38. Foundations in.

Fort William, Ont.
Residence, cost $5,500, Marks St., for R. Sproule. Architects, Hood & Scott. General contractor, R. E. Wright, Victoria Ave. 2½-storeys, 32 x 40.

Hamilton, Ont.
Residence, cost $7,000, Aberdeen Ave., for C. H. Bampfylde, Bay St. S. General contractor, P. Paterson, 174 Stinson street. Stone foundation, pressed brick construction.

Montreal, Que.
Residence, cost $25,000, Pine Ave., for J. A. Trudeau, 22 Notre Dame E. Architect, W. A. Gagnon, 1002 New Birks Bldg. General contractors and masons, Jno. Quinlan & Co., 4414 St. Catherine W. Carpenter, Alp. Bonin, 194 Ada Other contracts not yet awarded. Foundations in.

Semi-detached residence, cost $15,000, Westmount, for H. E. Plant, 112 St. Matthew street. Architect, general contractor and mason, Jno. Quinlan, 4414 St. Catherine W. Carpenter, D. M. Long, rear 39 Windsor St. Heating and plumbing, W. J. Graham, 85 Cathcart Street.

Flats, cost $12,000, Verdun (1st Ave. between Verdun and Wellington), for Mr. Lalonde, 1st Ave., or c/o Builders. Builders, Lalonde & D. Lanthier, 1332 Wellington. Three storeys, 75 x 55, cement foundation, brick construction.

Residence, cost $12,000, Cedar Ave., for C. B. Robin, 16 The Marlborough. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Carpenter, A. K. Hutchison, 4404 St. Catherine W. Remainder of contracts not yet awarded.

Addition and alterations to residence, cost $7,000, 28 Ontario Ave., for Percy Cowans, 95 Notre Dame W. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. Mason and brick, Reid, McGregor & Reid, 14 Guy Block. Excavating started.

Four flats, cost $8,000, Girouard. Owner and builder, Holmes Labelle, 330 Seigneurs. Two storeys, 78 x 45, cement foundation, brick construction. Excavating done.

Residence, cost $50,000, Westmount (Roslyn Ave.), for Geo. Rabinovitch, 107 St. James St. Landscape architect, F. G. Todd, New Birks Bldg. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Carpenters, Favreau & Corbeau, 12 Erie. Roofing, Douglas Bros., 19 St. Maurice. Plastering, McNulty Bros., 182 Mountain. Painting, Castle & Son, 568 St. Catherine W. Electric, Henry Morgan, 1 Beaver Hall Hill. Marble and tile, Sanitary Tiling Co., 136 Bleury St. 2½-storeys and basement, 23 x 55.

Residence, cost $25,000, Westmount (Aberdeen), for R. C. Patton, 421 Mackty. Architects, Cox & Ames, 78 Crescent. General contractor, D. M. Long, rear 39 Windsor. Mason and carpenter, General contractor. Heating and plumbing, J. A. Gordon, 301 St. Antoine. Roofing, plastering, painting and electric work let this week.

Flats, cost $12,000, Verdun (1st Ave). Architect and builder, E. Lalande, St. Benoit, Que. Four 3-storey, 73 x 51, brick construction, concrete foundation.

Addition to residence, cost $16,000, Cote des Neiges, for Carl Riordan, "Amherst House," 374 Cote des Neiges Rd. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, E. B. Evans, 75 St. Denis street. Addition 2½-storeys, 23 x 14, stone foundation, brick construction.

Three residences, cost $22,000, Outremont (Bloomfield), for A. Cerbin, 1149 Van Horne Ave. Architects, Viau & Venne, 76 St. Gabriel St. General contractor, carpenter and plastering, Owner. Roofing, heating and plumbing, Jos. St. Amand, 109 Laurier Ave. W. Electric lighting will be let shortly. Three stys., 20 x 77.

Montreal West, Que.
Residence, cost $11,200, Caston, for J. R. Colby. Architects, Peden & McLaren, 20 St. Alexis. General contractor, J. J. Kirkpatrick, Montreal W. 2½-

(Continued on page 92)

Tenders and For Sale Department

THE PAS, MANITOBA

Notice to Contractors

Sealed tenders, registered and endorsed on the envelope, "Tender for (tender bidding on)" and addressed to H. H. Elliott, M.D., Sec.-Treas. of the Town of The Pas, Man., will be received up to 6 p.m. **August 27th, 1913**, for the construction of the following works:

Tender A—Construction of Sedimentation Basin.

Tender B—Foundations for Power House.

Gravel 75c f.o.b. The Pas, Man.

Marked cheque for five per cent. (5 p.c.) of the amount of the bid must accompany each tender, or in lieu of the said cheque, the tenderer may furnish the bond of an approved surety company.

Plans, specifications and instructions may be seen at the offices of the Consulting Engineers, Saskatoon, or at the Resident Engineer's office at The Pas, Man., or plans and specifications will be given or forwarded on a deposit of Twenty ($20) Dollars—the deposit cheque to be returned if the plans and specifications are returned with the tender.

H. H. ELLIOTT, M.D., Sec.-Treas.,
The Pas, Man.

MURPHY & UNDERWOOD,
Consulting Engineers,
Ross Bldg., Saskatoon, Sask.

34

Sealed tenders addressed to the undersigned and endorsed "Tender for Jetty and Dredging at the North Arm of the Fraser River, B.C.., will be received at this office until 4.00 p.m., on **Tuesday, September 30, 1913**, for the construction of Jetty and Dredging at the North Arm of the Fraser River, B.C.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; W. Z. Earle, Esq., District Engineer, Winnipeg, Man.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C.; J. L. Michaud, Esq., District Engineer, Post Office Building, Montreal, P.Q.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 18, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.- 45074. 34-35

Main Drainage Works

Sealed tenders addressed to the Chairman of the Board of Control, City Hall, Toronto, will be received by registered post only, up to noon of **Tuesday, August 26th, 1913**, for the supply and erection of three motor-driven Centrifugal Sewage Pumps, automatically controlled.

Plans, specifications, forms of tender and other information may be obtained at the office of the Commissioner of Works, City Hall, Toronto.

H. C. HOCKEN, Mayor.
Chairman of Board of Control.

City Hall,
August 9th, 1913. ·34

Department of Railways and Canals, Canada

SOULANGES CANAL

Rebuilding Head of Guard Pier at Cascades Point, Que.

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for rebuilding head of Guard Pier, Lower Entrance, Soulanges Canal," will be received at this office, until noon, on **Friday, August 29th, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, Birks Building, Phillips Square, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labor, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached tht actual signature, the nature of the occupation and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada for the sum of $5,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into a contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 9th August, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—46228. 33-34

Tenders for Concrete Bridge

Tenders marked "Tender for Bridge," addressed to the County Clerk, Lindsay, Ont., will be received until **Saturday, August 30, 1913**, for the erection and completion of a reinforced Concrete Bridge and relative work across the Narrows of Mud Lake in the Township of Carden in the County of Victoria, according to plans and specifications prepared by Mr. George Smith, County Engineer, all to be finished not later than November 1st next.

The steel for reinforcement will be purchased and supplied by the Municipalities interested and at their expense, tenders will not, therefore, include a price for that material.

Plans and specifications may be seen at the office of the County Clerk, Court House, Lindsay, or copies supplied on application, on and after Wednesday, August 20th, 1913.

The lowest or any tender not necessarily accepted.

A. E. BOTTUM,
Chairman of Committee.
Lindsay, Aug. 16th, 1913. 34-35

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913**, by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
32-37 Cayuga, Ont.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—420 Pender Street.

TOWN OF WALKERVILLE

Tenders for Sewers

Sealed tenders will be received by registered post, addressed to the undersigned up to **Tuesday, the second day of September, 1913, at noon,** for the construction of sewers on the following streets and alleys in the Town of Walkerville.

1. Sewer on Lincoln Road, North of Lots 377 and 454, Southerly to Lots 412-417.
2. Sewer on Ontario St., from Kildare to Argyle Road.
3. Sewer in Alley West of Argyle, between Ontario Street and Devonshire Court.
4. Sewer in Alley East of Kildare Road, between Ontario and Devonshire Court.
5. Sewer on Kildare Road, South of Ontario, from Lot 134 to 149.
6. Sewer in Alley between Devonshire Court and Ottawa Street, from Kildare East to Argyle.
7. Sewer from West Side Kildare Road, Easterly in Alley, from Iroquois Street to Argyle Road.
8. Sewer in Alley, South of Iroquois St., from Windemere Road to Kildare and thence to Argyle.
9. Sewer on Kildare Road, South of Huron, from present terminus to Ontario Street.
10. Sewer in Alley, East Side Kildare Road, between Huron and Ontario Streets.

Plans and specifications may be seen on application to Owen McKay, C.E., Walkerville.

Tenders must be accompanied by a marked cheque, payable to the Town Treasurer, equal to 2½ per cent. of the amount thereof.

Should any party whose tender is accepted, fail to execute the necessary contract and bond for the due fulfilment of the same, his deposit will be forfeited to the Town.

Deposits of unsuccessful tenderers will be returned.

The lowest tender not necessarily accepted.

The names of two responsible persons, willing to act as sureties must accompany each tender.

CECIL H. ROBINSON,
Town Clerk.

Walkerville, Ont.
August 14th, 1913. 34

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, August 29th, 1913,

for the several trades required in the erection of a

New School Building on Humewood Avenue,

and for

Heating and Ventilating, Plumbing and Electrical Work, Deer Park School

and for

Moving a Pair of Houses on Leslie Street,

also for

Sale of Old Houses on St. Clarens and Grange Avenues

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank check for five per cent. of the amount of tender, or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART, Chairman of Committee.
W. C. WILKINSON, Secretary-Treasurer. 34

CITY OF LONDON

Tenders for Steelwork

Sealed Proposals addressed to the "Chairman and Members No. 2 Committee" will be received at the office of the City Clerk up to 5 p.m. on **Thursday, the 11th day of September, 1913,** for the supply and erection of three 130 feet spans rivetted truss steel highway bridge over the River Thames, the substructure for which is already under construction.

Plans, specifications and all particulars can be had at the office of the City Engineer.

No tenders will be considered unless accompanied by a deposit cheque for 5 per cent. amount of the bid.

The lowest or any tender not necessarily accepted.

B. W. BENNETT, Chairman No. 2 Committee.
WM. N. ASHPLANT, City Engineer. 34-35

TOWNSHIP OF BRANTFORD

Cement Sidewalks

Sealed tenders will be received up to **Saturday, the 30th inst.** at the office of the Township Clerk, County Buildings, Brantford, for the construction of 7810 linear feet of four-foot cement sidewalk.

Tenderers are expected to look over the site of the work before putting in their bids. Plans and specifications may be seen at the office of the undersigned.

Tenders must be accompanied by marked cheque for $300, payable to the Township Treasurer.

Lowest or any tender not necessarily accepted.

ALAN MAIR JACKSON,
Township Engineer,
34 Temple Bldg., Brantford, Ont.

For Sale

One Koehring Concrete Paving Mixer, capacity 14 cu. ft.

One Austin Cube Concrete Paving Mixer, capacity 9 cu. ft.

One 20 h.p. Case Traction Engine.

All of above used only a few months and in perfect condition.

Apply Box 831, Contract Record, Toronto, Ont.
29-t.f.

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, A1	$700
Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new	$2,500
Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1	$3,500
Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1	$2,800

TRACTION ENGINE

Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?

TRY US!

WILLIS SHAW MACHINERY CO.
La Salle Street, Chicago. Ill.

Situations Wanted

Sand, lime and brick engineer, expert in all silicate products with 18 years experience in Germany, England and the U. S. A., with all machinery and systems, wants to get acquainted with interested parties. Fritz Klaeck, Alexandria, Ont. 33-34

Residences

(Continued from page 89)

storeys and basement, cement foundation, brick construction.

Toronto, Ont.

One pair detached residences, cost $10,000, Howard Park, for W. V. Dixon, 259½ Yonge St. Tenders in carpentry being done by day labor. Brick construction, concrete foundation, shingle. Excavating started.

North Toronto, Ont.

Residence, cost $30,000, Snowdon, for H. Acton, Fleming, c/o Architects, Allan, George & Moorehouse, 67 Victoria St. Mason, Thomas Bros., Dupont St. Roofing, W. Davies & Co., 172 McPherson Ave. Plastering, Hanna & Nelson, 273 Rusholme Road. Painting, Cantwell & Wood, 759 Yonge St. Heating and plumbing, Read-Frankland, Ltd., 553 Bloor W. Electric, E. G. W. Salisbury,

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Second Hand Model 41 Marion Steam Shovel

FOR SALE

At A Very Reasonable Figure

We have to offer for immediate delivery, subject to inspection and prior sale a Model 41 Marion Latest Type Steam Shovel, equipped with 1½ cubic yard dipper; on railroad trucks, complete.

This shovel is not one year old and has been operated very little Shovel is in fine condition and is offered at a very low figure.

Full details, prints and specifications sent on request.

Apply Box 862 Contract Record, Toronto, Ont.
34-35

18 Fenwick Ave. Metal casement, Crittal Casement Co., 67 Victoria. Steel and hollow tile construction, stone foundation.

Regina, Sask.
Residence, cost $7,000, Montreal. Owner and general contractor, D. A. Morrison, 2130 Broad St. Brick construction and foundation, slate roofing.

Residence, cost $10,000, Leopold Crescent. Owner and general contractor, J. W. G. Mills, 2331 Quebec St. 2½-stys., brick construction and foundation.

Stanbridge, East Que.
Residence, cost $25,000, for C. S. Campbell, Merchants Bank. Builders, Laurentian Constr. Co., 103 St. Francois Xavier. Four storeys, cement foundation, reinforced concrete construction. Excavating started.

Power Plants, Electricity and Telephones

Brantford, Ont.
Electric sub-station, cost $5,426, for Hydro-electric Department. Architect, J. G. Ireland, 8 Commercial Chambers. General contractors, Bennett & Bowden. Two storeys, 28 x 39, brick construction, 3 transformers and switching apparatus are to be installed. These will be handled by the Ont. Hydro-electric Commission, Continental Life Bldg., Toronto.

Brockville, Ont.
Street lighting planned by Town Council. Clerk, George Dewey. Engineer-in-charge, Manager Philip. New cluster lamps on iron standards on both sides of King street.

Coquitlam, B.C.
Telephone exchange planned for B. C. Telephone Co., H. O., Vancouver. Building Supt., Mr. Johnston. Work may be done by day labor or general contract.

Hamilton, Ont.
Conduit system planned by Hydro-electric Dept. Clerk, S. H. Kent. Tenders received by Mayor, Jno. Allan, until August 28th, for conduit system for Hydro-electric; Plans, specifications, at office of Engineer, E. J. Sifton.

Melville, Sask.
Town Council contemplates doubling electrical power plant at a cost of $20,000.

Montreal, Que.
Electric lighting installation, Bonsecours Market, planned by Board of Commissioners. Sec., L. N. Senecal. Specifications, etc., at office of Supt. of Lighting Dept., City Hall. Tenders received by Secretary until noon August 21st.

Neepawa, Man.
Electrical apparatus planned by Town Council. Plans and specifications at office of Con. Engineer, W. E. Skinner, 204 Sterling Bank Bldg. Tenders will be called shortly for 2 150 h.p. boilers and a generater unit, consisting of 125 k.w. direct connected to a suitable engine.

Ottawa, Ont.
Underground services planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Chief electrician, Jas. Johnson. Plans, specifications, at office of Chief Electrician, Dept. of Public Works. Tenders received by Secretary until August 22nd.

St. Catharines, Ont.
Power station, cost $6,500, 212 Welland Ave., for Niagara, St. Catharines & Toronto Rly Co. General manager, K. F. Seixas, 133 Ontario St. General contractor, Newman Bros., 75 St. Paul St., St. Catharines. One storey, stone foundation, brick construction, composition roofing.

Swastika, Ont.
C. A. Foster, Haileybury, is interested in a company which contemplates installing 7-mile telephone line, from Swastika to Foster property, taking in all mines on route. Central station will be installed at Kirkland Lake. Architect, A. Throop, Haileybury.

Miscellaneous

Hensall, Ont.
The Council will at once take up the matter of securing either new fire apparatus or new waterworks fire system. Reeve, Geo. Joynt.

Rosthern, Sask.
By-law will be voted on August 23rd to provide fire engine and equipment. Mayor, Geo. Hodson. Sec.-treas., Geo. Braden.

Business Notes

Athabasca Landing, Alta.
Business block, hotels, etc., burned. Owners, Canadian Bank of Commerce. Loss, $2,500. Athabasca Forwarding Co., warehouse, $50,000; W. H. Gashill, store, $2,500; Athabasca Hotel Co., $20,000; Braults & Veins, warehouse, $10,000; A. McLeod, store, $10,000; Duech's Hardware Co., store, $12,000; H. F. Hackett, store, $5,000; Ike Gagnon, business block, $30,000; livery barn, $6,000; Grand Union Hotel Co., hotel, $50,000; H. F. Cull, drug store, $7,000; N. Grancraux, pool room, $10,000; E. Oliver, livery barn, $40,000; Revillon's warehouse, $6,000; Athabasca Trading Co., store, $16,000; Mr. Dubord, store, $5,000.

Hamilton, Ont.
Foundry of The Canada Steel Co., Sherman Ave. N., burned. Main building totally destroyed. Loss $25,000. Completely covered by insurance. New building will be erected at once.

The Smart Turner Machine Co., Ltd., 191 Barton St. E., Hamilton, are supplying The Canadian Porcelain Co., Hamilton, with one automatic feed pump and receivers; E. D. Smith & Sons, Winona, Ont., one duplex pump; Corporation of St. Catharines, one duplex pump; National Steel Cor Co., one duplex pump; The Donnaconna Paper Co., Donnaconna, Que., one duplex pump; The Canadian Steel Foundries, Welland, Ont., one centrifugal pump; The Garden City Paper Co., St. Catharines, Ont., one centrifugal pump.

Humboldt, Sask.
Store, Main, owned by W. R. Stevenson, burned. Loss, $50,000. Three storeys. Halings Bakery, loss, $7,500, and office building of Stocket & Elliot, Main street. Loss, $20,000. Three stys.

L'Epiphanie, Que.
Sash and door factory burned. Owned by Ferland Bros. Loss, $25,000, small insurance, residence of Jos. Gauthier and Jos. Lamarch, and grocery store of Edmond Bourque also destroyed. To be rebuilt.

Montebello, Ont.
Convent and residences burned. Owners, Grey Nuns. Loss, $15,000; A. Sauriol, residence, $6,000; Adolphe Richer, restaurant, $3,000; N. Chenier, 4 residences, $6,000; Dr. H. Barolet, residence, $6,000. Owners will rebuild.

Montreal, Que.
Factory and offices burned. Owned by Jas. Cleland, die manufacturers, 16 St. George; Continental Upholstering Co., 22 St. George; F. A. McKay, iron wroks, 18 St. George; residence, 4911 Western ave.; V. C. Fuller, 14 St. George. Loss, $35,000.

Offices, 317-321 Craig, owned by Can. Metropolis Realty Co., Ltd. (L. G. Bowker, 120 St. James St.), burned. Loss, $10,000. Will rebuild.

Ottawa, Ont.
Poultry and sheep buildings, owned by Exhibition Association, burned. President, T. C. Bate. Loss, $25,000. Will rebuild.

Rexton, N.B.
Hotel, owned by Gustave Sawyer. Completely destroyed by fire. Loss covered by insurance.

Sherbrooke, Que.
The Victoria Butter Factory burned. Proprietor, F. Roby. Will rebuild and require entire equipment.

Wardner, B.C.
Crows Nest Lumber Co.'s plant was completely destroyed by fire. Loss, $40,000.

Weyburn, Sask.
Store, owned by Ideal Grocery Co., 3rd Street, burned. Loss, $7,000. 2½-stys.

New Companies

Berlin Industrial Centre, Limited, has been incorporated with a capital of $40,000 to carry on business as a general land and building company, with head office at Berlin. The provisional directors are Alex Millar, H. J. Sims and W. H. Gregory, barristers, all of Berlin.

The Sebley Telephone Company, Limited, has been incorporated with a capital of $5,000 to carry on the general business of a telephone company, with head office at Newburgh. The provisional directors are C. W. Demille, Minister, T. I. Winter and H. M. Ryan, merchants, all of Newburgh.

Turbine Equipment Company, Limited, has been incorporated with a capital of $40,000 to carry on business as civil, mechanical and electrical engineers, contractors, etc., with head office at Toronto. The provisional directors are J. L. Ross, barrister, D. J. MacLean, manager, and C. J. F. Collier, law student, all of Toronto.

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

DEANE POWER PUMPS

ADMIRABLY ADAPTED FOR

HOUSE SUPPLY

BOILER FEEDING

TANK SERVICE

THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Jennings & Ross
Limited

Engineers and Contractors
Toronto

Royal Bank Bldg. - King and Spadina
Phone Adelaide 292

Showing 35 ft. excavation on the Kingston Road Sewer—Edgewood Avenue to Woodbine Avenue.

BOILER AND STEEL PLATE WORK

Of All Kinds

We are manufacturers of:—Boilers, Steel Tanks, Smoke Stacks, Ore Buckets, Ore Cars, Steel Flumes, Etc. Any size or style.

Hoisting Machinery a Specialty

Let us quote on your requirements. *All Work Guaranteed.*

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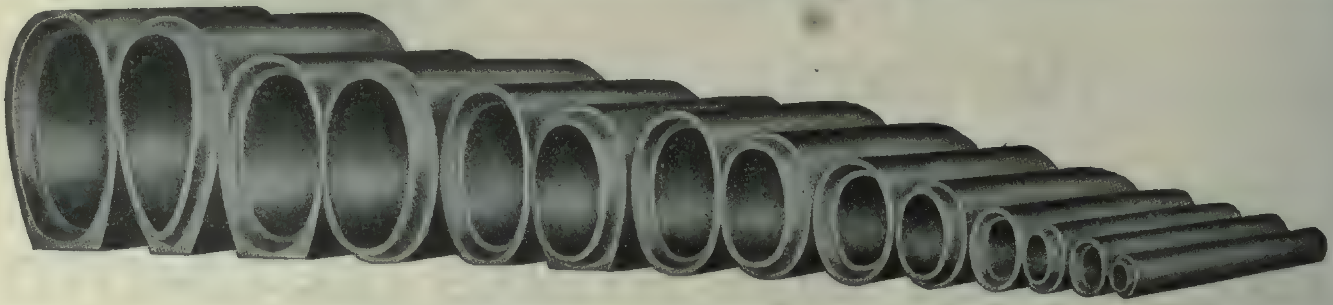

Sewers and Culverts

properly built of properly made

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LAST FOREVER.

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Dominion Concrete Company Ltd.

Kemptville, Ontario

EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	30 00	
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	26 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $9.00 per 100 lbs.

Boiled Linseed Oil in bbls., 6 c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 6 c per gallon.

Turpentine, in barrels, 56c per gallon.

Pure Red Lead, dry $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil. in 25-lb. tins, 4c.

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Cables, "Blizzard, London," A.B.C. Code, 5th Edition
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Glazed and Floor Tiles of Every Description
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All Colors with plain or dragged surface or with Matt Glaze.
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Barker & North, 26 Princess Street

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"Maple Leaf" Brand Stitched Cotton Duck Belting.

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.
It is built of plies of selected duck.

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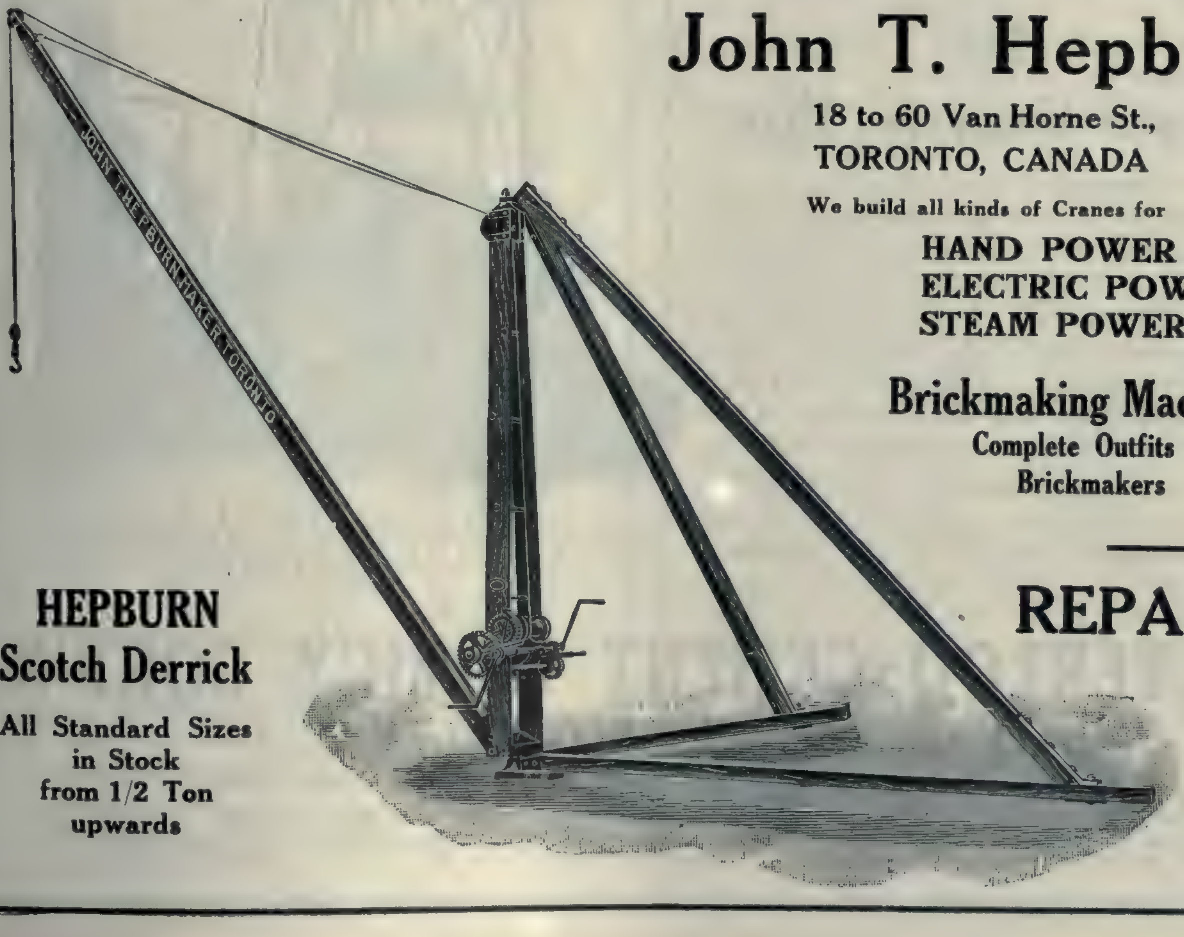

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All Standard Sizes
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from 1/2 Ton
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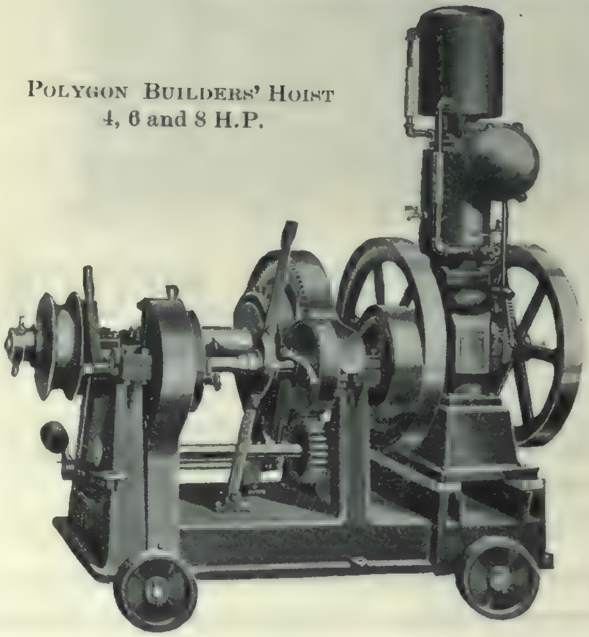
AND
BUILDERS' HOISTS



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4, 6 and 8 H.P.

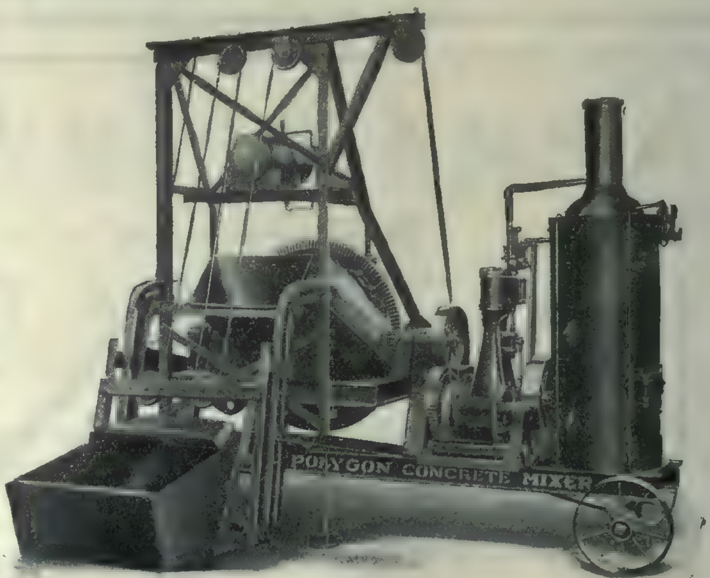
represent the highest efficiency yet attained in their respective lines. They have demonstrated their superiority through ten years of steadily growing appreciation and large sales all over the world.

THE POLYGON BUILDERS' HOIST
is a distinctly great advance over all machines of the kind yet designed. Large lifting capacity in ratio to power employed; rigidity, long bearings, covered gears, easy control and other exclusive features warrant examination by all who wish the most efficient hoist to be obtained at moderate price.

The
Polygon Concrete Mixer

has the reputation of being "The Fastest Perfect Mixer." The POLYGON (many sided) form of drum is its distinguishing feature. Once you grasp the POLYGON principle of mixing you will have no other. It mixes concrete, mortar, and other materials, fine or coarse, wet or dry, with equal facility. Size for size the POLYGON will turn out a greater quantity of perfectly mixed concrete than any other mixer.

In all points that make for profit on the job, the POLYGON is the logical choice of all who really investigate. Ask us for full particulars.



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Beware of Imitations

The very success of "Medusa" Waterproofing has led to the rise of a host of imitations and infringements. These so-called waterproof compounds are of such poor quality that it is necessary to use a proportion four times as large as "Medusa" Waterproofing and then these imitations only produce an **apparent** and **temporary** effect.

The effect of "Medusa" Waterproofing is everlasting and its permanent quality is due to its being absolutely insoluble and unaffected by water even after years of contact.

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Heavy Hard Burned Red
Shale Side Wire Cut

Stock Face **Inside Gray**
Red Stock **Clinker Brick**

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ESTABLISHED 1886

Contract Record
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Alphabetical Index of Advertisers
Page 16

Vol. 27 **August 27, 1913** **No. 35**

Marketing Cement on the Bonus System

THAT there is a great variety in the quality of the various Portland cements placed on the market has long been recognized. These differences arise from the basic properties of the materials from which cement is made or from differences in the methods involved in the manufacture. The differences may be local in time as well as local in place. The run of the mill for one day may not be quite up to the run of a previous or succeeding day, owing to some lack of care or oversight in mixing, burning or grinding.

Attempts have been made to meet this condition and to enable the purchaser to pay not only for the quantity of material bought but also for the quality of the goods he received. Up to the present time these efforts have not been crowned with any marked success.

The method of procedure has been to fix a price for all cements conforming under test to certain standard specifications, and then to pay a bonus as these minimum specifications are exceeded by the cement in question. According to one plan the price was increased as an excess of tensile strength after seven or twenty-eight days' setting was shown. Then it was discovered that certain qualities of cement set quickly, but at the end of a year they were inferior in strength to some of the products setting less rapidly. Again, fineness was taken as a basis upon which to pay an increased price. Then it was discovered that fineness alone was not an adequate measure of strength. Up to the present then very little has been accomplished to make recognizable these differences in quality, because of a lack of method in measuring the extent to which one cement surpasses another.

Just now there is a suggestion emanating from Mr. W. C. Reibling in the Philippine Journal of Science, by which he proposes to enable the purchaser of cement to pay on the basis of quality as well as quantity. As formerly, the purchase will be made from the lowest bidder who guarantees to meet the specifications required and a bonus will be paid as the cement delivered exhibits superior qualities in several ways.

Unless the cement is suitably packed and show reasonable uniformity and pass the required specifications, including soundness after the steaming test, there shall be no bonus whatever.

It is suggested that a bonus be awarded if the specific gravity is consistently above 3.10 or the loss by ignition not greater than 2 per cent., and also if the residue on the No. 200 sieve is less than 15 per cent., and that on the No. 100 sieve is less than 3 per cent.

A recognition of tensile strength is made by paying a bonus for the product which has a gravity of not less than 3.10 and a loss by ignition not greater than 2 per cent., of which, in twenty-eight days, a 1:3 standard Ottawa sand briquette shows consistently an average tensile strength above 400 pounds per square inch.

It is claimed that the above system should satisfy both the manufacturer and the contractor. It requires special care in mixing, burning, grinding and packing but the bonuses involved in this superior article would more than compensate for the added trouble and expense in preparation. The contractor would have at his command an article fulfilling his requirements and therefore more dependable for his work. The method suggested is superior to the former methods in that it recognizes a greater number of qualities in the cement but is defective in so far as the payment is based on tests. It is well known that tests may be performed on the same material by different persons with varying results, and moreover, tests have but a faint similitude to working conditions.

It is only as knowledge of the properties of cement increases and the relation of test results to working conditions become more fully known that payment on this basis will ever become possible.

Treatment for Decaying Stone

NATURAL stone as a building material has largely passed out of use in the Dominion of Canada, its use being restricted for purposes of ornamentation in more imposing structures or for the purpose of constructing large public buildings. While this may be true we have many buildings, heirlooms of the past, built entirely of stone or with stone foundations, in which the material used shows a tendency to decay and crumble away. Most people labor under the impression that stone possesses all the characteristics of the eternal ages and consequently pay but little attention to this part of the building and are somewhat surprised to find that the process of decay has set in.

Methods for the prevention of this condition have been evolved along two lines. They consist in the use of solutions, some of which are considered reconstructors and others merely as fillers and binders. The method of applying these solutions is the same in both cases. The first step consists in removing from the surface by means of a stiff brush, steel tools should not be used, all the decayed material. Then the loose joints are carefully raked out. If the surface of the stone has become coated with bituminous matter which cannot be easily removed, a jet of steam will probably prove effective. Having carefully prepared the surface of the wall the open cracks are filled with hydraulic lime mortar and where the cracks are large, hard well burnt tile is inserted to prevent too large masses of mortar occurring in one place.

The solution to be applied depends upon the nature of the stone to be treated. If there is a large percentage of lime the wall should be repeatedly washed, as many as fifty times if necessary, with a solution of hydrate of barium. This solution is made by dissolving one pound of crystals in a gallon of soft water and has been known to penetrate the stone to a depth of three-eighths of an inch within a month. Two other solutions acting as binder and filler rather than as a reconstructor are sodium silicate (water glass) and sodium arsenate. A coating of lime wash from fresh lime and hot water applied two and three times with any required coloring, forms an excellent general preservative.

Building Inspection

THE leading cities on the continent are doing their utmost to provide building codes which will provide safety in construction and sanitary conditions. In most cases their efforts are successful and smaller municipalities are following the lead and applying the codes so far as their less densely crowded condition requires.

A building code may break down at three points. The requirements may be so excessive as to throw the building of business blocks and other large structures into the hands of wealthy corporations, and thus tend to limit the amount of building and increase rents and generally interfere with the business accommodation of the city. Again, building inspection may be of such a nature as to render almost futile any regulations adopted in a building code, or a municipal council may override the regulations which have been put into operation.

Assuming that a sane code has been adopted, its efficacy then rests upon the inspection and upon the action of the municipal authorities. Upon the building inspector rests the responsibility of carrying into successful operation any building regulations which may have been adopted in the city. Hence he should possess two characteristics prominently. He should know thoroughly the code and know with equal thoroughness the art of building and the material employed. He should be characterized by absolute integrity, and should remember constantly that he stands to safeguard the interests of humanity, to guard them against loss and catastrophy and by a careful enforcement of the sanitary regulations to aid in maintaining the health of the community. An investigation into the methods of inspection employed in one of the largest of the American cities showed, that owing to the dishonesty of the inspectors the building code had become practically futile and that the safety and health of the community had been greatly endangered. The work of inspection calls for the very highest type of intelligence and integrity.

Democratic institutions, while possessing many excellencies and coming as near as may be to the best form of government, nevertheless possess serious defects. One of these defects is the tendency of those seeking office to prostitute their position in order to gain public favor and not infrequently, in order to gain the support of some more or less powerful voter, councillors have exerted their influence to procure the setting aside of building regulations in return for the support of the individual for whom the regulations were abrogated.

While it is admitted that a certain amount of discretionary power with regard to the building code should remain in the hands of the municipal council, it is well that this power be rarely exercised and that the council lend its constant support to the inspector charged with enforcing the regulations.

In the investigations previously referred to the municipal council in one year made 350 exceptions to the building regulations, a condition which practically rendered the building regulations a farce.

Editorial Comment

IN this issue of the Contract Record we publish the general conditions for competitive designs for the new Departmental and Courts Buildings at Ottawa, together with a plan of the site which is to be cleared of its present buildings and a plan of the proposed arrangement of the new buildings. The matter is of importance to all interested in architecture and the building trades and will repay a careful perusal.

* * *

GYPSUM plaster possesses many characteristics which make it valuable as fireproofing material. It has a low heat conductivity. The heat penetrates it at such a slow rate that in fires of ordinary duration the metal would hardly get warm. It has no appreciable expansion under the action of heat and as a consequence no contraction and destructive cracking when water is applied in a fire. It does not burn or support cumbustion. It is light and has the required strength for use in partitions and column coverings against fire streams. It may be adapted to any form of construction and even when used in slabs may be cut or sawed to fit any desired location. It has the further qualification of being cheap.

* * *

A RATHER striking piece of reconstruction work has been accomplished in Tuscarawas County, Ohio. During the recent floods many bridges were destroyed in this county. One stone pier, however, was found to be intact but badly settled on one side. The foundations had been laid in the river bed in 16 feet of water. A diver was employed, who upon examination discovered that the pier was resting uniformly upon a bed of gravel. Instead of removing the entire pier, as is usual, the upper part only was removed to a plane 24 inches below the surface. Piles were then driven in around the remaining part and on these piles a new foundation over and around the old one was constructed and upon this the material of the old pier was reset. Neither cofferdam nor excavation was necessary as a tight foundation form properly braced contained the concrete which was deposited under the water. The method proved both effective and cheap.

Building Tor Hill Reservoir, Regina

Position and Capacity—Excavations and Embankments—Details of Structure — Method of Operation — General Information

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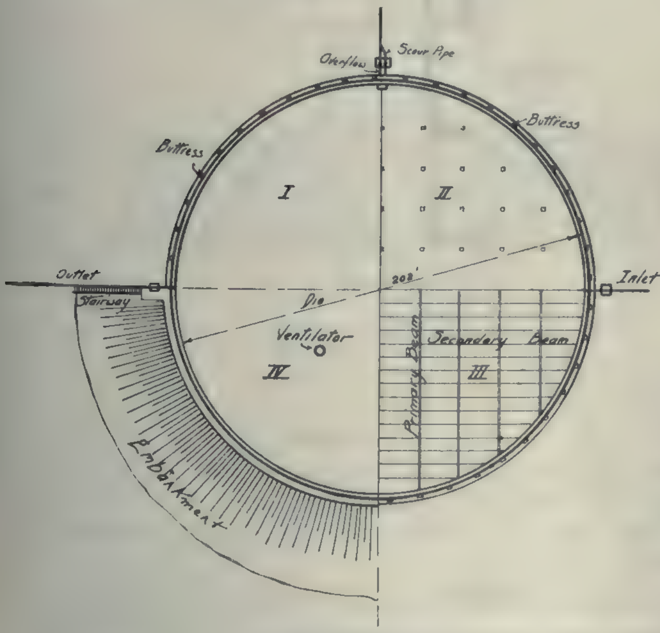
THE City Council of Regina on the recommendation of Mr. A. J. McPherson, then City Commissioner, now Chairman of the Provincial Board of Highway Commissioners, decided to adopt a scheme which the writer had submitted, whereby an ultimate daily supply of ten million gallons of water can be made available, at an expenditure of about $2,000,000.

The scheme included two five million gallon reservoirs. The construction of the first of these was commenced last summer, but owing to the unforeseen delays in the supply of certain materials, it was found impossible to complete the work before the winter had set in. Immediately it was safe to proceed in the spring the structure was finished as quickly as possible. The reservoir has been in use some three months and no signs of defects have been observed and the depth of water has been maintained at about 23 feet for nearly a month.

Tor Hill reservoir is 202 feet in diameter, holds 25 feet depth of water, and its capacity is five million imperial gallons. This reservoir is circular in plan, built of reinforced concrete, and is located on a hillside close to Boggy Creek waterworks, at an elevation of about 105 feet above the city; the top water line is about 120 feet above Regina level. It is so situated that it will answer in connection with future extensions of the water collecting works into five other watersheds.

Excavations and Embankment

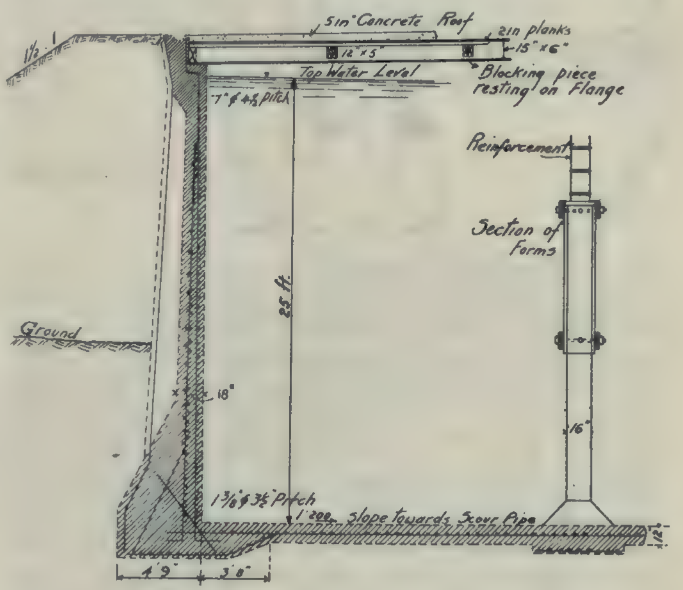
The following is a description of the work as carried out: The excavations averaged 9½ feet deep, the material removed was of a heterogeneous character common to glacial formation, ranging from fine sand to heavy clay. This was excavated by horse drawn wheel scrapers and the material deposited at convenient points, to be afterwards utilized in forming an embankment round the reservoir. In this work ordinary scrapers were employed. The quantity handled was about 12,500 cubic yards.



General plan :—I. floor and walls; II. columns; III. roof beams; IV. roof cover.

Footings of Walls

The footings were first laid. They are one foot lower than the underside of the floor, except where the pipe connections are located, here the thickness was made two feet beneath the underside of the pipes. The footings extend for a distance of 3 ft. 8 ins. from the inner face of the wall under the floor and are reinforced with half-inch round bars laid radially and circumferentially, and also diagonal brace laid radially, at six inch centres so as to form a strong tie between the wall and the floor.



Section through wall, roof and bottom.

Floor

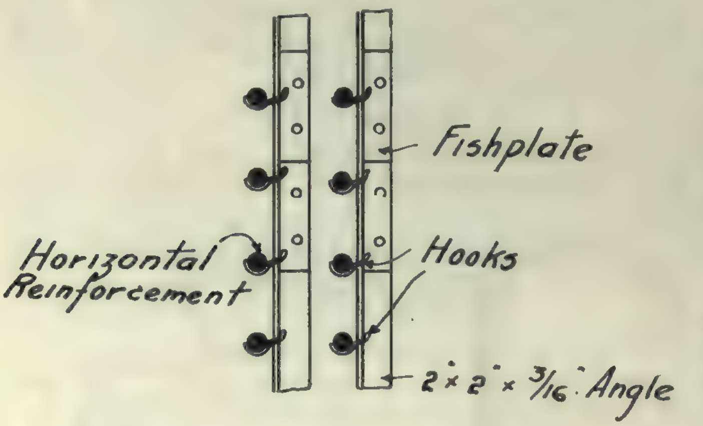
The reservoir floor is twelve inches thick, having a crossfall of one foot to the scour pipe, which is laid to a sump-hole at a depth of 2 ft. 3 ins. below the floor level. The floor was laid in two layers, each six inches thick, and between them were laid half-inch mild steel bars at six inch centres, in two directions, at right angles to each other, tied together at every fifth intersection in one way and at every intersection in the other direction. The top surface of the concrete was worked to a fine close texture.

Columns

There are 69 reinforced concrete columns, each 16 inches by 16 inches supported on truncated pyramidical bases 4 ft. by 4 ft. and 1 ft. 3 ins. high, which with 6-inch sub-base form an integral part of the floor. The sub-base was reinforced with half-inch bars laid at six-inch centres in cross directions.

The columns are reinforced with four ¾-in. round bars tied by 1-in. by 1/16-in. hoop iron links at 10 in. intervals. Where the bars join the base they are inserted into wrought iron tube sleeves one-quarter inch larger in diameter and grouted with neat liquid cement. After the bases had set these rods kept the forms from rising when they were filled with wet concrete.

The forms for the columns were made in three sections built of two inch planks with 4 in. by 4 in. cross pieces at three feet centres and held together by 5/8-in. bolts. Each section was numbered so that the forms made a complete column. Sufficient forms for twenty columns were made and these were therefore used at least three times. These forms were assembled on the ground and hoisted up and lowered over the rods by means of a light gin pole on a monkey derrick built on skids. Lumber 2-in. by 8-in. was used to build up the derrick and this was moved from column to column by the men. The columns were braced by one inch boards tied to the wall forms and were plumbed to assure the perpendicularity of the lower forms; the other forms were held in place by two bolts holding the second and third sections down to the one already filled in. One section about 9 feet high was filled each day.



Standard and hooks.

Wall

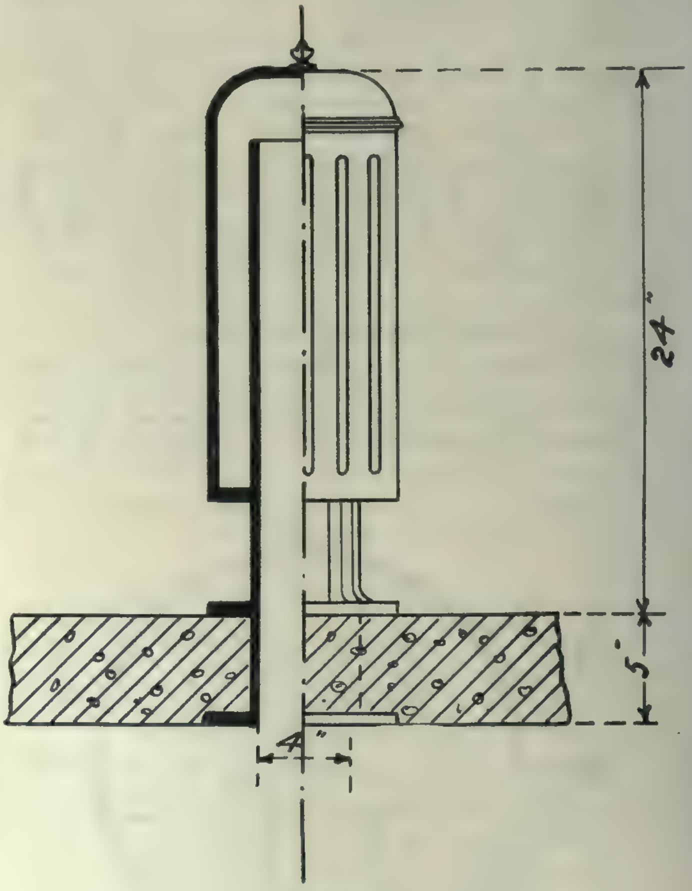
The wall is 57 inches thick at the floor level, while seven feet above the floor a steep batter on the outside reduces it to 18 inches, and from this point it tapers to 14 inches at the top water line. The wall then corbels out to allow a base for the roof beams and for a rain water gutter. In the original design the wall was to be 9 inches thick at the top and 14 inches at a height of 5 feet above the floor, with three external reinforced concrete rings placed at points of equal pressure, to provide extra strength, as the work would be carried out under somewhat unusual conditions, but, owing to the delays already mentioned, it was deemed expedient to alter the design by eliminating the rings and thickening the walls by an equivalent volume of concrete and steel, so as to simplify the construction and thus expedite the work. The inside face of the wall is vertical.

The horizontal reinforcement in the wall was designed to take up the tensional stresses proportional to the varying depths of water. At the floor level there are two 1¾ in. round bars at 3 in. centres, curved to template to fit the curvature of the wall, and at the top 1 in. at 4½ in. centres. These bars are held in place by 2 in. by 2 in. by ¼ in. angle steel standards in which holes were drilled at prescribed distances apart and ¼ in. steel hooks inserted to clip the rods. Such standards are 3 ft. 6½ in. apart along the perimeter of the reservoir, and fixed so that there are 5 inches of concrete between the horizontal steel reinforcement and the water face at the bottom, and 3 inches at the top. This method of placing and fixing the horizontal bars, resulted in a firm and satisfactory frame work which could not be disturbed when the men were placing the concrete.

The vertical reinforcement consists of half-inch bars at 8½ in. centres and tied to the horizontals by black wire at every fifth intersection vertically and at each intersection on the fifth rows horizontally.

There are 45 buttresses spaced at 14 ft. 2 in. around the outside of the wall. These buttresses are 2 ft. wide and project beyond the 14 in. wall at the top about 11 ins. and die out at the base. These are reinforced vertically by half-inch rods, spaced 4 inches apart.

The walls, etc., were built in courses about 12 inches high. Every horizontal and vertical joint was thoroughly cleaned before the next layer of concrete was laid. Any concrete work which had been standing twenty-four hours or more, had the laitance removed by picks, wire brushes, and plenty of water, so as to ensure a thoroughly sound bond. The concrete was well worked into the spaces between the steel rods, etc.



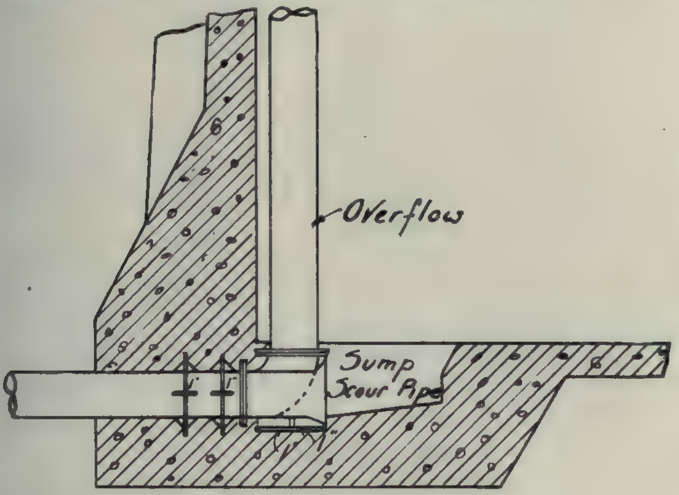
Ventilator.

On the completion of the work, the wall, floor, and columns were painted with hot liquid bituminous asphalte and afterwards limewashed.

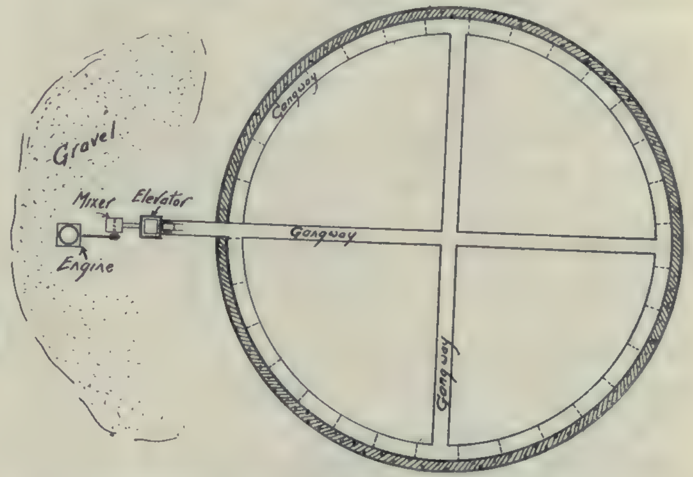
The timber work necessary to form the internal surface of the wall consisted of bents erected about 14 ft. apart, the girts were spaced every five feet and on each row of girts were placed 6 in. by 6 in. beams. The one facing the studding had a segmental piece nailed on to its face to form the curve. On the top of the 6 in. by 6 in. timbers was built the runways or gangways which served to transport the materials. As the wall was built up to the level of the runways the timber work was made higher so as to command the next tier of concrete work.

Roof

The roof is constructed of 15 in. by 6 in. by 60 lbs. rolled steel primary beams, cut to fit the 20 ft. spans and resting on the columns which are 20 ft. apart each way. The secondary beams are 12 in. by 31 lbs. rolled steel joists fixed at 6 ft. 8 in. centres and attached to the primary beams by angle iron brackets. The whole of the roof beams were rivetted together. The cover of the roof consists of 5 in. concrete, reinforced with half-inch steel bars laid crossways at 6 in. centres. The roof has a dome formation, being twelve inches higher at the centre than at the perimeter. The surface of the concrete was washed with hot liquid asphalt to prevent its being disintegrated by frost.



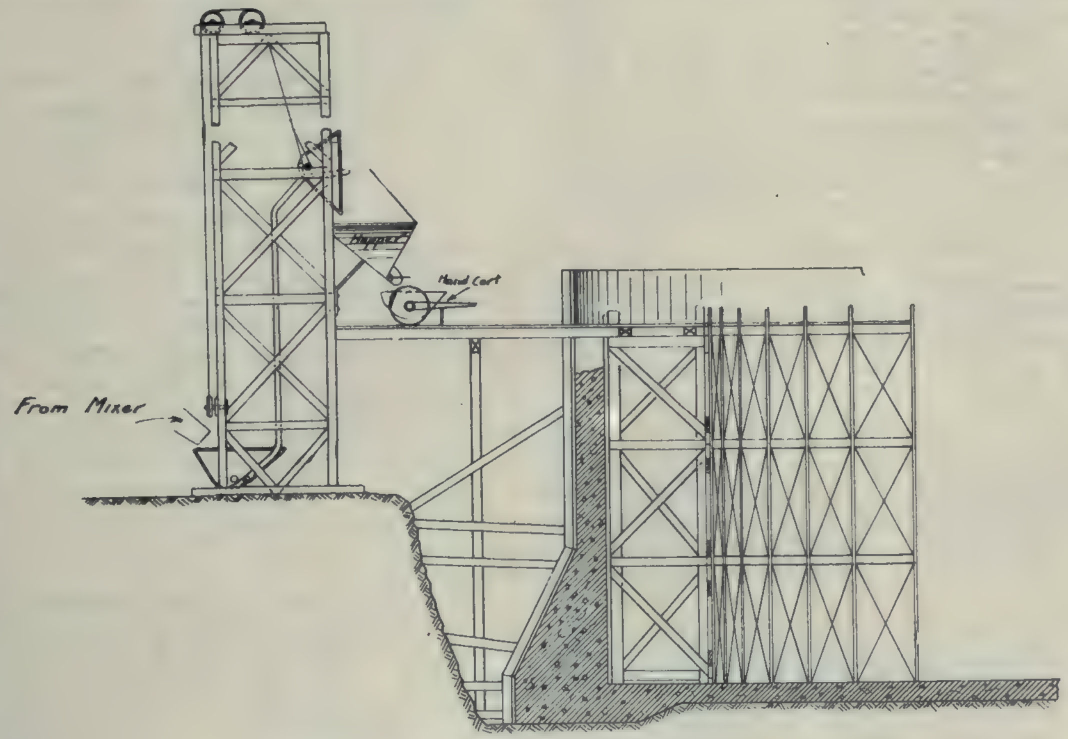
Overflow and scour pipe.



Arrangement for making and transporting concrete.

Rolled steel joints were selected for the roof construction as it would otherwise mean erecting false timber work to a height of 27 feet to support the reinforced concrete beams. With the steel joists, however, the forms rested on the flanges and this was a simpler and equally effective mode of construction.

The steel joists were elevated to the roof level by means of a fixed boom attached to the hoisting tower, which was used to raise the concrete and then landed on loose dollies and run within reach of a derrick. This placing derrick was built of 6 in. by 6 in. tim-



Staging for transport of concrete and holding of forms.

ber in the form of a double boom traveller, having a reach of 60 ft. when both booms were spread. It was slided along greased rails and carried a set of chain blocks at the end of each boom. There are four cast iron ventilators in the roof.

Pipe Connections

The 16-in. inlet and outlet pipes are placed diametrically opposite, and the overflow stand pipe, and the scour outlet which are together, are located halfway between the inlet and outlet. The overflow stand pipe is held in place by 4 in. by ½ in. stays anchored into the wall.

All castings fixed in the concrete were uncoated and had puddle rings cast on, to prevent any water finding its way along the outside of the pipe. These rings are 6 inches wide and 1 inch thick, strengthened by brackets 1 in. thick. All inside pipes have bellmouths. The inlet and outlet pipes stand 6 inches above the floor level.

All valves are located outside the reservoir, and enclosed in reinforced concrete manholes, measuring 3 ft. 6 ins. square at the top, and 3 ft. 6 ins. by 4 ft. 6 ins. at the valve level. The mains leading to and from the reservoir are of ample size to deliver at least five million gallons per day, and of such dimensions as to fit in with future extensions.

Wrought iron step ladders were built of 4 in. by ½ in. stringers, 18 inches apart and ¾ in. rungs. The ladders are fixed into the concrete work at the top and bottom.

Reinforced concrete stairways are built at opposite points of the diameter to afford access. Stringers, 5 ft. apart, 15 ins. by 6 ins., and the treads are built monolithic and reinforced with half-inch rods lengthways and crossways.

Steel Reinforcements

All bars or rods are medium steel, having an ultimate strength of 60,000 pounds per sq. inch, and an elastic limit of not less than one-half of the ultimate strength, and elongate not less than 22 per cent. in eight inches and bend cold 180 degrees round a diameter equal to the thickness of the piece tested, without fracture on the outside of the bend.

Steel bars were joined together by overlaps equal to forty times their respective diameters and tied with black wire. The working stress on the steel was limited to 15,000 pounds per square inch tension.

Portland Cement

All the cement had to comply with the specifications prepared by the Canadian Society of Civil Engineers as revised in 1911, and the methods of testing were as near as possible those referred to in such revised specifications.

Concrete

The concrete was specified to be as follows:—Floors, columns and wall, three parts of broken stone and gravel; one and one-half parts of sand and one part cement. The mass work round the pipes, in the valve chambers and in the roof cover were to be four, two and one respectively.

The pit gravel obtained close by, however, was found to conform fairly close to the specified proportions that a mixture of one cement to five pit gravel was substituted, care being taken to add more cement when necessary. About 3,400 cubic yards of concrete were laid. The limiting compressional stress in concrete was 500 pounds per square inch.

Mixing and Placing Concrete

The concrete was mixed in a ¾ cubic yard Smith mixer, steam driven. It was mixed wet and was elevated by means of an Insley automatic roller hoist from the bottom into an Insley receiving hopper at the top, situated a few feet above the level of working operations from time to time. The concrete was then discharged into hand drawn concrete hopper carts and wheeled over the gangways to all parts of the work. As the work proceeded the hoisting tower, gangways and forms were extended upwards.

Miscellaneous

A Ham Baker water level indicator is being fixed to indicate the varying water level and by electric transmission to record the same at the Barton pump house, half a mile distant.

A 20 in. by 10 in. Simplex Venturi meter supplied by Messrs. Francis Hankin & Company, has been installed on the delivery main to the reservoir and near to the above pumping station. This meter automatically records the quantity of water pumped and also registers the total valume.

The half-inch and ¾ in. steel rods were supplied by the Provincial Steel Company, of Cobourg, Ont.; other steel was supplied by the Western Steel and Supply Company of Regina; cement by Canadian Cement Company, Calgary; cast iron by the Canada Iron Corporations; and the concrete machinery by Mussens Limited, Winnipeg.

Some Itemized Costs

The following are some of the itemized costs:—Cast iron pipes, class C, 2½ cents per lb.; special castings, 5 cents; cast iron covers and ventilators, 4 cents, all delivered Regina. Cement was $2.85 per barrel; steel, ½ in. and ¾ in. bars, 2.44 cents per lb.; 1 in. 2.80 cents; 1¾ in., 3.21 cents; 15 in. joists, 3.60 cents; 12 in. joists, 3.90 cents; standards, 3.90 cents, all delivered f.o.b. Regina.

Placing of steel in the columns average cost of labor was 26 cents per 100 lbs.; in floor 12 cents; in walls 30 cents.

Cost of labor, team and coal for mixing and placing concrete in column footings averaged $2; columns $10; floor 82 cents; walls $1.10 per cubic yard.

Generally

Tenders were invited for the construction of this reservoir, on the understanding that the city would supply all cement, gravel steel and cast iron work, with the result that the lowest bid was $63,176. The engineer's estimate was $46,497, to which was added $6,974 for contractors' profit, making a total of $53,471. The offers were considered to be too high and it was decided to carry out the work by day labor, under the superintendence of Mr. Herbert Gibson. The total cost was about $88,000, of which the items which the city would supply under the contract absorbed about $58,000. The modifications in the design and specifications no doubt effected some reduction in the cost.

Mr. Theo. Brockmann was resident engineer during the first season. Mr. L. A. Thornton the City Works Commissioner took an active part in the organization of the work, and Mr. J. McD. Patton followed by his successor Mr. J. Mackay, Waterworks Superintendent, attended to the matter of supplies of materials. The reservoir was designed and supervised by the writer.

Principles Underlying Scientific Street Design

By J. Russell Ellis, Assistant City Engineer, Regina, Sask.

THE subject of this paper has been chosen advisedly and with the knowledge that hardly any two highway engineers will concur in their methods of treating the points brought out. My greatest hope is that a thorough discussion upon the various features of the problem will be instigated, and that possibly the reading of the paper will assist in renewing the acquaintance of those present with the more or less familiar principles involved.

The problem of proper street design is as broad and varied as any problem could well be. If the matter were always handled in a scientific manner and by a skilled designer there would be little excuse for presenting this paper. Too often, however, are the very underlying and essential points in the problem which require study and skilled judgment arbitrarily fixed by the legally constituted authorities in charge without proper advice, thought or knowledge. We have probably all seen the street which is too narrow or too wide for the use to which it is placed, in the first instance permitting of insufficient roadway room or width of sidewalk or both, and in the latter case causing an excessive cost of maintenance or suffering for lack of the same. Even when the width of the street is satisfactory the location is often ill adapted to the fundamental requirements of the traffic to which it is subjected. Again, the width and arrangement of roadway, sidewalks and parking strips are stupidly fixed. Still again, the choice of elevation, gradients, kind of paving materials and facilities for storm water drainage are commonly noticeable as features of which improper treatment has resulted in inexcusable confusion.

Reconnaissance and Preliminary Survey

The first step required to be taken in dealing with the problem in a scientific manner is a reconnaissance of the territory tributary to the street. For the purpose of this paper it will be assumed that our street has already been laid out and various improvements made upon the abutting property as is the case nine times out of ten when the engineer is given a hand in the design. A map drawn to a fairly large scale—not less than one hundred feet to the inch—should be provided with the street lines and all abutting property divisions accurately shown. This should be used in conjunction with a small scale map if available showing the streets and natural topographical features in the section of the city or town which is traversed by the street under consideration. After a careful study of the maps, in which possible changes in width or location may be noted, the investigation will be carried to the field. Here all improvements along the street will be sketched in upon the large scale map in approximate position; any apparent diversion of traffic to other streets and the reasons therefore will be noted, and any obvious errors or omissions in the map lines or topography will be noted. The general character of the use of the contiguous territory such as business, manufacturing, residential, residential mixed with business and public use will be tabulated with the limits of each. Some study of the work involved in improvement such as the cutting down of hills and the bridging or filling of depressions should also be made. It will probably be possible at this time to make use of the conclusions drawn from the first study of the maps and to correct them where necessary. Along with these studies a reliable traffic census will be required. For this work it will be necessary to decide to what extent of detail the conditions will warrant the investigations to go. Various forms for recording the observations have been devised and rules established which are available for reference but need not be blindly followed. Certain it is however, that records should be taken at different times during the day, at different seasons of the year and during different conditions of the weather. Where heavy and fairly continuous traffic is encountered it will probably be advisable to have the reports cover the entire twenty-four hours of the day. Concerning the information necessary to record, Professor A. H. Blanchard, Columbia University, has made the following classification:

1. Differentiation between horse drawn vehicle traffic and motor car traffic.
2. Division of each of these classes of traffic into pleasure and commercial traffic.
3. Sub-division of commercial traffic into loaded and unloaded vehicles.
4. Determination of the weight per linear inch of width of tire of all types of commercial traffic.
5. Sub-division of the two classes of horse drawn vehicle traffic, dependent upon the number of horses.
6. Sub-division of pleasure motor car traffic upon the basis of weight and speed, since, in many instances, the greatest damage to certain types of roads is caused by seven-seat touring cars, limousines and laundaulets, travelling at speeds of 40 to 60 miles an hour.
7. Extraordinary character of local traffic; for example, traction engines, hauling trailers, motor bus traffic, ice wagons, mill drays, etc.

It would be well to remember, however, that this classification was made for the study of road design in general, and it seems to the writer that some modification might be made when considering street design alone. At any rate, it would be necessary to consider to what extent in any case it is practicable to carry the investigation. For instance, the classification number 6 might well, in many cases, be omitted, since it should be feasible to estimate an average weight and speed of the pleasure motor cars, considering that such cars are generally standardized as to weight and that the speed is limited by law. This average could be obtained accurately enough for our purposes, and would curtail the work involved in taking the census to a considerable extent.

From the data obtained in making these preliminary studies a general tentative plan can be made. This plan will include any changes in location from the original lay-out that may be considered advisable as well as any changes in width. The considerations governing choice in these respects will, of course, be the class and amount of traffic and the topography of the ground.

The next work in order will be the preliminary surveys to consist of a proper alignment of the street as decided upon for mapping purposes and the taking of elevations for cross-sections and profile. This work should be carefully and accurately carried out, and the records taken will in the end be used for estimating purposes. The methods involved in this work are simple and familiar to all engineers. Suffice it to say that sufficient levels are taken to determine accurately the amount of material necessary to be handled in grading the street for improvement and for fixing the grade to suit probable requirements and existing conditions. The plan and profile will then be placed on the same sheet of profile tracing linen. In general the scales preferable for use in profiles are forty feet to the inch longitudinal and four feet to the inch vertical. The scale for the plan will then be made to conform to the longitudinal scale of the profile, and the one will be placed directly below the other. With this data collected, we are now prepared to begin the detailed scientific study of the problem, and it is this portion of the work which is too often sadly neglected.

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* Read before the Regina Engineering Society, Aug. 14, 1913.

Traffic Data

The first consideration affecting the question of the proper width of the street should be its classification as regards present or probable future use. The usual classification is placed under three heads, viz.: main thoroughfares, secondary thoroughfares and residential streets. The classification may be carried farther under a number of sub-headings. The traffic census and an estimate of future development, after careful study of the tributary territory, will be used in making the classification. It will be necessary to determine as best we can what facilities will eventually be required for the purpose of rapid transit. In large cities and on certain streets our conclusions will cause us to provide for underground or elevated railways, in other places the surface street railway only will be necessary. With the estimate of the amount of this traffic it is not difficult to calculate the width necessary to provide for taking care of it. For instance, the width required for single track street railway operation is eight to nine feet and for double-track from nineteen to twenty-one feet. The general traffic should, as far as possible, be kept off the railway allowance. Other public utility accessories that present a probability of being required on the street such as pole lines, pipe lines, conduits, etc., will require consideration as to how much width will need to be excluded from other uses for them. Then the necessity or desirability of considering the ornate side of the problem as affected by planting spaces or parking strips should be given its proper place as going hand in hand with the scientific design. It may be considered that a width of four feet will be necessary for planting one row of trees, but the widths and arrangement of these spaces should not be fixed until after the width of roadway, sidewalks, etc., have been determined in order that the correct division or breaking up of the space may be made. It might be noted here that the practice of placing sidewalks against the curbs where the roadway is less than fifty feet in width results in an improper division of the space.

The width of roadway exclusive of street railway allowance is a vital feature of the design. This is the point where one of the greatest aids of the traffic census comes in though we will need to estimate the width that will be necessary for all future requirements as well as those of the present time. This may not call for the entire width being covered with pavement at first, but the estimated requirements should be provided for. After we have made a careful estimate of the amount and character of the traffic the problem of supplying the necessary width for its accommodation is of a more elementary character. It should be remembered that the principal purpose of the street is to provide efficient means for the necessary movement of the public and the opportunity for transporting the commodities required by it. To accomplish this necessitates providing the proper width to prevent congestion or inconvenience. We will need to fix a definite width to allow each vehicle on the street. Some authorities advise a width of eight feet, others nine feet. It would seem that on account of the tendency toward motor cars of wide bodies that where a preponderance of motor traffic is to be taken care of, the greater width should be used. Where it is estimated that most of the traffic will be composed of horse drawn vehicles eight feet is sufficient. For calculating the widths of sidewalks required two feet is assigned to each pedestrian. Care will need to be exercised here that places where many people gather and leave at certain fixed times do not over-tax the sidewalks. In all cases where feasible, however, the widths of the improvements necessary for the present use only should be adopted, with provision made for increasing them from time to time as needed.

Gradients

The question of limiting gradients requires to be gone into carefully. The points affecting our decision in this matter are the maximum loads to be expected in the street car, motor and horse drawn traffic, climatic conditions causing slipperiness, the damage accruing to existing improvements along the street by cutting below or filling above the level convenient for their use and, in some cases, the desirability of having the floor levels of large buildings at a distance not too varying from the street pavement. We will also need to begin thinking at this point about the class of paving materials that will be used in the construction, particularly with regard to their slippery tendencies. The grades should not be too steep to prohibit the ordinary desirable heavy loads being transported economically unless the interest value of the cost of reducing them including all damage to abutting properties would exceed the loss in cost of transportation. This problem should be figured out in detail where it is evident that large expenditures will require to be made in order to get the desired grades. In general we may consider that a maximum grade of five per cent. is a desirable limit upon heavy traffic streets, and this maximum should only be employed wherever absolutely necessary and at infrequent intervals. A possible way of reducing the rate of grade upon a street is to have the roadway wind from one side to another. This method when used will probably necessitate a greater width of street and a different arrangement of the parking scheme. In this connection it may also be well to consider making detours from the straight line in order that bad hills may be skirted instead of being crossed directly over their summits. By these means a considerable saving in steep grades may often be effected. The minimum rate of grade, too, depends upon the class of pavement used. It must be sufficient to allow prompt drainage of the surface water into the catch-basins. The expedient, however, of what is known as false grading in the gutters will allow roadway, curbs and sidewalks to be laid with a level longitudinal grade, if necessary, but the gutters will have to have sufficient grade to create a flow of water. The minimum grade for this purpose should in no instance be made less than four-tenths of one per cent., and this should be used as sparingly as possible.

Paving Material

The choice of kind of paving materials to be employed in the construction involves a great number of considerations which, however, can be investigated along scientific lines. Experience has already established that certain materials are undoubtedly best adapted for certain purposes, and the results may be made use of without further investigation. For instance, no one denies that Portland cement is the proper material for any permanent street pavement base and for the sidewalks, and the truth is equally as much evident that certain materials for the wearing surface of the roadway pavement are adaptable under certain climatic conditions, while not under others. In considering the pavement base, however, we shall need to design the thickness and proportions of the concrete to safely withstand the loads and stresses to which it will be subjected. Ordinary practice has held pretty closely to the limits of four and eight inches, varying with the nature of the traffic and the condition of the sub-base. It is advisable to make an analysis of the bearing power of the soil and the stresses which will be produced by the traffic in each particular case where conditions vary materially from other cases which have been investigated. The principal stresses induced in the base are due to climatic forces and the loads causing compression. Variation in temperature tends to cause disintegration by expansion and contraction of the concrete, and water tends to penetrate through to the sub-base, making it soft and reducing its bearing power. Therefore the base must be designed so as to expand and contract without breaking the bond, and the water must be kept out by an impervious surface. The loads tend to push the pavement into the sub-base, and hence the base must have strength and rigidity enough to distribute this force safely. In general the safe load which may be allowed for the sub-base is two or three tons per square foot. It is probably needless to say that the width of tires will be considered as to the manner of transmitting loads to the base.

In designing the pavement wearing surface for the roadway a greater number of considerations enter. First, in the way of stresses we have to consider forces caused by impact, shearing and suction as well as compression and temperature stresses. The forces caused by impact are received by the wearing surface only, and hence the wearing surface should have sufficient resilience to absorb these forces without damage. Standard tests have been devised for use in this connection. Shearing is induced by the tractive power of the wheels of a self propelled vehicle and the feet of horses. The wearing surface must have sufficient strength to resist this force, and must have stability enough to prevent its being torn away from the base from the same cause. Hence the study and testing of the bonding properties are obligatory. Suction forces result from the partial vacuum created behind a rapidly moving motor vehicle. The individual parts of the wearing surface must be held together in order to resist this force. Compression and temperature stresses will be handled in a manner similar to that outlined for the concrete base.

Second, a comparison of the value of the different wearing surfaces should be made with especial reference to cost, durability, maintenance, cleaning, traction resistance, slipperiness, sanitary qualities, noise and possibly other qualities made desirable by local conditions. The United States Office of Public Roads working along these lines some years ago collected reports from the engineers of a number of American cities. The results of this enquiry were published in the form of a table which is reproduced below. Under the percentage column the various qualities desired in a pavement are assigned proportionate values, the total being 100 points. The pavement ranking first under any given quality is given the full quality percentage, the rest grading down from this value in proper proportion.

Note.—Favorableness to travel is dependent chiefly upon smoothness and freedom from dust and mud, secondarily upon the qualities composing "acceptability."

Acceptability includes noise, reflection of light, radiation of heat, emission of unpleasant odors, etc. It chiefly concerns the pedestrian and the adjoining resident.

Cost per square yard includes concrete, but not excavation, curbing, etc.; except for macadam, which is not usually laid on concrete.

The table is not given here in order that the results shown may be taken as applying to any particular case, but merely to suggest the proper procedure for the investigation. In any one problem certain conditions of a local nature are bound to enter.

When the available and seemingly desirable pavement surfaces have been thus compared it will be possible to reject those which do not meet requirements and thereby reduce the field of investigation. With those which are considered suitable the final test will be that of economy. Careful estimates should be made of the initial cost, the annual cost of maintenance and the life of each. Then using the prevailing rate of interest with the amount of capital required to do the work we can soon determine which is the most economical material to use.

Parking Treatment

A vital feature in street design from the aesthetic point of view is the parking treatment. There is no doubt that the average engineer would benefit exceedingly in collaboration with the landscape architect in this phase of the work, when this is possible. Certain elementary considerations, however, may be kept in mind, and a careful study of this question should not be dispensed with.

It is desirable to have residential streets planted with trees and grass in the strips reserved for parking purposes. Ordinarily the most suitable plan to follow is to place these spaces between the sidewalks and curbs, between portions of the roadway pavement where the space is available and, where the building line is at or near the street line, to have a space between this and the sidewalk. Trees should be planted in straight lines as a rule, twenty to fifty feet apart in the row, and the grass should manifestly be carefully cultivated. The selection of the kind of trees will be governed by local conditions, but the rapidly growing varieties are generally preferable. Low, dense growing trees such as evergreens are not often suitable for the purpose. They should produce a good shade and be shapely, the size being regulated by the available space, and the proximity of buildings. It will be understood that certain varieties of trees will be unsuitable for urban planting on account of the condition of the atmosphere and the environment of surrounding improvements.

No one who is familiar with the methods of dealing with the various phases of the problem of street design as has been outlined will gainsay that no small amount of detailed effort will be involved in proceeding along these lines. It will be evident, however, that the results of the investigation of certain points will be applicable to the design of all streets in one town or city. Still other features will be similar when they apply to streets of like use throughout the municipality, and a majority of the results will coincide when relating to all of the streets of one classification within a limited territory. It should be borne in mind that the design of a street when once executed will be in a large measure permanent and that countless numbers of users far into the future will suffer from any of the original defects. The economical side of the problem alone should appeal to all citizens, for not only will traffic be inconvenienced and made more costly, but abutting and nearby property values will be affected, and the community as a whole will be the loser in proportion to the enormity of the defects.

After all, the principal considerations are practically fundamental. When the reconnaissance and the preliminary surveys have been made, and the observations taken and data collected for determining width, limiting gradients, kind of paving materials and parking treatment, the sound judgment and knowledge of the competent designer gained from study and experience enable him to evolve a correct, scientific plan. There can be no excuse for any other.

Conditions for Competitive Designs of Government Buildings, Ottawa

SOME time ago the Public Works Department of the Dominion of Canada decided to add to the present preliminary and departmental buildings and provide for complete departmental equipment and courts buildings. In the courts building it has been decided to provide for the Supreme Court, the Exchequer Court and the Royal Commissioners Court. The new buildings are to stand on a bluff of the Ottawa River and the west of the present departmental group. Mr. Edward White, the English landscape architect, prepared a ground plan which has been accepted by the Government. In order to provide for the necessary buildings it was decided to arrange for the submission of competitive plans and Mr. T. E. Collcutt, past president of the Royal Institute of British Architects, and of whom biographical reference was given in the Contract Record of July 9, together with Mr. J. H. G. Russell, president of the Royal Architectural Institute of Canada, and Mr. J. O. Marchand, A.D.G.F., member of the Royal Architectural Institute of Canada, were appointed assessors to draw up the conditions and instructions to the competing architects and to select from the preliminary sketches six designs. The authors of these designs are to be invited to submit final designs and each of the five unsuccessful architects submitting a design in accordance with these condition shall receive an honorarium of $3,000.

The undertaking involves the expenditure of a large sum of money. As public buildings it is eminently fitting that their aesthetic character be such that they stand a monument to the architectural taste of the Canadian people. Their construction should be such that while suggesting the purpose for which they were built, they combine strength and finish. As a matter then of interest, not only to the members of the architectural profession and the building and construction trades, but to the general Canadian public, we publish below the terms of the competition, together with plans showing the site as it is occupied at the present time and the proposed arrangement for the new buildings.

Conditions

Promoter—The Government of the Dominion of Canada promotes this competition and is hereinafter referred to as the Government.

General Plan—The Government invites Architects to submit preliminary sketch designs in competition for the erection of certain buildings, which are to be included in the scheme for the development of complete Departmental and Courts Buildings. The ground floor area of the Departmental Buildings must cover a space of about 200,000 superficial feet, this superficies to include all walls, outer and inner, corridors staircases, lavatories, etc., the entire scheme to be shown on the block plan together with the layout of the adjacent grounds as terraces, foot walks, etc., etc.

Buildings to be Erected at once—It is the intention to build at once a certain portion of this complete scheme, viz.:—The Supreme Court, the Exchequer Court, the Railway Commissioners Court, and the necessary offices in connection with these Courts, as hereinafter scheduled, also a block or blocks of Departmental Buildings covering a ground floor area of about 100,000 superficial feet and providing about 500,000 superficial feet of floor area, including all walls, etc.

Scheme of Site—A scheme dealing with the site which is acceptable to the Government is shown in enclosures No. 4 accompanying the conditions of the competition. This plan, however, need not be considered as a final solution of the question.

The Government desires the competitors to have a perfectly free hand in the development of their designs.

The above mentioned scheme has been published in the London and the Canadian architectural papers and at the same time there were published suggestions for the elevations, which were further illustrated by perspective views of the buildings shown on the plans. The Government disassociates itself entirely from these designs, and does not wish them to be considered as in any way representing its views or wishes.

Competitors—The competition shall be restricted to architects who are British subjects, practising in the British Empire.

Assessors—The Dominion Government has appointed Mr. T. E. Collcutt, Past President of the Royal Institute of British Architects, Mr. J. H. G. Russell, President of the Royal Architectural Institute of Canada, and Mr. J. O. Marchand, A.D.G.F., and a member of the Royal Architectural Institute of Canada, as Assessors to draw up the conditions and instructions to competing architects and to select from the preliminary sketches, six designs, the authors of which are to be invited to submit final designs and each of the five unsuccessful architects submitting a design in accordance with these conditions shall receive an honorarium of three thousand dollars ($3,000).

Restrictions—No promoter of a competition, and no assessor engaged upon it, nor any employee of either shall compete or assist a competitor, or act as architect or joint architect for the proposed work.

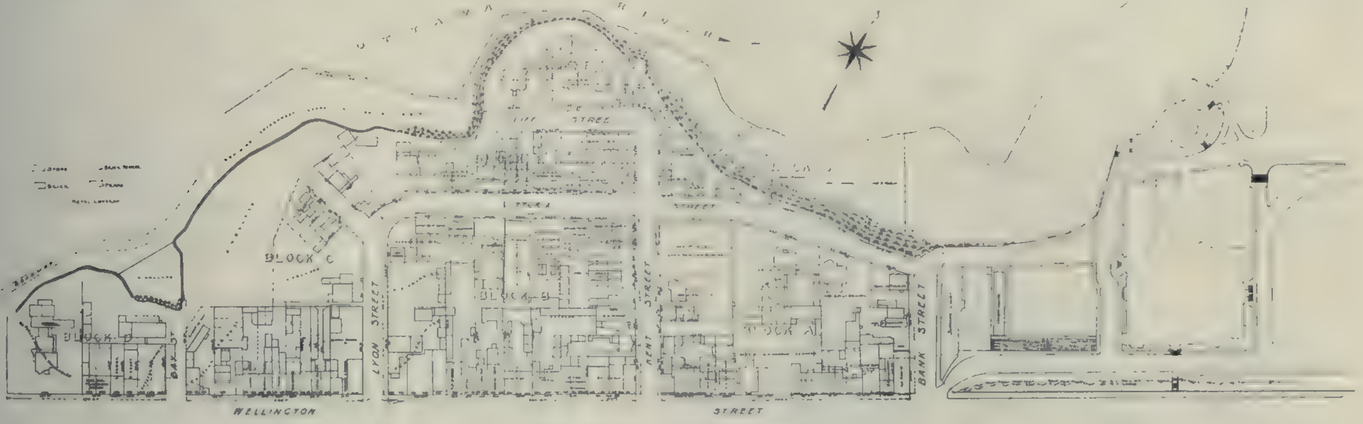
No competitor shall enter into association with any other architect unless such intention has been declared in the notification of the intention to compete and if such associates shall win the competition, they shall still continue their association.

Insurance—The Government does not accept responsibility for damage to any of the drawings submitted, but it will insure them from damage by fire while in its possession.

Delivery of Designs—The designs in the first competition must be delivered in Ottawa (carriage paid) not later than 12 o'clock noon, second (2nd) of January, 1914, addressed to the Secretary of the Department of Public Works, Ottawa, Ont., and any design delivered later than that date, shall be excluded from the competition, except only where delay is proved to the satisfaction of the Minister to have arisen in transit. The date for sending in the designs in the final competition will be determined hereafter, but a period of at least three months will be allowed for the preparation of such designs.

Award—The award in the preliminary competition will be made within twenty-five days of the date fixed for receiving the designs and a similar time will elapse between the time for receiving the final designs and the award to the successful architect.

Return of Drawings—The whole of the designs submitted in the first competition will be returned to their authors and will be seen only by the assessors and the Honourable the Minister of Public Works and his Deputy. No description or illustration of these designs shall be published or in any way made public.



The site as it is at present.

Exhibition of Designs—The final designs shall be publicly exhibited in Ottawa with the names of the authors marked thereon for seven or more days immediately subsequent to the award, and they shall be the property of the Government.

Enquiries—All enquiries regarding the competition shall be addressed to the Secretary of the Department of Public Works, Ottawa, Ont., and all such enquiries must be typewritten and submitted on plain paper without heading or signature and must be received on or before the twelfth day of September, 1913. They will be answered by identical communication to all competitors.

Exclusion of Designs—No competitor shall submit more than one scheme for the solution of the problem in this competition.

Any design that does not give substantially the accommodation asked for will be excluded. The submission of drawings under these conditions shall signify the acceptance of all the conditions hereinbefore and hereinafter set forth.

Drawings Required—The designs in the first competition are to be illustrated by plans, sections and elevations drawn to a scale of sixteen feet to one inch (excepting Block Plan) and must include the following plans:—

(a) Plans of each floor except where one floor is the duplicate of another floor.

(b) Three elevations.

(c) Sections on such lines as may best show the elevation of the floors of each group of buildings affected by the varying levels of the site.

(d) A detailed drawing to a scale of two feet to one inch of some portion or bay of the building as may best illustrate the general design, such detail not to exceed in length thirty or thirty-five feet on the plan.

(e) One perspective drawing not longer than thirty-six inches which must conform in all particulars with the elevations and also with the terraces, etc., as may be shown on the block plan.

(f) A block plan, to the same scale as the plan of the site enclosed with these conditions:—

This block plan to show the whole scheme as stated in clause two of these instructions.

A design would not be excluded from the competition should the authors exceed to a moderate extent the outside line of cliff either for the building or the terraces surrounding it. The extra cost of any such projection entailing as it would the building of retaining walls, etc., must be considered however as of much importance.

It should be borne in mind that some of the streets leading into Wellington Street may in the future be developed into important thoroughfares.

A space of at least three hundred feet must be maintained between the proposed buildings and the present Departmental buildings. This space can be formed into terraces, etc., as competitors may think it necessary for the proper development of their designs.

Designs—The second competition to be illustrated as before mentioned in Clause No. 15 and to consist of:—

(a) Plan of each floor except where one floor is the duplicate of another floor.

(b) Three or more elevations illustrating the principal fronts.

(c) At least three sections as required to fully illustrate the designs.

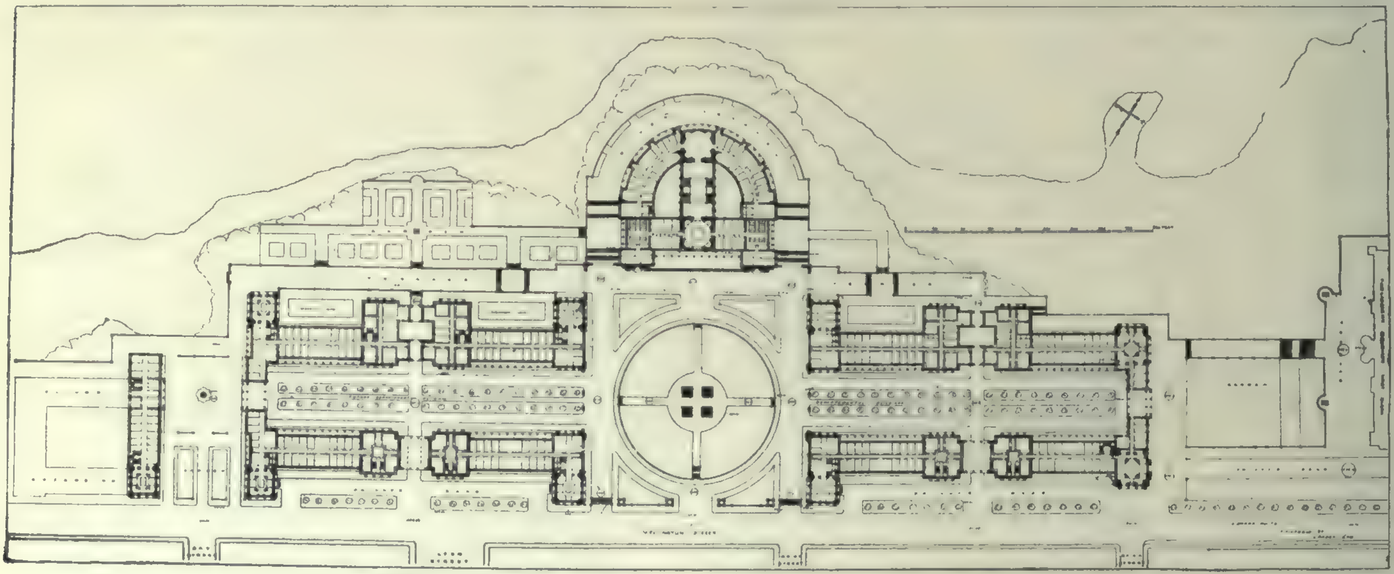
(d) Detailed drawings of one external and one internal bay to a scale of two feet to one-inch.

(e) One or two perspective drawings of the exterior. The length of such drawings not to exceed thirty-six inches. Perspective drawings must conform in all particulars with the elevations and also the position of terraces, etc., as may be shown on the block plan.

(f) A block plan as before described.

Description of Drawings—The whole of these drawings may be on paper or tracing paper (except in the case of the final designs, which must be on paper) all to be mounted on card-board and without margin. They may be in India ink or pencil. The floors to be coloured a light tint of India ink. The walls in plans and sections to be of a darker tint. A flat grey tint may be put on the door and window openings of the elevations and sections if desired. No ornamental features such as cornices, floor patterns, etc., to be shown on the plans. Pencil or light grey wash may be used at will to present work on different planes, openings, shadows and the texture of materials in the elevations and sections.

All rooms and corridors shown on the plans shall have dimensions figured thereon.


The suggested arrangement of the Government buildings.

The titles of the drawings shall be in Roman capitals, all other lettering, notes and figures shall be in plain block type.

The perspective drawing or drawings may be rendered in pen and ink, in pencil or in monochrome wash and may have a margin, not over three inches in width.

The drawings shall be sent in a plain portfolio.

Report and Schedule—Each design to be accompanied by a short descriptive report, unsigned, either printed or typewritten on plain white paper of folio size, briefly describing the arrangement of the buildings and the materials to be used.

The competitor shall present a schedule giving the total area and cubic contents of each block of buildings.

The basis of the calculations for the cubic contents shall be taken from a point two feet below the finished floor of the lowest storey used for offices to a height of five feet above the level of the topmost ceiling.

The cubic contents not to include terraces or terrace walls.

Name of Author—The design together with the descriptive reports must be sent in anonymously, and the author's name and address, together with a declaration that the design has been prepared by himself and his staff in his own office with the exception of the perspective (which may be prepared outside), must be enclosed and sealed in the envelope supplied with these conditions. Form of declaration required is enclosure No. 5. The case, and each of its contents as unpacked will be marked by an officer of the Department of Public Works with a number for identification, but no distinguishing mark, motto, or device is to be put on the drawings, report, envelope or case by the competing architects or their agents.

The sealed envelopes will not be opened until after the award has been made.

Disqualification—Any infringement of these regulations or disclosures of identity of authorship to the assessors individully or collectively or through any member of the Government shall be held sufficient ground for exclusion from the competition.

Employment of Successful Architect—The author of the design placed first by the assessors in the final competition shall be employed by the Government as architect for the work to be done at once as set forth in clause three of these conditions, provided that he can satisfy the assessors as to his possession of sufficient experience and ability to undertake and carry out the work to a successful issue. In case of his inability to so satisfy the assessors, it shall be within the power of the Government to call upon him to nominate and he shall nominate an associate architect whose professional status and experience shall be such as to satisfy the assessors and who shall be remunerated by the Government, but the amount of such remuneration shall be deducted from the commission otherwise payable to the successful architect.

Office—The successful architect must maintain an office in Ottawa during the progress of the work.

Architect to Revise Drawings—The architect, who shall be awarded the work shall, if required, make such changes in his competition plans as shall be necessary to meet the views of the Honourable the Minister of Public Works.

The Architect's Services—After the plans have been finally accepted, the architect shall prepare working drawings and specifications and shall supervise the construction of the buildings, and subject to the approval of the Honourable the Minister of Public

Works, he shall have control of all matters of arrangement, design and execution.

Drawings and Specification—All drawings and specifications as "instruments of service" shall remain the property of the architect but one record copy on tracing linen of all contract drawings, together with a set of specifications, all amended to correspond with the work as carried out shall be furnished to and be the property of the Honourable the Minister of Public Works on the completion of the work. Whenever the Government decides to erect other buildings as set forth in section 2 of these conditions or otherwise, the Government shall have the absolute right to use such drawings and specifications in any way it thinks best.

Clerk of Works—The architect shall appoint one or more Clerk of Works, approved by the Honourable the Minister of Public Works. The architect shall regulate the duties of each Clerk of Works and shall have power to discharge him. Each Clerk of Works shall devote his whole time to the works, and shall be paid by the Government.

The Engineers and the Architect—The Honourable the Minister of Public Works shall appoint a Professional Engineer or Engineers to instal the power plant, heating, ventilating and illuminating systems. The fees for such engineering entailing advice, specifications and superintendence of the installation, shall be paid by the Government. The architect shall consult with the engineers on the general layout of their equipment and the construction of the ducts, foundations and other matters incorporated in the architect's drawing and specifications.

The architect shall receive 2½ per cent. commission on the cost of all the contracts for the aforementioned engineering work as a recompense for his services in consulting with the engineers and meeting their requirements in the arrangement of the building, as shown on his plans and described in his specification.

The Architect's Commission—The architect shall receive for his services the usual commission of 5 per cent. on the whole cost of the building proper, as distinct from the engineering work above described.

If no instructions are given him to proceed within twelve months from the date of his selection, or if the proposed works are abandoned by the Government, the selected architect shall receive payment for his services in connection with the preparation of the competition drawings (including the changes provided for in section 23 of these conditions) of a sum equal to one and one-fourth per cent. (1¼ per cent.) on the amount of the estimated expenditure. If the said architect shall be subsequently employed the one and one-fourth per cent. (1¼ per cent.) previously paid to him shall merge in his ultimate commission.

Character of Proposed Building—The style of the building is left to the discretion of the competitors.

The construction shall be fireproof throughout.

The precise materials to be employed can only be determined later. The competitors, however, shall prepare designs for buildings to be faced with Canadian stone.

The buildings generally are not to exceed five storeys in height.

Vault accommodation for storage and space for power plant need not necessarily be considered as there will be ample space in the basements.

It will not be necessary for competitors to show a basement or sub-basement plan, as this space is to be in excess of that called for in the schedule.

Total Requirements for all the Departmental Buildings to be Eventually Erected on the Proposed Site

A total floor area including all walls, corridors, lavatories, etc., of about 1,000,000 superficial feet. The arrangement of offices to be in large units for sub-division or rearrangement, as may be required.

Requirements for Courts Building

The competitors must use their discretion as to placing Court Rooms, either on the ground or firt floor.

Supreme Court

Court room	1	....	2,500
Conference room, near Court room, and to contain bookcases for Judges' Library	1	....	800
Registrar's room	1	....	400
Registrar's stenographer adjoining registrar	1	....	300
Clerk of the Court, adjoining Registrar	2 in all	....	800
Vault in connection with above	....	....	150
Registrar's Court (Chambers)	1	....	600
Judges's private rooms	9	400	3,600
Reporters' room	2	400	800
Sheriff	1	....	300
Secretaries to Judges	2	400	800
Waiting room, for Counsel to consult with lawyers, must be close to Court room	1	....	400
Barristers' and Counsel's room, wardrobes, basins, etc.	1	....	400
Messengers' room	1	....	400
Library, for the several branches and to have gallery	1	....	8,000
Clerical staff	3	400	1,200
Diningroom and kitchen	2 in all	....	500
			21,950

Exchequer Court

Court room	1	....	2,500
Judges' private rooms	3	300	900
Registrar's private office	1	....	600
Registrar's public office	1	....	1,000
Chief Clerk, adjoining Registrar	1	....	600
Vault in connection with above offices	..	....	200
Registrar's Court (Chambers)	1	....	600
Deputy Registrar	1	....	350
Stenographers	1	....	300
Messengers' room	1	....	500
Lunch room and kitchen	2	....	650
Waiting room	1	....	400
			8,600

Railway Commission

Court room	2,500
Commissioners offices and library	12,000
Secretary, Assistant Secretary offices and record room	10,000
Traffic Department including record room	7,000
Chief Engineer and Assistants offices	5,000
Fire Department	2,000
Chief Operating Officer Department	5,000
Law Department Offices	1,500
General offices	5,000
Total	50,000

Note.—Provision to be made in addition to above floor area for corridors, staircases, elevators, lavatories, etc.

The Montreal Harbor Commissioners have decided to construct an additional concrete elevator with a capacity of about three million bushels. Plans are now being prepared. With this elevator, the port will possess accommodation for eleven million bushels.

Micro-Organisms and Mechanical Filters*

Time of Prevalence of Micro-Organisms — Effect Upon Filter—Solutions Used in Treatment—Summary

By F. H. Stover, Bacteriologist and Chemist, Louisville Water Company]

THE chief functions of water filters being the removal of bacteria and suspended matter the natural inference would be that the operation of the plant would be easier at the times when these substances are present in least amount. Many filter superintendents, however, find that such is not always the case and that warm weather and clear water bring troubles peculiarly their own. The usual symptoms of these troubles are marked shortening in the length of the filter runs and the prevalence about the filter beds of a pronounced odor, varying from "grassy" to "fishy" in nature. Microscopical examination of the water at such times usually reveals the presence of numerous minute forms of the type generally classified by waterworks men as "micro-organisms," which, in the waters of the Ohio River, are principally diatoms, with a few algae and miscellaneous forms present.

These organisms are usually accompanied by considerable amounts of very fine flocculent, amorphous matter, which, in part at least, is probably the result of bacterial action upon various organic substances. Since it is often present in increased amount when these micro-organisms abound, it is extremely likely that part of it is also due to the activities of these forms.

The river water at such times usually has a turbidity of less than 30 parts per million and frequently as low as 5 to 10 parts per million, while the bacterial count will vary from 300 to 3,000 at the lower turbidities. These periods of clear water are coincident with the periods of least rainfall, and the river falls to its lowest stages during these times. These conditions of clear, warm and shallow water, abundant sunlight and sluggish current afford these micro-organisms the most favorable conditions for development and their numbers increase rapidly at such times.

At Louisville the water is pumped from the river into two reservoirs having a total capacity of 100,000,000 gal., and which allow of about four days' natural sedimentation before the coagulant is added. As these are simply open basins the organisms, in some cases, increase while passing through them, but the greater depth of water, 20 ft., renders the conditions somewhat less favorable than would be encountered in the shallower parts of the river.

Of the varieties of micro-organisms found in the water about 75 per cent. are diatoms, the remainder belonging to the algae and miscellaneous groups. The forms of diatoms most commonly present are asterionella, synedra and melosira. It is only with waters of low turbidity that these troubles occur and then in marked degree apparently only when the number of organisms present exceeds 200 to 300 per cubic centimeter.

At these times the turbidity which is present consists of extremely finely divided particles and it is the opinion of Mr. Stover that each of these factors, micro-organisms, amorphous matter and fine turbidity, does its share in the shortening of the filter runs.

Low turbidities, averaging about 30 parts per million, occurred during the latter 10 days of September, 1912, at which time the water contained very few organisms and very little amorphous matter. During the first twenty days of this month filter runs averaged forty hours between washings, while for the latter third of the month, when using the water of less turbidity, they dropped to an average of 25 hours, a decrease of 38 per cent.

With these very low turbidities it becomes increasingly difficult to secure a floc of proper size and consistency, and as a result the suspended matter is able to penetrate more deeply into the sand layer than under normal conditions. In the absence of any considerable number of organisms of amorphous matter this shortening of the filter runs was attributed to the fine turbidity alone.

Early in May, 1913, a gradual shortening of the filter runs was observed and microscopical examination of the water showed only from 20 to 30 organisms per cubic centimeter. Amorphous matter, however, was present in large amount and continued so for several days, the length of the filter runs decreasing from 30 to 11 hours in a period of 9 days, although the number of organisms present during this time never exceeded 200 per cubic centimeter and remained during most of the period considerably below this figure. An instance of the combined effects of all three factors was observed between the dates of May 9 and 24.

General Effects Upon Filters

The first sign of approaching trouble is usually noticed after using for several days a water having a turbidity of about 30 parts per million or less when a progressive decrease in the length of the runs commences. Filters which have been making 30-hour runs without reaching over 4 or 5 ft. loss of head will drop to 25 or 20 hours inside of a couple of days and will reach a maximum loss of head of 8 ft. in this time. In other cases successive runs will show a decrease of 25 to 50 per cent., especially as the runs drop below 25 hours, when the decrease has sometimes been so rapid that at the end of a few days the best runs would average only 2 to 3 hours in length.

At such times the surface of the sand in the filters seems to become abnormally hard and compact in a short time, and when broken up the sand grains show a slight tendency to stick together. This condition cannot be wholly corrected even by thorough washing.

Microscopic examination of the sand when in this condition usually reveals the presence of numerous diatoms and other organisms, apparently cemented together in a matrix of amorphous matter and fine turbidity. These living organisms, it is believed, accelerate the formation and retention of this gelatinous film on the sand grains. In support of this may be mentioned the following: During the period from May 19 to June 14, 1911, the number of micro-organisms in practically all the samples examined was about 600 per cubic centimeter, the variations from this number, except in one instance, being so slight that it may be said to have remained practically constant. Yet during this period the length of the filter runs steadily decreased, until application of copper sulphate was made on May 26, following which there was a general increase in the length of the runs for a period of 6 days.

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* From a paper before the American Water Works Association, Minneapolis.

The only observable difference in the water coming to the filters during this period was that it contained dead instead of living organisms. The amount of turbidity and amorphous matter and the number of organisms were practically unchanged, the shortening of the runs having been apparently due to the cumulative effects of a constant number of organisms.

A similar increase in the length of the runs has also been observed when the organisms in the water died, apparently from natural causes. The rise between June 6 and 8 is attributed to this cause, for at this time the effect of the copper sulphite treatment of May 26 was at an end and the higher turbidity of June 10 and 11 had not yet arrived. During the times that the turbidity curve remains approximately constant the increases and decreases in the length of the filter runs follow quite closely the variations in the number of micro-organisms present.

The decreases in the length of the filter runs of course cause correspondingly large increases in the amounts of wash water used. During the year 1912 the average amount of wash water used at Louisville was 2.05 per cent.—the lowest average for any one month being 1.44 per cent. During the periods of shortened filter runs, however, the amounts will vary from 6 to 10.7 per cent.

Methods of Treatment

The methods of treatment tested have been of three kinds—killing by chemicals; attempted removal by increased coagulation, and obtaining a different character of water, as in by-passing the sedimentation basins and drawing direct from the river.

The use of hypochlorite of lime for this purpose had been considered early in 1911, but before an opportunity offered for a trial of it some results of its use in this way were published by Mr. J. W. Ellms, of Cincinnati, in the spring of 1911. His experiments were attended by some success, but the results were not all that could be desired. One of his conclusions was that the nearer the hypo was applied to the filter beds the better the results in increasing the length of the filter runs, and that hypo applied directly to the filter beds gave the best results of all.

Not being equipped with devices for applying hypo accurately as a continuously fed solution, it was decided to apply it as a powder to one of the filter beds. This was done by draining off the filter until about 3 inches of water remained on it and scattering the powder uniformly over the surface, after which the bed was allowed to stand for a period of 24 hours. It was then washed and put into servcie.

No improvement in the length of the runs followed this treatment, and the bacterial efficiency of the bed for several days following was much below normal. The amount of hypo used was 12 lb. on a filter 30 x 72 ft. in size. No further experiments were made with the hypo.

Use of Copper Sulphate

With the copper sulphate applications markedly favorable results have been secured in all but one instance, and even in this case the results cannot be said to have been negative, as the runs were kept at 6 hours and above under conditions when much lower ones might have been expected, and probably would have been expected, and probably would have occurred had not the copper been used. The minimum length of runs reached at this time was 5 hours, which occurred 9 days after this dosing.

Within 24 hours after the application of the copper there was in each instance a noticeable increase in the length of the filter runs and that these lengthened runs continued for periods varying from 8 to 19 days in length.

The copper was applied in the second sedimentation basin and in the coagulant basin by dragging bags of it from a boat. It is probable, however, that equally good results could be obtained by applying it as a solution, in a manner similar to that by which alum or hypo are applied.

In plants not provided with sedimentation basins, but which run the incoming water direct to coagulant basins, at least 12 hours should be allowed between the application of the copper and the filtering of the water and a slightly longer period would be desirable if possible.

Usually the length of the filter runs would begin to increase in from 12 to 24 hours after the application of the copper. Hence in figuring the cost per million gallons filtered the cost was apportioned over the amount of water filtered during the period of increased runs following the application of the chemical.

A careful examination of the water from the basins, both as it flowed to the filters after coagulation and again after filtration, failed to reveal the presence of even a trace of copper. There were numerous fish in the reservoir, but except in the cases of a few very small and apparently newly hatched ones, practically none was killed. During and for a few hours subsequent to the application of the copper a few large fish were observed to come to the surface for a short time, acting slightly dazed, but it was apparently a temporary effect only.

The only drawback to the application of the copper is that a large increase of bacteria has been observed to follow its use, but this may be in some measure due to local conditions and need not necessarily be met with in other waters.

The explanation of this bacterial increase is probably that the killing of the micro-organisms and possibly some of the less resistant bacteria leaves some of the hardier forms in the midst of an abundant food supply and freed for the moment from any antagonistic effects of other forms. Hence a rapid increase follows for a short period. No B. coli were detected during this time, however, and it was found that the application of 0.25 part per million of available chlorine was sufficient to eliminate this increase, so that in plants provided with a sterilization plant this increase can be readily taken care of if it occurs.

The removal of the micro-organisms by increasing the dose of coagulant beyond that necessary for bacterial efficiency was tried but did not give results of a promising nature. Doubling the normal dose of coagulant increased the removal of the organisms by only 10 per cent. and had very little effect on the runs.

The use of river water direct to coagulant basins was tried in two instances, and in both cases gave encouraging results, although in each case an increase in turbidity followed within a few days and thus left no opportunity to see how long this improvement would have lasted.

In addition to the regular determinations of micro-organisms and amorphous matter, the determination of the actual time of filtration of a given volume of the water under investigation has been found of value. This has been done by using what may be termed a miniature filter. In order to expedite matters the Sedgwick-Rafter filter, which is commonly employed to concentrate micro-organisms before counting, was used, and thus all the determinations were made by the use of one sample.

In the river sample of June 21, 1912, it was observed that the time of filtration of the 500 cubic cm. through the Sedgwick-Rafter filter was only one hour as compared to about three hours for the water, which was coming from the sedimentation basins. The river sample contained about the same number of organisms, but much less amorphous matter than the sedimented sample.

The sedimentation basins were therefore by-passed and the river water run direct to the coagulant basins. An immediate increase in the length of the runs followed; the increase was from 5 to 9 hours in the following three days. A rise in turbidity occurring at this time put the runs back to normal.

The samples on which the time of filtration was noted were simply poured onto the small filter just as for an ordinary examination for micro-organisms, care being taken to use exactly the same amounts of sand and water in each instance. When the turbidity of the water exceeds 50 parts per million these small filters clog rapidly and this determination becomes of no value. This test has one advantage, however, in that it can be made by a person not familiar with micro-organism work and it does not require the use of a microscope.

Summary

The water of the Ohio River, when of a turbidity below 30 parts per million, almost invariably causes decreases in the length of the filter runs. If such turbidities are accompanied by micro-organism and much amorphous matter, still greater decreases follow. Filter runs may be greatly increased by the judicious use of copper sulphate, although after-growths of bacteria sometimes follow its application and must be guarded against. Small doses of hypochlorite of lime do not affect these micro-organisms in such a way as to increase the length of the filter runs. The determination of the time of filtration of samples of water through small laboratory filters will in some instances enable the operator to select the water from that point of his system which will give the longest filter runs.

Methods of Distributing Overhead Expenses

By Royal R. Keely

ALL expenditure in any industry may be divided into three broad classes, labor, material, expense; or, more broadly, into direct and indirect expense. Direct expense may be defined as all that may be charged directly to the product; indirect expense as all other expense connected with the conduct of the business and which must be borne by the sale of the product.

In a foundry, for example, the labor applied directly in producing a length of cast-iron water pipe is called direct labor expense; that is, it is the labor applied directly to the product of this piece of pipe and is in no way related to other articles that may be produced. The pig iron required in making the length of pipe is direct stores expense. Other labor connected with the administration or supervision is classed as indirect expense. Stores required for repair of building and equipment, office supplies, etc., are classed as indirect stores expense.

In order that the management may intelligently conduct any business, the cost of each article of product should be known. In determining the cost of the length of cast-iron pipe referred to, the labor applied directly in making it, as for instance, the setting up of the mold, pouring of the metal, removing of the form from the mold and cleaning it of sand, etc., and the pig iron entering into it, may be charged directly to its cost. But since all expense of the conduct of the business must be borne by the product, this individual length of pipe must bear its share of the expense of supervision, taxes, insurance, depreciation, repairs, heat, light and power, selling and advertising, general office expense, etc.

Methods of Determination

The determination of just what its share of these expenses should be has aroused much controversy, and there are in use to-day six methods of determining this indirect or overhead expense: (a) in proportion to material used; (b) in proportion to the direct labor charge; (c) the time or number of man-hours employed in production; (d) machine rates; (e) cost numbers or factors; (f) prorating by inspection or judgment.

The first of these may be satisfactory if the product is homogeneous, as brick from a brickyard, where if any one kind of brick constitutes one-tenth the product of the plant, this will take one-tenth of the total overhead expense.

The second, that of apportioning expense according to wages paid, is very generally used. Here, if the direct wages paid on any kind of cast-iron pipe are one-tenth the total direct wages for the foundry, then this kind of pipe bears one-tenth of the total overhead expense. The objection to the method is that a job produced by a 40-cent man at a vise and bench would bear the same proportion of overhead expense as one produced by the same man on a large and very expensive machine. This method will be sufficiently accurate only in cases where the workplaces are all of nearly equal value and capacity and the workmen paid fairly uniform wages.

By the third method overhead expense is apportioned by the time spent on the job, instead of the value of the time, as in (b). It also does not take account of the equipment.

In the machine hour, or the workplace hour method, the rate is figured to include all expense of maintaining and operating the given workplace, a term broad enough to include everything, from an allotted area where a man may work with a monkey wrench or paint brush to the most complicated and costly machine in the shop.

Machine Rates

In a modern office building the income-bearing unit is the office room to be rented, and in fixing the rental account must be taken of all the overhead expense. In a machine shop, each workplace may be regarded as enclosed by four imaginary walls, forming a room of suitable size for the performance of its operation. Each workplace is then considered as a unit in itself from which profit may be made in turning out a product, or it may be rented to an individual workman.

If all the workplaces are rented, then the source of income is not on product sold, but altogether from rental on the available useful space of the manufacturing plant. All space, however, cannot be turned into rentable workplaces, for there must be general heat, light and power plant, storage space, aisles, halls, passages, offices, etc. The rented space, therefore, must not only maintain and operate the entire shop, but must produce a profit for the owners. Each workplace unit must bear its share of interest and depreciation on its building, interest and depreciation on the cost of machine, taxes, insurance, etc., on the investment, repairs and maintenance of building and equipment, its share of heat, light, power, etc., as well as all other general charges, if it is to make a profit for its owners.

The cost of the product from each workplace is made up of rental, raw material entering into the product, and a fair compensation for the worker, and the selling price must include his profits. The rental of each workplace must be a figure that will enable its operator to make a profit and must at the same time pay all the owner's expenses and make a profit besides. Provision must also be made for the idle time of a workplace.

This indicates the method of arriving at the machine rate. The method is superior to the others in that it takes account of the variation in the cost of production on different types of workplaces, and would be accurate if there were no idle hours. In any system the wages are very carefully charged directly to the item of product, but since the general charges of interest, depreciation, insurance, etc., may be equal to or greater than the wages, it is important to cut these down to a minimum by putting as great a proportion as possible directly against the particular items of product, as in this method.

Mr. Church in his book on Expense Burden advocates a supplementary rate to dispose of the expense connected with the idle hours and the auxiliary departments, as shipping room, store room, etc. By this plan, expenditure is connected with production centers, the charges being debited to jobs by machine rents or rates so carefully arranged as to include all of them. All floating or general items are collected into a monthly shop-charges account, which is relieved by the total of charges which have been debited during the month by means of machine rates, leaving in the account a residual sum. This sum is reduced by the supplementary rate to an hourly burden, distributed over the jobs in the usual way.

To quote from Mr. Church himself: "It will be obvious that by this means all the charges will be distributed, leaving nothing in the charges account, and that if all the machines have made full time in the month, the supplementary rate will rise, because only working hours are credited to the shop account as per the total of the machine rates found at the end of the month. Thus we secure that each job gets its own expenses only attached to it, plus an average of floating charge and of what surplus may be due to slack times or inefficiency in the shop."

Again he says: "The idleness of a machine may or may not be considered as the fault of that machine. If, for instance, a machine was found to be idle nineteen-twentieths of its time, this might be due to one of two causes. Either the process was rare but essential, or the machine itself was largely superfluous. In the first case it would be eminently fair that the charge should be made very high when it was put in use, since the shop charges due to its presence and upkeep are indubitably incurred for the sake of this occasional use In the second case it might be rather a matter of accommodation that the machine was retained at all, in which case the shop as a whole should bear the burden and not the unlucky piece of work that should happen to be put on such machine at that time." It is thus seen how this ingenious method puts to each item of product its proper share of overhead charges, for the workplaces which are in use. Then the balance left over, due to idle machines and other auxiliary and general expense, is prorated by a supplementary rate.

Cost Numbers

In the fifth method, that of cost numbers or factors, which is a simpler system worked out by Frederick W. Taylor in his study of Scientific Management, the machine rates are determined by a process similar to that already described, and the rates are then treated not as figures of value, but as relative numbers called "relative cost numbers," or simply "cost numbers." If the cost of maintaining and operating two machines is three cents and three dollars per hour respectively, the cost numbers will be three and three hundred respectively. The number of hours each machine runs on any job is multiplied by its cost number. At the end of the period, the total hours by cost numbers for each article or class of product on which it is desired to compute costs and also for the entire shop, are added together. The result obtained is about the same as that reached by Mr. Church's method, without the complication and extra work of apportioning a second time for the supplementary rate.

In general, a rate for apportioning the overhead expense can be established by this method for any class of product and the variation of the rate from period to period will give an accurate indication of the percentage of idle time in connection with this product. The disposal of all shop expense is now provided for. There will be few difficulties in the way of putting the direct labor and stores charge against the article of product into which it enters.

The writer generally accomplishes this result by assigning to the product and stores a definite, concise symbol for each size and kind. The mnemonic system of symbolization, as developed by Mr. Taylor, gives most excellent results. All expense in connection with the conduct of a business is divided, into (a) auxiliary, or "A" accounts, as power, stores, shipping, planning, etc.; (b) business office, or "B" accounts; (c) sales department, or "C" accounts; (d) manufacturing departments, or "D" accounts; (e) machinery and equipment, or "Y" accounts; (f) real estate, or 'Z'" accounts.

The expenses in connection with the A, D, Y and Z accounts are shop expenses and are disposed of by the method of hours by cost numbers, already described. B and C have no direct relation to shop costs and the expense of these departments may be disposed of by another method to be considered presently. All labor is apportioned by a system of job cards, time-stamped at the beginning and again at the end of the job. The sum of the time shown on all these cards must equal the time for which the workman is paid. There is only one job on a card and each card bears the symbol of the product to which the time is charged. The stores are issued from the store room on similar cards. During the period all job cards and stores issue cards are accumulated by symbol in a card index file. At the end of the period the total of all money paid, as represented by the cards, is drawn off by products.

In the classification of expense there is a symbol for each item of expense, both direct and indirect. The direct labor and stores can now be entered at once on the cost card for product turned out. The indirect labor and stores are entered on expense distribution cards, together with other indirect charges, as taxes, insurance, depreciation, etc.

The selling and business office expense, B and C, may be apportioned by a different method, either by direct shop cost, by wages, or by the time consumed in the manufacture of the product, according to the nature of the business. In some cases it may be merged with the shop expense and the total prorated by the method outlined. The usual method is by direct labor cost, or by hours of labor consumed in production.

Inspection or Judgment

The sixth method of apportioning the overhead expense, i.e., by inspection or judgment, is one in which the experience and judgment of officials of a company are used in putting this expense where it belongs.

To arrive at a practical method for doing this, the principal items of expense, which may include advertising, catalogs, correspondence, legal expense, patents, traveling expense, salesmen's salaries, drawings, etc., are listed and the expense of each apportioned to each class of product in proportion to the benefit derived, the proportion being determined from inspection. Thus, it may appear that advertising expense should be distributed among four different products as follows: 10 per cent to the product A, 20 per cent to the product B, 30 per cent. to the product C, and 40 per cent. to the product D. Product A may be an old and staple article, having a general demand, while D may be a new and patented article for which demand must be created by advertising.

If the profit on any class of product is exceptionally high or low, it will call for a careful examination of the direct and prorated charges. The direct charges of stores and labor are very definite items and on these there can be little question. The indirect charges, especially those in connection with business administration and selling, are very intangible and hard to connect with any expense of manufacture, but it must be remembered that every dollar or expense, both direct and indirect, must be borne by the product which is made and sold.

The method of Hours by Cost Numbers for all shop expense and that of apportioning by inspection for selling and business administration expense, are most generally applicable to the ordinary manufacturing establishment.

Other Methods of Prorating Overhead Expense

A seventh method of prorating overhead expense consists in a combination of (a) and (b), prorating the expense in proportion to the sum of the material and labor costs.

For example, suppose that in a given time there are two products made, A and B, the first costing $100 for material and $50 for labor, the second $50 for material and $100 for labor, the overhead charges, or burden, for the two together being $150. By the two methods of prorating given by Mr. Keely, (a) in proportion to the material, and (b) in proportion to labor, the cost accounts would show the following:

By method (a)	A	B
Material	$100	$ 50
Labor	50	100
Burden	100	50
Total factory cost	$250	$200
By method (b)		
Material	$100	$ 50
Labor	50	100
Burden	50	100
	$200	$250
By the combined method we would have		
Material	$100	$ 50
Labor	50	100
Burden	75	75
	$225	$225

Still another modification would be to charge material and credit burden with a certain percentage of the material cost, to cover storage and interest on capital invested in the material, and to apportion the remainder of the burden in proportion to the sum of the labor and of the material cost thus enhanced; thus, if 20 per cent. is added to the cost of material, the account would stand.

	A	B
Material	$100	$ 50
Add 20 per cent.	20	10
Labor	50	100
Sum	$170	$160
Remainder of burden prorated	62	58
	$232	$218

Whether any of these methods, or the machine hour, or cost number method should be adopted in any particular plant depends on the nature of the business, and on the object that is to be obtained by the cost system.

Regarding the length of cast-iron pipe, assuming that it is only one of a hundred kinds of castings that the foundry makes, it is impossible to apportion precisely its share of the expense of supervision, taxes, insurance, depreciation, light, power, etc. Suppose the piece of pipe is not a regular product of the foundry, but only an occasional one ordered by a neighboring shop, the order being accepted at a very low price because the foundry is short of orders at the time. The bookkeeper reports that money has been lost on that pipe, and presents the following account: Material, including waste, 1 cent per lb.; labor 0.5 cent; burden 1 cent; total 2.5 cents per lb. Sold for 2 cents; loss 0.5 cent. The owner says, "I think we have made money on that order, for the cost of labor and material was 1.5 cents, and the selling price 2 cents, leaves a margin of 0.5 cent to apply to burden. It cost nothing for selling and advertising, and the expense for supervision, taxes, etc., would have gone on if we had not taken the order." Six months later the order is repeated, when the foundry is full of profitable orders, and the price is made 3 cents, not because the cost including burden is 2.5 cents and 0.5 cent is wanted for profit, but because that is "the price the market will bear."

The following is a system of making an estimate of a machine-hour cost. Assume a large and expensive machine costing $2,000, which is in use a different number of days each month. The cost-clerk may present the following tabulation of annual burden charges to be made against it:

	Cost while Idle	Additional Cost while Running
Interest, 5 per cent. on $2,000 . .	$100	
Rent, 100 sq. ft. at 50 cents . . .	50	
Taxes, 2 per cent. on half value	20	
Insurance, 0.5 per cent. on value	10	
Light and heat (in winter only)	20	
Depreciation (obsolescence and corrosion), 5 per cent.	100	
Repairs or depreciation due to wear, 2 per cent.		$40
Lubrication and cleaning, say. .		10
Power, 2 h.p., estimated load factor, 0.25; 2 × 3,000 hours × 0.25 × 2 cents per h.p. hr		30
Superintendence, office expense, etc. Total $20,000, share of this machine, 0.5 per cent. . . .		100
	$300	$180
	180	
Total	$480	
Add for contingencies 25 per cent.	120	
	$600 or $50 per month	

Charge $50 per month
$2 per day if running 25 days per month
5 per day if running 10 days per month
10 per day if running 5 days per month

Labor costs $3 per day for each day the machine runs

Days run in a month	5	10	25
Labor cost at $3.	$15	30	75
Machine hour cost	$50	50	50
Total	$65	80	125
Number of units of product made	50	100	250
Cost per unit	$1.30	0.80	0.50

Supose these units are sold so as to net the factory 80 cents each

Loss, each	0.50	0	——
Profit	——	——	0.30

Or suppose these units are parts of a finished product, shall they be billed to that product, 50 units at $1.30, 100 at 80 cents, 250 at 50 cents, plus the charge for material (whatever it may be), making it appear that the cost of the product varies from month to month according to the number of idle days of a certain machine during a preceding month?

A far better way is to have a fixed hourly charge for the machine in question, which is not changed during a whole year. For example, it may be estimated that the machine will be in use 150 days in the year, averaging 12½ days per month. The daily charge then will be 50 ÷ 12½ = $4.00, and if the work day is 10 hours, 40 cents per hour. The cost of these units will then appear as follows:

Days run in a month	5	10	25
Labor cost at $3	$15	30	75
Burden at $4	20	40	100
Total	$35	70	175
Number of units made	50	100	250
Cost per unit	$0.70	0.70	0.70

This plan not only saves the bookkeeper's time in figuring the hourly cost each month, but makes a fairer charge to the finished product of which these units are part, which product should not be charged with the accidental idleness of any one machine.

We can get the percentage of idle time directly for each machine by summing up from the time cards the number of hours credited to it in each year, or month if need be. Assuming that the machine should run 12½ days on an average to earn $50 per month, the table last given shows that we lost $30 on it the first month, $10 the second, and gained $50 the third.

I wish especially to emphasize the inadvisability of charging to a machine hour any part of the selling expenses, advertising, etc. The machine hour is part of the factory expense, and should not be charged with losses due to inefficient salesmanship. The sales department should be considered as a separate business from the factory, and should have a separate system of accounts.

Extensive Transit Undertaking

RAPID transit for every section of the city by the year 1918, at a cost of approximately sixty millions of dollars is recommended in the report of the Director of Transit for the city of Philadelphia. In the system all three methods of urban transportation are to be used. The present surface lines will be extended and subways, in some cases containing four tracks, will be employed largely in the business centre, while in the less densely peopled part, elevated roads will be put in commission. Of the total cost the city is to provide some thirty-five millions of dollars, while the Rapid Transit Company will supply twenty-three millions. Until 1918 the municipal coffers will not receive one cent for the outlay, and after that the returns will not be sufficient to pay the interest on the sinking funds. However, this loss will be more than compensated for by the increased taxation through the extension of the city's limits made possible by the improved transportation facilities.

Some experiments with the Goldschmidt system of wireless telegraphy have recently been carried out in Germany. Stations have been erected by this company at Eilverse, near Hanover, and at Tuckerton, in the United States, the distance between the two stations being over 4,000 miles. It is stated that the messages transmitted from Eilverse were received with perfect distinctness at Tuckerton. The results are considered to be all the more successful as the American station is not yet quite completed, and the antennae have at present a height of only 400 ft. Moreover, the experiments took place in daylight.

Some particulars are now available of the important trial of oil-burning locomotives which is about to be carried out on the North-Western State Railway of India. There will be a six months' preliminary trial for the purpose of testing different types of burners, followed by a twelve months' trial to determine the relative values of oil and coal. Six heavy passenger engines are to be equipped with oil-burning apparatus for the latter trial and work against six coal-burning engines. Three engines of each kind will work the mail trains and three of each type the passenger trains between Karachi and Padidan.

Building in the Maritime Provinces

Correspondence of the Contract Record

Throughout the summer work has been in progress on the breakwater at Courtenay Bay, N.B., and upon the site of the dry dock, the C. P. R. elevator at west St. John, the site of the new post office building, the new sugar refinery, the new marine depot, two new bank buildings, a large new warehouse, street railway extension and enlargement of plant, the new Keith's Theatre, the foundation of the new highway and street car bridge between East and West St. John, and many new buildings are being erected in the city and its outskirts. On some of these contracts work has proceeded day and night, so that the demand for labor has been much greater than for many years past. Norton Griffiths & Company, of England, the Metcalf Construction Company and the Foundation Company, a Philadelphia firm of builders, several dredging companies, Rhodes Curry & Company, and a number of other large construction companies are carrying out contracts at St. John this year.

Building permits issued in St. John during July showed an increase of three times the value of those issued in July last year, while the value of permits issued for the year ending July 31st, was nearly four times as great as for the preceding year. This relates only to building within the city limits. The amount of building in the outskirts has shown an even greater increase.

The St. John Railway Company will shortly complete the extension of its line toward East St. John, and is adding to its plant. Five new cars have just been added. It is expected that within a year the company will be able to give a continuous service over the new bridge between East and West St. John.

The branch railway from Fredericton to Minto in the Queens County coal fields has been so nearly completed that it is possible for coal trains to pass over the line. The completion of this branch line brings the mines into connection with the Canadian Pacific Railway system, and a larger market than was before available. The Canadian Pacific will operate the line and also its extension from Minto through to a junction with the Intercolonial Railway at Norton, and it is spending a good deal of money this year putting the Norton branch in better condition for traffic.

Two bridges which involve serious engineering problems are receiving the attention of engineers in connection with the St. John Valley Railway, or that portion of it between Gagetown in Queens County and the city of St. John. When this railway is completed, and the Grand Trunk Pacific Railway is also completed, the latter will send freight which is routed for St. John over the Valley Railway from a point near Fredericton. Hence, the Valley Railway must be up to the standard of a transcontinental line. Between Gagetown and St. John the railway must cross the St. John River and Kennebeccasis River, at points where both are very wide and where it will be extremely difficult to get foundation piers. Plans were prepared, but were not satisfactory, and new plans and estimates are now in preparation. The federal parliament has voted a million dollars for the construction of these two bridges, but doubt is expressed whether this amount will be sufficient. The original contract provided that this railway was to be completed by November, 1915, but it is regarded as impossible to complete these bridges in that time, since the plans have not yet been completed nor anything done in preparation for the work of construction.

Another important bridge contract in New Brunswick is that at St. John, where a street railway and general traffic bridge is to be erected to connect East and West St. John. It is to be completed within a year. Work on the foundation has been in progress for some time, and orders have been placed for the material of the superstructure. It will be the longest spandrel-arch bridge in the world. Still another important bridge contract is that at Newcastle, where a traffic bridge is being erected across the Miramichi River, which is of great width at that place. A company has also been formed to build an international bridge across the St. John River at St. Leonards, to connect the New Brunswick and Maine railway systems, but arrangements have not yet been completed for going on with this work.

The financial stringency has had no effect upon the heavy construction work in progress in St. John. A great amount of dredging is being done in the harbor, new wharves of timber and concrete are being erected, the million bushel elevator for the C. P. R. will be completed this year, dredging and wharf building for a marine depot for government vessels are in progress, the great breakwater in Courtney Bay has been thrust out to a length of three thousand feet and is still being extended, the foundations for four of the great buildings for the sugar refinery have been sunk, and work has been begun on the steel superstructure, while work on the foundation of the other three buildings of the group is proceeding. The foundation for the new post office has been excavated out of solid rock, and a similar task has just been completed on the site of a new building for the Bank of British North America, while many other works of minor importance, but requiring engineering skill, are in progress. The city is doing a considerable amount of street paving this year, and extending the water and sewerage system, as well as renewing a good deal of the water distribution system. Half a dozen contracting companies, at least four of them of international experience, have contracts for construction work at St. John this summer. The conditions under which construction work is carried on vary a great deal. For example, to get a foundation for the sugar refinery, it was necessary to sink a large number of concrete piers from twenty to more than thirty feet, and thus the result of many months of work carried on by a large crew of men, working night and day, is hidden below ground. On the other hand, at the site of the post office it was necessary to keep drilling machines constantly at work, and to blast out a difficult kind of rock, and here, too, a large crew of men have been at work for many months, and have not yet completed the very large excavation necessary under the contract for the massive structure to be erected. At the site of the grain elevator, which is now nearing completion, it was necessary to sink piers to a great depth to a footing on ledges of rock, but it was also necessary to reckon with the tide, which flowed in and made it impossible to work continuously on the job. The men were only able to work between tides, and thus the hours of work were constantly being changed.

One of the department stores of Madras, India, has put into use two up-to-date motor delivery vans. This method of delivery has proved so satisfactory in that widespread city, that other business houses will probably speedily adopt it.

New Church at Westmount, P.Q.

The Westmount Methodist Church, P.Q., is to be erected from designs by Badgley and Nichlas, architects, Cleveland Ohio. It is in a modified type of English Gothic architecture, and will be built on a site 85 x 132, at the corner of Sherbrooke Street and Roslyn Avenue. The exterior is to be of Credit Valley stone, the interior being finished in oak. The church and Sunday School adjoin on the same floor level, separated by a lifting partition, so that they may be opened togther when required. The partition is mechanically operated and finished and frescoed to match the walls. This plan gives a combination of the two departments without marring the churchly character of the building. A gallery is situated on each side, and when the partition is raised, the gallery is continued round three sides of the church. The church will have seating accommodation for 1200 people and the Sunday School for 600.

The Sunday School consists of a main room surrounded by two tiers of class rooms, arranged to open together by folding doors, so that the entire school can be gathered together for the opening and closing services. The basement will be high and well lighted and fitted up to accommodate the social life of the church. It will contain a large dining hall, also used for gymnasium and entertainment hall, ladies' parlour, boys' and girls' showers and locker rooms, kitchen, store rooms, boiler and coal rooms and toilet rooms.

The plans show three entrances, from Sherbrooke street and Roslyn Avenue, the latter being the principal one. From two of the entrances access is given by the vestibules to both the church and the Sunday school.

Methodist Church, Westmount.

The heating will be by steam with a very complete arrangement of automatic ventilation, while the lighting will be indirect electric fixtures.

A rather unique method of repairing a concrete wall surface damaged by freezing before setting, was successfully used in the case of a retaining wall on the Pennsylvania Railroad at South Fork, Pa. The patch has now stood over 15 months, and is apparently in as good condition as when placed. The faulty concrete was removed by a small hand pick to depths varying from 1 to 18 inches. The sound concrete exposed was carefully cleaned; steel dowels were driven into it at 6-inch intervals, and a light reinforcing mesh attached to the dowels. Forms were then placed for the face of the wall, the concrete thoroughly wetted, and the holes filled with a 1.2 mortar.

Office Building for Port Arthur

The concrete frame work of the new Whalen office building at the corner of Cumberland and VanNorman streets, Port Arthur, is nearing completion. Six storeys are completed and two yet remain to be added. When completed the building will accommodate 180 offices on its eight floors. Outside the structure will be completed in white terra cotta on the three sides facing the streets and the base will be of granite.

Whalen Building, Port Arthur.

The finish and equipment will be thoroughly modern and up-to-date. Maple floors are to be provided and marble corridors. Mahogany trim will be used, while the doors will be inlaid with mahogany. A vacuum cleaning system is to be installed and the building will be heated by steam. Three high speed elevators will provide accommodation for the office tenants.

The building, which will be fireproof throughout, will cost in the neighborhood of $450,000. The Canadian Stewart Contracting Company, who are in charge of the work, have employed on an average of 100 men daily since the work began. This is the first office building to be erected in the Twin Cities and it is to be completed and equipped in a way that would do credit to any city on the continent. The foundations were constructed with a view to a possible addition of three storeys later, making a total of eleven storeys.

The Clyde navigation trustees, it is stated, do not intend to apply to parliament for the necessary authority for carrying out the whole of the new dock extension scheme of which they have just approved, but are only going to proceed with the construction of three of the five basins authorized to be built. These basins, which will be in the centre of the new dock system, will be large enough to accommodate four of the largest Clyde-North Atlantic liners of to-day, and as soon as the necessary powers are obtained the work of construction will begin.

The Ozonair System of Pure Air Ventilation

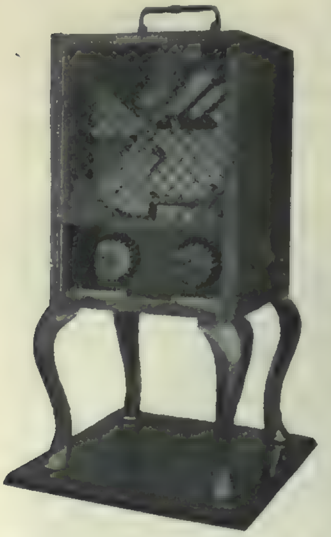


Fig. 1—The Portable Type for Offices and Living Rooms.

SINCE the successful installation of an Ozonair Air Purifying plant as an addition to the existing ventilating system in the House of Commons, Ottawa, the advantages of using ozone for ventilation and air purification have been largely discussed. In this article therefore, we propose to give a brief description of the Ozonair System of Pure Air Ventilation.

What Ozone is.—Ozone is a gas, and is known as an allotropic form of oxygen. It has an odour somewhat resembling seaweed and a light blue colour, whereas oxygen is both odourless and colourless. A molecule of oxygen consists of two atoms—that is to say, oxygen atoms always go about in couples. Ozone on the other hand, has a molecule comprising three atoms of oxygen, but it has only a short life of about 40 minutes, after which time it reverts to oxygen, not because two is company and three is not, but because the molecule is very unstable and the extra atom is desirous of attacking something in order to oxidise it. Hence ozone is the most powerful oxidising agent known and this is the secret of its utility. The chemical formula for oxygen is O_2, for ozone, O_3.

How Ozone is Made.—Ozone can be formed chemically, but not on a commercial scale, so this need not be dealt with, but means have been discovered in recent years of producing pure ozone on a commercial scale by silent electrical discharges in the form of a condenser action. Since then the industrial and other applications have followed. It must be mentioned however, that ozone is formed whenever oxygen is subjected to an electrical spark; but in these cases harmful gases are formed at the same time, which are as harmful as ozone, in suitable concentrations, is beneficial.

Ozone Applied to Ventilation.—This application is more properly known as "Air Purification," because ozone, when used at a concentration suitable for breathing, will destroy all organic particles in the air due to exhalations from the lungs, body, clothes, or to cooking smells and other causes of pollution met with in human habitations or places where people congregate. It will also clear the air of tobacco smoke and is therefore of additional value in restaurants and cafes and places of amusement where smoking is allowed.

Besides removing these impurities, it renders the air fresh and exhilarating, and also partially sterilizes it—that is, the weaker bacteria are destroyed. When used for these purposes the concentration of ozone is about one part of ozone to a million parts of air by volume, and if the smell of ozone is too noticeable, this is a sign that the ozone has done its work and is present in excess. A commercial ozone apparatus should therefore be capable of being switched off or regulated.

There are three ways of applying ozone to ventilation. These are (1) by the use of portable ozonisers with self-contained fans, where there are suitable inlets for fresh air to be ozonized, as in rooms, offices, shops, warehouses, works, hospitals and even some theatres, in fact, in all places where the number of persons is not so great as to consume all the oxygen in the air that can find its way in. Fig. 1 shows a small portable ozonizer. (2) Where there is an existing system of ventilation by the introduction of fresh air under pressure, by inserting a suitable ozoniser in the main air duct. (3) By the installation of a complete system of ventilation by means of ozonized fresh air, with fans, ozonizers, duct work, etc., with suitable openings for its distribution in the building. Fig. 2 shows a diagramatic arrangement of a complete ozonair ventilating system. It will be seen here that the air is drawn from the freshest source and washed through a screen where all the impurities and deleterious gases are removed, then into the mixing chamber and on into the ducts. The ozone is drawn into the mixing chamber through a small pipe and is here mixed to a suitable concentration with the cleaned air.

It may be mentioned that where a complete ozonair ventilating plant is installed, it is found that only one-third the amount of air is necessary compared with an ordinary system of ventilation by means of non-ozonized air, in order to produce equal results without draughts. The system is extremely simple and the running costs are understood to be practically negligible.

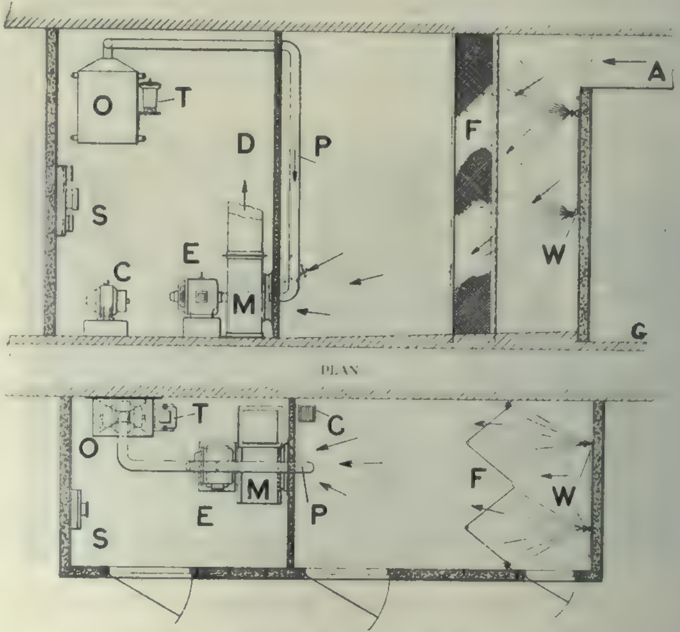


Fig. 2—Diagrammatic Arrangement

A—Fresh Air Inlet
W—Water Sprays
M—Air Filter Screen
E—Mixing Chamber and Fan
S—Electric Motor
F—Switchboard
O—Ozone Generator
P—Ozone Pipe
T—Transformer
C—Converter*
D—Air Discharge
G—Gully for dirty water

*Required only where a continuous current supply is furnished.

Installations by the last two methods described above, have been fitted to some hundreds of buildings all over the world, including public and municipal buildings, blocks of offices, banks, hotels, theatres and picture houses, in the last of which in the Old Country, smoking is invariably allowed.

In conclusion it is interesting to note, that ozonair generators are in use for water sterilization, bleaching and deodorizing fats, waxes, oils, etc., bleaching wood pulp, brewing, food preservation and in short all indutsrial cases where air or material deordorization is necessary.

Public Roads and Highways Commissioners for Ontario

Mr. C. A. Magrath, C. E.

Mr. C. A. Magrath, C.E., is the son of the late Mr. Bolton Magrath, of Aylmer, Ont., Inspector of Protestant Schools in the province of Quebec. The son was educated as a land surveyor and some thirty years ago went to the Canadian Northwest to engage in his profession. After some experience in surveying and engineering Mr. Magrath became interested in the irrigation and railway interests in southern Alberta and for a number of years has been manager of the Alberta Coal & Railway Company at Lethbridge, which controls some of the mines and irrigation systems, and railways in the vicinity of that city.

For two terms Mr. Magrath was a member of the Old Northwest Legislative Assembly, and was for a time member of the Haultain Cabinet without portfolio. He was first elected to the Dominion House of Commons in the Conservative interest in 1908. Since 1911 Mr. Magrath has devoted himself nearly altogether to his professional work. He has been described, and not inaptly, as Canada's foremost irrigation engineer, and undoubtedly ranks foremost among those who have striven to develop what is known as the sub-arid districts of Alberta.

Mr. Magrath's standing as an engineer may be gathered from the fact that he was appointed by the Dominion Government to the Canadian section of the International Deep Waterways Commission, which has for the object of its investigation the deep waterways forming the boundry between Canada and the United States. By his experience, ability and eminence, Mr. Magrath justifies his appointment to the Ontario Public Roads and Highways Commission, and upon its first organization meeting was elected chairman of that body.

Mr. A. M. Rankin, M. L. A.

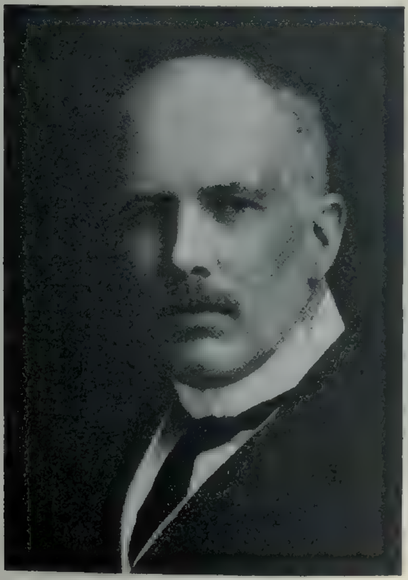
Another member of the Ontario Public Roads and Highways Commission is Mr. A. M. Rankin, M.L.A. for Frontenac County. Being actively interested in farming and milling operations near Collin's Bay, Ont., Mr. Rankin early turned his attention to the question of roads as a means of local transportation. For some time he has taken a very active interest in the improvement of the highways of his own county and in the general good roads movement. At the present time he is vice-president of the Good Roads Association, and it is largely owing to the activity of Mr. Rankin in this regard that the Provincial Government is, at this juncture, undertaking so large an expenditure for the improvement of roads and highways. Mr. Rankin has occupied a number of public positions, including that of reeve of the county of Frontenac, and at the last general election was elected member of the Provincial Parliament of Ontario.

Mr. W. A. McLean, C. E.

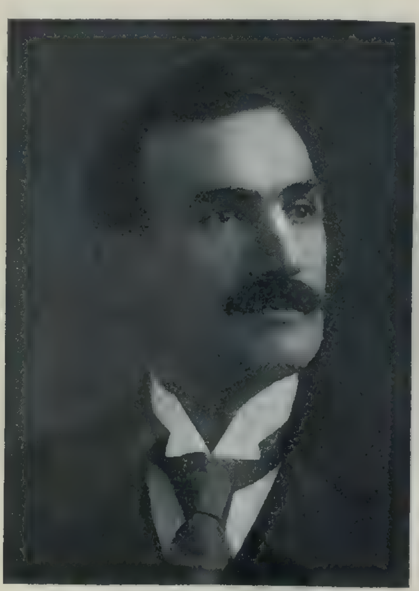
Mr. William Arthur McLean, C.E., is also a member of the new Public Roads and Highways Commission of Ontario. He entered the service of the Provincial Government in 1896 and was appointed to his present position in 1910. Mr. McLean was born at Belmont, Ont., and received his public school and collegiate education at Ingersoll, Strathroy and St. Thomas, and his university training at Toronto.

As a preliminary training in engineering work, Mr. McLean entered the office of the City Engineer of St. Thomas, where he obtained valuable experience and extensive practice in all phases of municipal work. For the last four years Mr. McLean has devoted himself to the conditions prevailing in the Ontario highways and is without doubt the best informed man on that question in the province. Mr. McLean is a member of the Canadian Society of Civil Engineers, the Association of Ontario Land Surveyors and the Engineers' Club of Toronto. He is also vice-president of the American Road Builders' Association and was a representative from Ontario at the recent International Good Roads Congress held in London. At the meeting of the Public Roads and Highways Commission Mr. McLean was elected secretary.

Reinforced concrete construction is just beginning to be used in Formosa. The capital city, Taihoku, is being practically re-built, 120 new business houses having been erected during 1912, and plans for 180 having been made for this year. Brick and stone are the more common materials, and are of local production. Concrete is gaining in favor, and it is expected that it will be used to a large extent in the future.



Mr. C. A. Magrath, C. E.



Mr. A. M. Rankin, M. L A.

Mr. W. A. McLean, C. E.

Canadian Railroad Development

Double tracking on the C. P. R. will be completed to Swift Current by fall, according to a statement made recently by J. G. Taylor, general superintendent of the Saskatchewan division of the C. P. R. The double track is now in operation, west as far as Chaplin, 54 miles, and east to Regina, 42 miles.

The Northern Construction Company recently began the work of building the Pacific terminals of the Canadian Northern Railway at Port Mann. This work comprises a turntable with an 80-foot clearance, a roundhouse with 15 stalls and a possible extension to 60, and repair shops 140 ft. x 312 ft.

Construction work on the warehouses to be built on the new Great Northern Railway dock on Burrard Inlet, near the B. C. Sugar Refinery, which is now fast approaching completion, is to be started at an early date. The contracts for the under-structure have just been awarded to the firm of Grant, Smith & McDonnell and material for the work is now being assembled ready for an immediate commencement.

The Minister of Railways has been asked to approve the plan for a new railway from the main line of the Canadian Pacific at St. Polycarpe Junction to the town of Cornwall, Ont., and the hearing on the route map application has been now arranged for. The company was incorporated last session under the name of the Glengarry and Stormont Railway, and the road is designed to serve several cross-country municipalities in those counties. It is about 30 miles long.

Stratford, Ont., is to have a new railway station. General Superintendent of Ontario Lines H. E. Whittenberger, and Industrial Commissioner Fitzsimons of the Grand Trunk Railway System, were in Stratford recently completing the arrangements for the new building, and the result is that a start on the construction will be made as soon as the materials are on hand. The new station is to cost $67,000, and will be a granite and pressed brick structure. It will be of a size that will meet the requirements of Stratford for some years to come and is to contain the offices of the officials of the Stratford division of the G. T. R.

The construction of the double track bridge across the Red River in Kildonan, on the Bergen cutoff, is being rapidly pushed forward. The substructure, which consists of seven piers and two abutments, is being put in by the Foundation Company of Montreal. These rest either on hardpan or solid rock. In some cases the concrete rests on the arch, and in others on the piles, the concrete in all cases being carried fifteen feet below the bed of the river. The superstructure will soon be commenced and is in the hands of the Dominion Bridge Company.

West Hartlepool, which lays claim to be the first municipal authority to produce electricity by means of waste heat, will open its new generating station in the course of two or three weeks. The two turbo-generators, each of 1,500 kilowatts, will be driven by exhaust steam from the furnace blowing engines of the Seaton Carew Iron Company, adjacent to whose works the station is built. In return for the exhaust steam, which has hitherto been blowing to waste in the air, the Seaton Carew Iron Company will receive free from the Corporation the supply of electric current needed for its works.

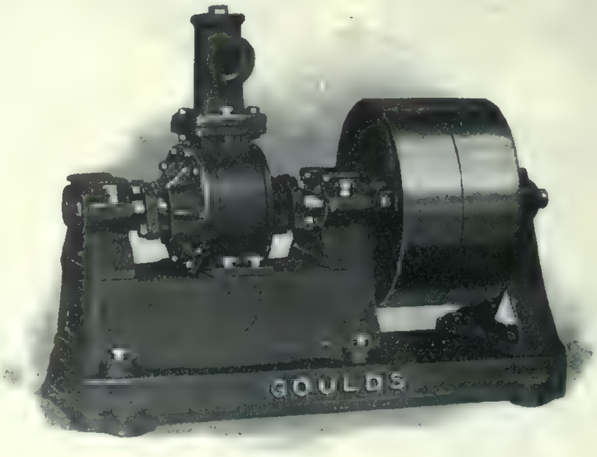
NEW ROTARY POWER PUMP

A new type of rotary power pump has just been developed by The Goulds Manufacturing Company, Seneca Falls, N.Y. This pump differs from the rest of the line of pumps of the same capacity in that gear style cams have been substituted for the three-toed cams used in the remainder of the line, as shown by one of the illustrations, and the gears on the end of the cam shafts have been eliminated.

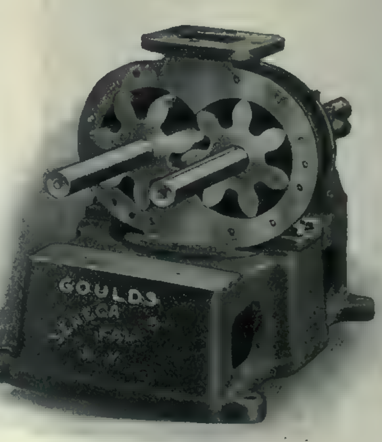
Two sizes are built: No. 1 has a capacity of 25 to 50 gallons per minute at 225 to 450 revolutions and No. 2 has a capacity of 50 to 100 gallons per minute at 225 to 450 revolutions. Both pumps are suitable for pressures up to 100 pounds or 230 feet elevation.

They are mounted on a cast iron bed plate, fitted with an outboard bearing and tight and loose pulleys for belt drive. The suction connection is made within the base directly beneath the case and is reached through hand holes in the base. No. 1 has two discharge openings, one tapped for pipe and the other threaded for hose couplings, No. 2 has three discharge openings, two fitted the same as No. 1, and the third fitted with an interchangeable blank flange. The suction is 3 inch on No. 1 and 4 inch on No. 2. Ths discharges are for 1½ and 2 inch pipe or hose respectively.

The Goulds line of pumps are for sale in Canada by The Canadian Fairbanks-Morse Company, Limited.



Goulds' new rotary pump.



Gear style cams.

CANADIAN PUBLIC HEALTH ASSOCIATION

The Third Annual Congress of the Canadian Public Health Association will be held in Regina, September 18th, 19th and 20th, 1913.

The following papers will be presented at the sectional meeting of Engineers and Architects, of which Mr. L. A. Thornton, B.A., B.Sc., City Commissioner of Regina, is Chairman;

(a) "Municipal Loans and Municipal Works," R. O. Wynne Roberts, M. Can. Soc. C.E., Consulting Engineer, Regina.

(b) "Hygiene of School Buildings, J. H. Puntin, L.R., I.B.A., Architect to the Regina Public School Board.

(c) "Results of Water Filtration at Saskatoon," Geo. T. Clark, B.A., A. M. Can. Soc. C. E., City Engineer, Saskatoon.

(d) "Sanitary Surveys of Rivers," J. R. Malek, C.E., Assistant Sanitary Engineer, Bureau of Public Health, Regina.

(e) "Sunlight in Cities," Theo. Brockmann, Dipl. Ingr. (Berlin), City Engineer's Office, Regina.

(f) "The Effect of Water Filtration; Biological and Chemical," H. W. Cowan, C.E., Toronto.

(g) Paper.—Title to be announced later, J. Antonisen, C.E., Superintendent, Brandon Municipal Railway.

(h) "Canadian Conditions Affecting the Design, Construction and Operation of Sewage Disposal Works," R. H. Murray, A.M. Inst. C.E., A.M. Can. Soc. C.E., Resident Sanitary Engineer, Bureau of Public Health, Regina.

In addition to the above, the following papers of particular interest to engineers will be presented at the general sessions:—

"The Smoke Problem," R. N. Blackburn, Wh.Sch., Chief Inspector of Steam Boilers for Saskatchewan.

"Standards With Reference to Sewage Treatment," T. Aird Murray, M. Can. Soc. C. E., Consulting Engineer, Toronto, Ont.

Engineers and public health officials intending to be present at the Congress, should notify the Local Bureau of Public Health, Regina.

Mainly Constructional

The News in Brief—From Coast to Coast

Plans for the $70,000 addition to the Windsor armory are practically completed and tenders will be called in the immediate future.

The John S. Metcalf Company, Limited, Montreal, have received a contract from the C. P. R. to make extensive alterations to elevator D at Fort William, Ont. The estimated cost is $50,000.

The Pacific Highway Association is accomplishing excellent work in improving the highways within its scope. Through its activity a continuous improved highway has been opened from the Mexican boundary to Hazelton, B.C.

An early beginning is to be made with the construction of the government dry dock at Levis, P.Q., the contractors being M. P. and J. F. Davis. It is estimated that the machinery required in the construction will cost about $2,750,000.

The Siemens Company is supplying 41 motors ranging from 185 h.p. downwards for the Acadia Sugar Refinery Company, Nova Scotia, in connection with the new plant. They are to be suitable for 3-phase, 60 cycle, 550 volt circuit.

The new building on Windsor street, Halifax, for St. Mary's College will be ready for the Christian Brothers by June, 1914. The plans are through and tenders are called for. The building will have a frontage of 90 feet, a depth of 38 feet and will be three storeys in height.

The town of Camrose, Alta., has displayed remarkable building activity during the past six months. Thirty-three new residences have been constructed and eleven new business houses. A new provincial Normal School and a government telephone building are well under way.

It will be necessary to flood 450 acres of land alone in Grantham township to build the new Welland Ship Canal, but this will be partly made up by 200 acres which the building of the new harbor at Port McCalla will create. The 450 acres will be expropriated. In and near Thorold, 27 acres will be back flooded, and one of the principal streets of the town will be largely used.

Owing to the higher cost of paving, the controllers of Montreal have asked for a further appropriation. The original estimates were based on prices that prevailed at the beginning of the season, when the city engineer secured the bulk of the work by underbidding the contractors. The city has now all the work it can handle, and did not compete for the last section of streets.

The Association of Metal Lath Manufacturers, Youngstown, Ohio, have issued a pamphlet containing the standard specifications for exterior plastering and showing the application of their product to this work. In these days where fireprofing is of the utmost importance and metals are taking the place of inflammable materials in construction, the metal lath is becoming a building material of great importance.

The Marine and Fisheries Department has decided to construct a new lighthouse on Main Duck Island, in Lake Ontario. The new building will have a steel and concrete tower and will be fitted with a powerful modern light. At present there is a light on the mainland, but the new light will afford a better guide. Tenders are being called, and it is proposed to have the lighthouse constructed before the season closes.

MacArthur Brothers Company, a firm of New York railway contractors, received the contract for the construction of the last section of the Kettle Valley Railway, which extends from the summit of the Hope range down the valley of the Coquitlam River to Hope, on the Fraser River, B.C. This section measures thirty-eight miles and includes some heavy rock work and will be completed by November 1, 1914, for something more than $3,000,000.

The recent excursion to Cleveland, Ohio, under the auspices of the Builders' Exchange of London, Ont., proved a most enjoyable outing. The excursion party, numbering in all about three hundred, left Port Stanley at 9 a.m. and arrived at Cleveland about 3 p.m. They were welcomed at the harbour by members of the Cleveland Builders' Exchange and conducted by street cars and automobiles to various points of interest in the city.

As a result of inspecting conditions in the west, Col. F. S. Meighen and W. W. Hutchison, president and vice-president respectively of the Lake of the Woods Milling Company, have decided that important extensions to their plant in the west are necessary in order to handle the growing business. Mr. Hutchison said last night that it was practically settled that another mill of large capacity would be built by his company in the near future, to cost $500,000.

Report comes from New York City that the Consolidated Gas Company found itself in possession of a building nineteen storeys high on either wing but only twelve storeys in the centre. The central part rests upon a foundation incapable of bearing the additional weight of seven storeys. The engineers in order to provide for the required seven storeys are throwing a bridge from one wing to the other and from this bridge intend to suspend a seven storey structure.

After an illness of only a few days Jacob Serson, provincial superintendent of bridges and resident of Kootenay for nearly 30 years, died last night in Nelson hospital. He was about 49 years of age. Mr. Serson joined the C. P. R. staff thirty-eight years ago and soon become noted for his work in bridge construction. About eight years ago he was appointed provincial bridge superintendent for British Columbia.

Mr. E. G. M. Cape, Montreal, has been awarded the contract for the construction of a new factory and office for the Imperial Wire & Cable Company, Montreal. The buildings have been commenced on the site at St. Patrick street. The factory and offices will comprise several structures, the principal being one of eight storeys. When completed, the factory will be one of the largest and best equipped in Canada. The machinery will all be run by electric power.

The new ferryboat Essex, built for the Detroit and Walkerville Ferry Company, for service between Walkerville and Detroit, will be delivered to her owners shortly by her builders. Much is expected of the new ferry towards relieving the congestion of passenger and vehicle traffic which exists both on the Walkerville and Windsor routes, especially when race meetings are held in Windsor. The Essex was built with a view to accommodating a full deckload of vehicles and as an ice crusher, and cost $75,000.

A catalogue on brick fireplaces issued by the Thomas Moulding Company, Chicago, has come to hand. The term catalogue is scarcely descriptive of this artistic booklet. A great variety in the design of fireplaces is shown and to each is given the name of some prominent English or American writer. There is a fitness in the name, too, as the fireplace seems to carry one back to some phase of the author's life. The catalogue contains considerable suggestive material for those who contemplate building.

For months the Canada Cement Company has been preparing plans and making preliminary arrangements for the construction of the huge 4,000 bbl. plant south of Medicine Hat. Over 100 men are now at work on this plant, and the number is being increased almost every day. The siding on the Crow's Nest Line has been named Delaine and a depot established there. Some idea of the immensity of this industry can be gained as the buildings will cover something more than twelve acres when completed.

Some very large contracts are about to be awarded by the government. Tenders for the Toronto Harbor Works, to cost six million dollars, and each requiring a deposit of $300,000, will be in on the 23rd. Proposals for the second contract on the Welland Canal, estimated at four million dollars, will be received on the 27th, and for the first section of the Severn River end of the Trent Canal on the 25th. Owing to the magnitude of the works and the large deposits required only large firms will be in a position to tender on the original contracts.

According to telegraphic advices received in Calgary from Edmonton recently, Calgary has been decided upon as one of the places at which the Dominion government will erect internal terminal elevators. The announcement was made at Edmonton recently by Minister of Public Works Robert Rogers, of the Dominion government. The elevator site is in East Calgary, where connection with the C. P. R., the C. N. R. and G. T. P. is convenient. The elevator is to be of 3,500,000 bushels capacity and will cost to erect in the neighborhood of $1,500,000.

Although the building permits taken out in Montreal show a considerable increase in value as compared with last year, there has been a decided falling off in actual construction. The demand for houses is greater than ever, and probably this class of building has not been affected to any extent by the monetary situation. It is the extensive schemes which have been held up, pending easier money. The supply houses have naturally felt the decline in the contracting trade, and there is not the shortage in materials which characterized last season's building.

The Dominion Engineering & Inspection Company of Montreal has been retained by Messrs. Ross & McDonald, architects, for the inspection of the structural steel and cement, for the Central Technical School and the Royal Bank Building, Toronto. The company has decided to establish a permanent branch in Toronto, under the management of Mr. C. A. Meadows, designing engineer for the Geo. B. Meadows, Toronto, Wire, Iron and Brass Works, Company, Limited, and will conduct a general inspection and cement testing practice there.

We desire to acknowledge the receipt of the Proceedings of the Ninth Annual Convention of the American Road Builders' Association. The report contains a number of very excellent papers upon many phases of road building, contributed by the leading roadway engineers of Canada and the United States. In these days when the question of road making is so much to the front and we are beginning to realize the importance of our highways as a means of intercommunication, much that will stimulate discussion and aid in the practical work will be found in this volume.

"Steam Power Plants" is the title of an unusually attractive forty-two page booklet recently published by Lockwood, Greene & Company, architects and engineers, for industrial plants, 60 Federal street, Boston. It describes in detail the construction and equipment of a few of the many well-known power plants designed by this concern. Unusually clear illustrations of both the exteriors and interiors of the plants are shown. Those interested in industrial power plant construction and equipment may obtain a copy of this booklet by addressing Lockwood, Greene & Company, 60 Federal street, Boston.

Paving contractors are so loaded with work in Toronto this year, that it is probable that a larger number of pavements than usual will have to stand over until next year. The city also has a large number of contracts on its hands, and Deputy Engineer Powell says that it has all it can handle until snow flies. The commissioner has made 734 recommendations of roadway works this year, and of that number 175 have been let and are under way. Three hundred and seventy-three have been completed in 1913, including 311 left over from last year. Sixty-two have been recommended and completed this season.

The Canadian Allis-Chalmers, Limited, Toronto, selling agents for the Foos Gas Engine Company, have issued Bulletin No. 89, descriptive of the engines manufactured by this company. The booklet is attractive in form and illustrated with a number of very clear cuts and contains excellent descriptions of the structural operation of these engines. The matter dealt with is the application of these engines to the driving of pumps both for irrigation and deep well work. Extensive tables are given showing the consumption, power and work done by the various sizes of these engines. The bulletin will repay close study.

The Neptune Meter Company, with main office at 90 West Street, New York City, have published a neat little booklet entitled, "Trident Reliability." The booklet contains cuts of some of the meters manufactured by the company and gives the principle upon which the company claims to operate, namely, to build a meter that will be accurate within close limits under all conditions of service and to make it so well that it will retain its accuracy over the largest period of time without any necessity of attention or repairs. The patent roller thrust bearing of the Trident disc piston which counteracts the thrust and eliminates the wear on the piston itself, is also described.

That tenders will be invited for the construction of the new armory at Victoria, B.C., which is expected to cost about $250,000 when completed, was announced recently. The armory is to be situated at the corner of McBride and Bay streets, and will provide twice as much accommodation as that now in use. It will be two storeys in height and will be provided, besides, with a basement. Its actual floor space, outside altogether of that taken up by the armories, staff quarters, etc., will be 200 x 100, which will give plenty of room for massed drills, etc. In the basement will be laid out miniature rifle ranges, a gymnasium, and other facilities for the training and entertainment of members of the corps.

A large crew of men is at work clearing the site of the Dominion Powder Company's plant a half mile north of Abbotsford, B.C., while contracts have been let for the erection of no less than ten concrete buildings in which the various safety powders will be manufactured and stored. Work of erection will start as soon as the site of ten acres is cleared, and Manager Israels expects to have one unit of the plant erected and in operation this autumn. This portion of the plant will manufacture stumping powder only, and the company expects to have its product in the hands of Fraser Valley ranchers before Christmas. Clearing operations and the erection of buildings and installation of machinery will keep a large crew of men busy here for some months.

With a view to provide accommodation for the large number of people who require temporary office accommodation, the General Agency and Information Bureau, Limited, have secured the eighth floor of "**La Sauvegarde**" Building, Notre Dame and St. Vincent streets, Montreal, one of the many fine office buildings recently erected in the business section of the city. A large number of offices has been provided on this floor and these may be rented by the day, week, month or a definite period as may be required. If an office is not desired, desk room in a common hall may be secured. The Bureau also provides information dealing with the financial firms, a board room, stenographer and typewriter, safety boxes, telephone and telegraph office, parcel office and many other conveniences to be found in the best equipped office buildings.

Tar spraying seems a very brief palliative of dust, though it is said that oil tar, being more liquid than coal tar, will penetrate a road surface and effect more durable benefit. The pneumatic tire called forth the aid of tar to prevent the suction effect of the tire as made manifest by the scabbing of the surfaces. But the original pneumatic tire had no steel studs such as now rasp up the road surfaces, perhaps as badly as the hoofs of the horse. We are at least beginning to learn that a road surface must be constructed on a strong foundation, that it should be more than broken stone closely packed, that its particles must have positive coherence or inter-adhesion, and that the surface must shed water, while a heavy wheel must not cause detrusion.

The government has returned his deposit check to Michael Sullivan, the Kingston contractor, who was the successful tenderer for the erection of new barracks at Long Branch, near Toronto. This cancellation of the contract has given rise to a rumor that new barracks will be built instead in Montreal, and the permanent force concentrated in that city. Inquiry at Ottawa elicited the information that the cancellation of the plans for the proposed new barracks at Long Branch does not mean that no buildings are to be erected there. On the contrary, it is officially stated here that the work will be pushed vigorously forward. The plans called for an expenditure of something like a million and a half, and provided accommodation for eight hundred to a thousand men. This scale was found to be much in advance of the requirement.

A big manufacturing industry is to be established in Ottawa by Mr. M. J. O'Brien, of Renfrew, in connection with his mining interests. A statement to this effect was made in a letter to the board of control in which he asks that the city sell him the end of Aberdeen street. Mr. O'Brien owns the property on both sides of this street which runs into the C. P. R. track, and he desires to acquire the street end so that he may erect a building running along the C. P. R. track for siding accommodation. In making the application for the street end the statement was made that Mr. O'Brien intends to concentrate the manufacturing end of his mining interests and instead of the plants in Eastview, Papineauville, and other places will have one large plant in Ottawa.

Three bridges constructed under the direction of the Massachusetts Metropolitan Park Commission were built with roadway surfaces of creosoted wood blocks. The three bridges are the Saugus River Bridge, the Wellington Bridge and the Western Division Bridge, the two former being pile bridges, each containing a movable span which is surfaced with a spruce plank floor, and the latter a plate girder. The sub floors of the two first named were composed of 6-inch hard pine covered with 1-inch of waterproofing. A 1-inch sand cushion was used in both instances. On the Saugus River Bridge 3-inch blocks were laid, while on the Wellington Bridge 4-inch blocks were used, the bridges being thrown open to travel in 1905 and 1904 respectively. The sub floor of the Western Division Bridge, which was completed in 1905, is composed of 4-inch planks, waterproofed on the surface, and 4-inch blocks laid on a 1-inch sand cushion form the wearing surface. The cost of the blocks and laying in the two first named bridges was about $2.25 per square yard. In the Western Division Bridge the cost of the blocks, including laying and waterproofing of the sub floor, was $2.75 per square yard. The Western Division and the Saugus River Bridges carry a pleasure vehicle traffic. The Wellington Bridge, however, is subjected to a heavy mixed traffic. In each instance the present conditions of the surface is said to be excellent and no maintenance work has been necessary.

Personal Mention

The general manager of the Boving Company of Canada, Mr. Henry F. Clayton, is making a business trip of a month's duration in the Canadian Northwest.

Mr. R. F. Uniacke, the chief engineer of the Transcontinental Railway, has completed his inspection of the bridges and general condition of the road as far west as Winnipeg and has returned to Ottawa.

Mr. J. G. McMillan, B.A.Sc., who for the past five months has been in the James Bay region for the Provincial Government of Ontario looking for suitable harbor location for the terminus of the T. & N. O. Railway, has returned to Toronto. The work of taking soundings in the bay has been completed.

James D. Robertson, formely sales manager for the Pittsburgh Valve, Foundry & Construction Company, has again assumed charge of the sales of this company, returning as second vice-president after two years' absence. During those two years Mr. Robertson successfully launched in business the Warren Tool & Forge Company, of Warren, Ohio. At the time of his withdrawal from the Pittsburgh Valve, Foundry & Construction Company, two years ago, Mr. Robertson had spent twenty-one years with that institution.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Calgary, Alta.
Engine house, cost $8,000, West, planned by City Council Waterworks Dept. Engineer, Geo. Craig. One storey, 236 x 56, brick and reinforced concrete construction, cement foundation, felt and gravel roofing, steam heating, motors and generators, engine, pumps, transmission.

Goderich, Ont.
Council has decided to lay a new water main on St. Andrew St., and contemplates laying another to the Wells Survey. Reeve, B. C. Munnings.

Montreal, Que.
Board of Control has asked for $19,000 to complete trunk sewer in Longue Pointe Ward. Sec., L. N. Senecal.

Sewer, cost $4,000, Outremont (Wiseman between Ducharme and C. P. R.), planned. Sec.-Treas., Mr. Sampson. Engineer, Mr. Duchastel, Town Hall. Tenders will be called shortly.

Montreal Tramways Co., A. E. Robert, president, will start work immediately on repairing roads in Lachine which are out of repair, over which tracks run. Sec.-Treas., H. Charette.

Paving, planned by Board of Commissioners. Sec., L. N. Senecal. Tenders submitted from following firms: Warner, Quinlan Asphalt Co., 745 St. Catherine W.; Sicily Asphaltum Paving Co., St. Viateur St.; Bitulithic Paving Co., 745 St. Catherine W., for asphalt paving, and The Canadian Creosote Co., for two streets to be paved with wood. Contracts not yet awarded.

Pump station, Lachine (Summerlea), contemplated by Town Council. Sec.-Treas., H. Carette. Site suggested and plans will be prepared.

Montreal South, Que.
Concrete roadway contemplated by Municipal Council. Board of Trade are taking active steps to have work started.

Sewage system planned by Municipal Council and Board of Trade.

The Board of Trade are taking active steps to have a waterworks system installed.

Oshawa, Ont.
Plans will be prepared shortly for sewers from Simcoe St. to Ross Corners. Clerk, Thos. Morris.

Pt. Edward, Ont.
Granolithic walks planned by Town Council. Clerk, Jno. F. O'Neil. Work will start at once.

Powassan, Ont.
Storm sewers, 1,400 feet, Main, Edward and Clark streets, planned. Clerk, L. G. Phillips.

Regina, Sask.
Centrifugal pumps for Light and Power Dept. Supt., E. W. Bull. General contractors, Canadian Allis-Chalmers Ltd., Winnipeg. For 2 vertical shaft, motor driven centrifugal pumps to operate against 22 ft. head, capacity 12,500 gals. per minute each.

St. Catharines, Ont.
Concrete sidewalks on Head, Hillcrest, Lake, Cherry, Wiley, Carlton, St. Paul, Calvin, Lisgar, Ontario and Crown Sts., planned. Cost $7,000. Clerk, J. A. Pay. Engineer, W. P. Near.

City Council plan 10 in. tile sewers in Myrtle and Division streets and Welland Ave. Cost $3,500. Clark, J. A. Pay. Engineer, W. P. Near.

Walkerville, Ont.
Tenders received by Clerk, Cecil H. Robinson, until September 2nd, for 10 lots of sewers. Plans, etc., on application to Owen McKay, engineer.

Brantford, Ont.
City Council plan sewers in 12 streets as recommended by Board of Health. Clerk, H. F. Leonard. City Engineer, T. Harry Jones.

Kingston, Ont.
Council passed by-law to lay asphalt block pavement on Wellington street from William street to the Park. Mayor, T. J. Rigney. Engineer, R. J. McClelland.

Leamington, Ont.
Council plans to pave Erie and Talbot streets. Material to be selected. Councillor Brown in charge.

Montreal, Que.
It is proposed to widen Notre Dame street from 60 to 80 feet for a distance of 2,000 ft. The Electric Service Commission will prepare report for underground conduits for this part of street. Board of Commissioners. Secretary, L. N. Senecal.

CONTRACTS AWARDED

Ingersoll, Ont.
Cement curbs and gutters on Thames street planned. Clerk, W. A. Smith. General contractor, Fred Hagen.

Islington, Ont.
Sidewalks planned by Twp. of Etobicoke. Clerk, J. A. MacPherson, Islington, Ont. General contractor, Walter Buckhurst, walks on Queen street at 98c per lin. ft. Scott & Fisher, walks on Fishers Road, Percy & Mellwood streets, at 66c per ft. and 85c per ft. at crossings.

London, Ont.
Pavements planned by Board of Works. Chairman, B. W. Bennett. Engineer, W. N. Ashplant. Work will be done by day labor.

Asphalt pavement, Horton, from Talbot to Wellington streets, on 2-in. concrete base, planned by City Council. Chairman, Board of Works, B. W. Bennet. Engineer, W. N. Ashplant. General contractors, Foley & Gleeson, Ottawa, $11,070.

Montreal, Que.
Roadway to Quebec City planned by Prov. Govt., Dept. of Public Works. Sec., Alphonse Gagnon, Que. General contractor, H. Beauregard, 70 St. James street, Montreal. Contract for twenty miles sublet to Alberto Dini, 421 Cadieux street, Montreal, from Charlemagne to Lavaltree. Sub-contractor has sublet to two contractors Milo and Costa of Mtl.

Contracts awarded to Henri Bertrand, 2727 St. Hubert, for sewers in Montcalm, $1,256, Tellier, $1,798, Chestnut, $1,040 and Duquette, $840.50. To Papuin & Dannoset for sewer in Grand Blvd., $3,180.80; to Z. Corbeau, 2502 Chateaubriand, for sewer in Clifton street, $3,304; to A. J. A. Chagnon, 1216 des Erables, for sewer in Regent street, $3.157, and St. Dominique street, $18,900, to Jno. H. Leahy, 123 Valois for sewer in Boyce, $7,580. Secretary, L. N. Senecal.

Brick sewer, cost $13,014, 111 yards, Outremont, Wiseman ave. Sec.-treas., Mr. Sampson. General contractors, R. T. Smith & Co., 175 Metcalfe ave. Engineer, Mr. Duchastel.

Ottawa, Ont.
Valves, etc., required by Waterworks Dept. Engineer, Archibald Currie, City Hall. Check valves. General Supply Co., 356 Sparks street. Gate valves, McDougall Ltd., 529 Sussex street. Steel tubes, Mannesman Tube Co., Ltd., Mont.

Intake pipe, cost $40,000, planned by City Council, Waterworks Dept. Mayor, J. A. Ellis. City Engineer, Archibald Currie. General contractors, Loamis McBean & William, Montreal, for lifting, repairing and relaying old and new intake pipes in Ottawa river.

Petrolia, Ont.
Sewage outlet, cost $3,915. Mayor Pollard. Engineer in charge, Mr. Jones. General contractors, Kettle, Jennings & Howlett.

Quebec, Que.
Roads—General contractors, Cairnie & St. George, C. P. R. Telegraph Building, Montreal, for roadwork between Quebec and Rousses Point. Prov. Govt., Dept. of Roads. Deputy Minister, B. Michaud, Quebec.

Thorold, Ont.
Pavements planned by Town Council. Mayor, Jno. Broderick. Clerk, D. J. C. Munro. General contractors, Asphaltic Concrete Company, 74 King E., Toronto. and Warren Bituminous Paving Co., of Ontario, Ltd., 103 Bay street, Toronto.

Winnipeg, Man.
Two turbine pumps, cost $13,590, planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractors, Canadian Allis-Chalmers, Ltd. Two No. 6

3-stage Mather & Platt patent high lift turbine pumps; two Escher Wyss tube, 3-stage single suction pumps.

Railroads, Bridges and Wharves

Amable, Ont.
C. N. R. Co.'s location of station at Amable, Ont., Twp. Pentland, Dist. of Nipissing, at mileage 188.5 from Ottawa, has been approved.

Calgary, Alta.
C. N. R. Co. has been authorized to construct spur for Hyman & Co.

Twp. of Carden, Ont.
County Council plan construction of reinforced concrete bridge across the narrows of Mud Lake, Twp. of Carden, Co. of Victoria. Steel will be purchased and supplied by the municipalities interested. Plans, specifications, etc., at office of County Clerk, Lindsay, Ont., who will receive tenders.

Coyle, Ont.
Toronto, Hamilton & Buffalo Railway Company has been authorized to construct bridge over the Welland River at Coyle, Ont.

Fraser River, B.C.
Dredging at the North Arm of Fraser River. Tenders received by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, until Sept. 30th. Plans, specifications, etc., at offices of C. C. Worsfield, Dist. Engineer, New Westminster, B.C., W. Z. Earle, Winnipeg, Man., J. S. MacLachlan, Victoria, B.C., U. L. Michaud, P. O. Bldg., Montreal, P.Q., J. G. Sing, Confederation Life Bldg., Toronto, and Postmaster at Vancouver, B.C.

Hawkesbury, Ont.
Grand Trunk Railway Company has been authorized to construct two branch lines to the premises of the Riordan Pulp & Paper Company.

Kincardine, Ont.
W. Mason, c/o A. Ingram, Juniper Knoll, contemplates erecting bathing houses, docks and building a new steam pleasure yacht.

Lindsay, Ont.
Railroad extension for C. P. R. Plans being prepared for building of a second track from near Lindsay station to the junction at the eastern end of the town, and the building of a cement wall along the Scugog River beside the line.

Montreal, Que.
G. T. R., McGill street, plan to widen top of Rockfield bridge, Lachine, 10 ft. each side and erect iron fence.

C. P. R. Co. has been authorized to construct spur into premises of the General Fire Extinguisher Co.

Norwood, Ont.
C. P. R. Co. has been authorized to construct bridge No. 5.7 over Hill street, Norwood, Ont.

Prince Albert, Sask.
C. N. R. Co. has been authorized to construct spur into premises of McKenzie Ellis & Co.

Pitt River, B.C.
Wharf planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Will be built one mile above C. P. R. bridges, have one approach 180 ft. long and be 40 x 60.

Toronto, Ont.
C. P. R. Co. has been authorized to make alterations to foot bridge at Wallace ave., to carry it over the third track which the C. P. R. is now constructing from Parkdale to West Toronto.

Vails' Point, Ont., Grey Co.
Tenders received by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, until Sept. 15th for construction of wharf at Vails' Point. Plans, specifications, etc., at offices of J. G. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, J. H. Armstrong, Dist. Engineer, Midland, Ont., Postmaster at Vails' Point and Dept., Ottawa.

Wallaceburg, Ont.
Freight sheds, cost $6,000, for Chatham, Wallaceburg & Lake Erie Railway. Manager, Wm. Norris, Chatham. One storey, white brick construction. Plans in progress.

Winnipeg, Man.
C. P. R. Co. has been authorized to construct spur for J. Gunn & Sons.

CONTRACTS AWARDED

Cardigan Bridge, P.E.I.
Bridge, cost $4,000. Prov. Govt., Dept. of Public Works. Secretary, L. B. McMillan, Charlottetown. General contractors, MacKinnon Holmes & Co., Drummond Road, Sherbrooke, Que. Two spans, 80 x 16 ft., 4 ft. sidewalk. Creosoted pile substructure and steel superstructure.

Chesley, Ont.
Contract for cement abutments for Boundary line bridge awarded to David Keys at $5.20 per cu. yd. Steel bridge with floor awarded to Hunter Bridge Co., $2,150. S. K. Ewart, Reeve, Chesley, Ont.

Edmonton, Alta.
Addition to C. N. R. freight sheds, cost $6,500. Company's architect prepared plans. General contractors, Duncan & MacDonald, C. N. R. One storey, 40 x 200, frame construction, cement block foundation. Foundations started.

McCann, N.S.
Dam for the Maritime Railway & Power Company. General contractors, The Ambursen Hydraulic Construction Co., Ltd. New Birks Bldg., Montreal, Que.

Mulgrave, N.S.
Dredging, cost $11,600, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, the Coastal Dredging Company.

Province of Ontario.
Double tracking railway from a point near Islington to Guelph Jct., planned by C. P. R. General contractors, Johnson & Girouard, Ottawa.

Prince Albert, Sask.
Dam planned by City Council. General contractors, Ambursen Hydraulic Construction Co., New Birks Building,

Peterboro, Ont.
Two concrete bridges, cost $6,750, McDonnel and Park street, planned by City Council. Chairman, Board of Works, Wm. Buller. Engineer, R. H. Parsons. General contractor, W. H. Lytle.

Quebec, Que.
Dry dock, Lauzon, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, M. P. & J. F. Davis, 14 St. Peter street. Excavations 65 ft. deep by 1 ft., 200 x 60, will have to be made through solid rock. Contractors may require machinery for drilling, also steam shovels, etc.

Swift Current, Sask.
Dam, cost $86,000, planned by Town Council, Secretary, Geo. D. Arnott. Engineer, Geo. D. Mackie. General contractors, Ambursen Hydraulic Construction Co., 823 New Birks Bldg., Montreal. Work will be done on percentage basis. Tenders will be called shortly for pipe line, estimated cost $10,000. Contingencies, etc., $8,000.

Walkerton, Ont.
County Council plan general repairs to bridges damaged by floods. General contractor, A. G. Hampson.

Public Buildings, Churches, Schools, etc.

Athabasca, Alta.
Town Council will erect hall for immediate occupation, constructed so that it may be utilized for fire hall when a modern town hall is erected. Cement construction.

Calgary, Alta.
Elevator, cost $1,500,000, planned by Dom. Govt., Dept. of Trade & Commerce. Deputy Minister, F. C. T. O'Hearn, Ottawa. Will have capacity of 3,500,000 bushels.

Chesley, Ont.
Interior fittings for post office. Tenders received by Secretary, R. C. Desrochers, Ottawa, until Sept. 4th. Plans, specifications, etc., at offices of W. Halliday, Clerk of Works, Chesley, T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and Department of Public Works, Ottawa.

Dresden, Ont.
Tenders received by Secretary, Thos. Convay, until noon, Sept. 2nd, for erection of Carnegie Free Library. Plans, specifications, etc., at office of architect, W. A. Mahoney, Guelph.

Fort William, Ont.
Armory, Walsh street, planned by Dominion Govt., Dept. of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. Two storeys and basement, 243 ft. 9 in. x 140 ft. 10 in., brick construction. Hardware floors, rifle range, bowling alley. Plans, specifications, etc., at office of City Clerk and Department, Ottawa. Tenders received by secretary till Sept. 4th.

Goderich, Ont.
Addition and alterations to "Red Star" Moving Picture Theatre planned. Seating required. David Brown, owner.

Medicine Hat, Alta.
Church residence, cost $5,000, Ottawa St., for Methodist Church. Pastor, Rev. J. W. Morrow. Architect, G. Fisher, 90

Ottawa street. Two storeys, 30 x 40, brick, cement foundation. Plans drawn.

Montreal, Que.
Church for Notre Dame de Grace Methodist Congregation. Pastor, A. S. Doggett, c/o Rev. W. E. Baker, 48 Arlington street. Plans in progress.

Tenders received by secretary, R. C. Desrochers, Ottawa, Dom. Govt., Dept. of Public Works, till Sept. 8th, for addition to fittings for Postal Station "B" Plans, specifications, etc., at offices of R. L. Deschamps. Overseer, M-1 Central Post offices and Dept., Ottawa.

Dom. charter has been granted to the Arcade Film Theatre Ltd. Interested, M. J. McLaughlin, 106 St. Matthews St. Capital $25,000. To construct theatres, etc.

Alterations to convent, cost $27,000, Outremont, 314 St. Catherine Rd., for Soeurs Missionaires de l'Immacules Conception, 314 St. Catherine Rd. Architect, Chas. Chausse, 17 Pagnuelo. Carpenter, Jos. Collette, 202 Chateauguay. Roofing, heating and plumbing, D. Benoit, 1975 St. Lawrence. Private tenders called for plastering and painting. Contract to be awarded about Sept. 6th.

Church and presbytery planned by English Catholic Church Congregation of Verdun. Rev. Mr. McDonald, 48 Church.

Fire station, Lachine, Dominion Park, planned by Town Council. Sec.-treas., H. Charette.

Church, Fullum, for Parish of St. Eusebe, c/o Rev. H. J. Robillard, 641 Fullum. Architect, Beaubien Champagne, Ecole Polytechnique, 228 St. Denis. Tenders will be received by architect this week for work only, part material supplied. 70 x 90 x 250.

Boiler house, Point St. Charles. Tenders submitted as follows: J. L. Simmons, 538a Lasalle Rd., $6,225. Thos. Wand, 326 Laval ave., $6,576; East Construction Co., $7,605. Murray & McRitchie, 20 St. Nicholas, $8,400.

Post office fittings. Tenders received by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, till Sept. 4th, for addition to registration office, fittings and furniture for Central Post Office. Plans, etc., at office of R. L. Descamps, Overseer of Public Bldgs., Montreal, and Dept., Ottawa.

Garbage reduction plant planned. R. S. Lea, New Birks Bldg., Montreal, is preparing a report for Board of Control for a more economical disposal of city's garbage, capacity over 700 tons per day. Secretary, L. N. Senecal.

Moose Jaw, Sask.
Elevator planned by Dom. Govt., Department of Trade & Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa, Ont. Tenders received until September 8th. Plans at office of Dept. and from Board of Grain Commissioners, Fort William.

Ottawa, Ont.
Addition to Carnegie Library, Metcalfe, contemplated. Chief Librarian, W. J. Sykes. Mayor, J. A. Ellis. To knock out wall and extend reading and reference rooms. Plans in progress.

Addition and alterations to church, cost $4,400, Lower Town, for Roman Catholic Corporation of Ottawa. Architect, Chas. Brodeau, 63 Alma street, Hull. Brick construction and foundation. Plans in progress.

Regina, Sask.
Theatre, Broad and 11th ave., for Geo. Broder, Victoria ave. 75 x 125, brick and stone construction. Plans in progress.

Saskatoon, Sask.
Terminal elevator planned by Dominion Govt., Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa, Ont. Tenders received until Sept. 8th. Plans at office of Dept. and from Board of Grain Commissioners, Fort William.

Toronto, Ont.
Heating, plumbing, ventilating and electrical work in Deer Park School. Tenders received by Sec.-treas., W. C. Wilkinson, Board of Education, until August 29th. Plans, specifications, etc., at office of Supt. of Buildings, City Hall. Chairman of Comm., W. O. McTaggart.

Tenders received by Sec.-treas., W. C. Wilkinson, Board of Education, until Aug 29th, for construction of new school building on Homewood ave. Plans, specifications, etc., at office of Supt. of Buildings, City Hall. Chairman of Committee, W. O. McTaggart.

Victoria, B.C.
Museum planned by Prov. Govt., Department of Public Works. Minister, Hon. Thos. Taylor. Architect, F. M. Rattesbury, 621 Sayward Bldg. Four storeys, 90 x 260, structural steel and stone construction. Site has been secured.

Winnipeg, Man.
Tenders addressed to A. Johnston, Deputy Minister of Marine & Fisheries, will be received until Sept. 12 for construction of Range Light Towers at the mouth of Red River (new channel). Plans, specifications, etc., at the Dept., Ottawa, and Selkirk, and post offices, Selkirk, Winnipeg, St. Boniface and Gimli.

CONTRACTS AWARDED

Blackstock, Ont.
Drill Hall, cost $12,500, planned by Dom. Govt., Dept. Militia & Defence. Secretary, E. F. Jarvis, Ottawa. General contractor, W. A. Tom, Collingwood, Ont.

Brockville, Ont.
Nurses' Home, cost $63,500. Provincial Govt., Dept. Public Works. Secretary, H. E. McNaughton, Toronto. General contractor, W. P. Driscoll. Three storeys, brick construction. Foundations in.

Addition to school, cost $2,500, New West Ward School. General contractors, Parslow & Horton. Plumbing and heating, Geo. Ross & Co. Two storeys. D. Spidal, Chairman School Board.

Addition to Old West Ward School, cost $3,000. Chairman, Dom. Spidal. General contractor, Fred Clow. Heating and plumbing, Geo. Ross & Co. Two storeys.

Edmonton, Alta.
School, cost $150,000. Secretary, M. Brady. Architect, G. E. Turner, Mortlake Block. General contractors, Read, MacDonald & Brewster, Tegler Block. Heating and plumbing, Edmonton Sheet Metal Works, 3rd street. Electrical work, Burnham Frith Electrical Co., Rice street. Stone, Bedford Limestone Co., Bedford, Indiana.

School, cost $3,500, Norwood Extension. Sec.-treas., Mr. Bradey. Architect, Mr. Turner, Mortlake Block. General contractors, Geary & Jamieson, 622 1st street. Two storeys, fireproof construction. Foundations in.

Hamilton, Ont.
Addition to school, cost $5,000, Dundas Road, planned by Twp. School Bd. Architects, Rastrick & Son, 31 King St. E. Mason, Wm. Aldridge, 28 Hunt St. Carpentry, Jno. Mills, 167 Herkimer St. Roofing, M. V. McLean, 314 Hess St. S. Painting, C. King, 32 Caroline N. One storey addition, 67 x 40, brick constr.

Indian Head, Alta.
Drill Hall, cost $13,700. Dom. Govt., Dept. of Militia & Defence. Secretary, E. F. Jarvis. General contractor, Jas. McDiarmid, Winnipeg.

Marysville, N.B.
Church, cost $7,000, for Methodist Congregation. Pastor, Rev. Thos. Hicks. General contractor, Alfred C. Higgs, Nappan, N.S. Foundations in.

Moncton, N.B.
Church, cost $52,200, Queen & Church, for First Moncton Baptist Congregation. Architect, Secretary of Trustees, W. H. Chappell, Charlottetown, P.E.I. General contractor, J. M. Clark, New Glasgow, N.S. 135 x 100, Sackville sandstone, brick construction.

Montreal, Que.
Repairs to Medical Bldg., cost $5,000, for McGill University, c/o M. Vaughan. General contractor, Geo. Roberts, 79 Lagauchetiere W.

Fire station No. 25, cost $50,000, Drummond, planned by Board of Commissioners. Fire Chief, Mr. Tremblay. Architects, Cox & Amos, E. T. Bank Bldg., St. Catherine St. W. General contractor, masonry, carpentry, plastering and painting, E. G. M. Cape, New Birks Bldg. Steel, Dom. Bridge Co., Dom. Express Bldg. Roofing, Richardson, Simard & Co., 745 Clarke. Heating and plumbing, J. J. Briard, 1277 St. Dominique. Electrical work, Phillip Lahee & Co., 20 St. Nicholas. Marble and tile, Robt. Reid, 125 St. Alexander.

Ottawa, Ont.
Parish Hall, cost $18,000, Percy and 4th ave., for Roman Catholic Corporation of Ottawa. Rev. Father Whilan, Nepean street. Architect, A. L. Weeks, 75 Sparks street. General contractors, Fairley & Cosgrove, 562 Rideau Hall in connection with church.

Addition to Citadel No. 1, cost $7,000, Slater, for Salvation Army. Architect, Major Miller, Toronto. General contractors, McDermott & Tyndall, 243 Flora.

Peterboro, Ont.
Incinerator planned by City Council. Chairman, Board of Works, Wm. Buller. Engineer, R. H. Parsons. General contractors, the A. H. Reid Incinerator Co., Toronto. To be erected on north side of Townsend street between Aylmer and George streets.

Regina, Sask.
Addition to general hospital, cost $88,107. Clerk, A. W. Pool. Architect, N.

R. Darrach. General contractor, R. J. Lecky Co., Ltd., Northern Crown Bank Bldg. Four storeys, brick and stone construction, brick and concrete foundation.

Revelstoke, B.C.
School, cost $44,000, planned by the Board of Education. General contractor, O. W. Abrahamson.

Stratford, Ont.
Fair Bldg.; cost $10,000, Britannia, for North Perth Agricultural Society. Secretary, Jas. Stewart, Downie street. Architect, T. Hepburn, Downie street. General contractor, W. Bradshaw, Water St. Main Building, 80 x 80, grandstand 70 ft. frontage, steel construction, seating capacity 600. Foundations in.

St. John, N.B.
Post office planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, G. E. Fairweather, 13 Germain street. General contractors, Rhodes Currey Co., Amherst, N.S. Steel work will start in about two weeks. Foundation will not be put in until spring.

St. Thomas, Ont.
Interior fittings for post office. General contractors, Hall & Dollery Electrical Co., 848½ College street, Toronto. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa.

Sudbury, Ont.
Public building, cost $98,200, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Doran & Devlin, Eastern Block, Ottawa.

Toronto, Ont.
Market building, St. Patricks, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Teagle & Son, 55 Boswell avenue.

Abattoir equipment, cost $108,376, required by Board of Control. Mayor, H. C. Hocken. General contractors, W. R. Perrin & Co., 530 King St. E.

Winnipeg, Man.
Church, Qu'Appelle street, for Knox Presbyterians. Pastor, Rev. Dr. F. P. DuVal. Architect, J. H. G. Russell, 1110 McArthur Bldg. General contractors, J. McDiarmid Co., Ltd., Canada Bldg. Foundations and retaining wall will be completed this year, the remainder next.

School for Rural Municipality of St. Vital. Secretary-treas., Jno. Edmond, Grand Vital. Architects, Hooper & Davis, Confederation Life Bldg., Winnipeg. General contractors, Modern Construction Co., Sterling Bank Bldg., Winnipeg. By-law passed authorizing municipality to start with work. Two stys., 40 x 60. Excavating started.

Fire station, cost $43,780, planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractors, Willoughby Kelso Company.

Theatre, Market street, owned by Patterson & Cass, Canada Bldg. Architect, G. W. Northwood, Northern Crown Bank Bldg. General contractors, masonry, carpentry and plastering, J. McDermott & Co., Canada Bldg. Steel, C. C. P. Turner Co., Canada Bldg. Electrical work, Cowan & Levy, Portage ave. Terra cotta, T. Gross, Electric Railway Chambers. Painting, heating, plumbing and interior fittings not yet let.

Woodstock, N.B.
Library and Agricultural School planned by Estate of L. P. Fisher. Trustee, Allison B. Connell, Woodstock. Architect, G. E. Fairweather, 13 Germain St., St. John. General contractor, J. Fred Ryan, Fredericton, N.B.

Business Buildings and Industial Plants

Berwick, N.S.
Office building, cost $5,000, for United Fruit Co. Manager, S. B. Chute. Two storeys, brick construction. Plans in progress.

Cedar Springs, Ont.
Warehouse, cost $7,000, contemplated for J. S. McGingan. Architect not yet chosen. To be used for storage and manufacturing of tobacco. Fireproof construction, corrugated iron or asbestos roofing.

Clayburn, B.C.
A. F. McLaren, c/o McLaren Cheese Co., Toronto, plans to erect ten milk factories in the Province of British Columbia, the first one to be at Clayburn.

East Oakland, Ont.
Cattle and implement buildings, cost $5,000, for Wm. Harkness, West River Road, Galt P.O. Fireproof construction, concrete and stone foundation. Plans in progress.

Kelvin, Ont.
Cattle building, cost $3,000, for Jacob Roswell. Fireproof construction, stone and concrete foundation. Plans in progress.

London, Ont.
Factory, cost $15,000, planned for Battle Creek Toasted Corn Flakes Co., Ltd. President, A. A. Campbell. Architect not yet chosen. Company will add one and possibly two new buildings to plant.

Montreal, Que.
Addition to glove and leather factory contemplated by F. Galibert, 580 Parthenaia street. Plans in progress.

Fire alarm factory, cost $100,000, contemplated for the Argus Fire Alarm Co., Ltd., 54 Notre Dame E. Architect not yet chosen. Officers: Alex Guenette, Lachine; Anslem Guenette, St. Jerome; L. Cadieux de Courville, 94 Pontiac street; J. E. Moranville, 54 Notre Dame East; Henri Guenette, 54 Notre Dame East.

Repairs to warehouse, cost $15,000, planned for Caverhill, Learmont & Co., 89 St. Peter street. Elevator shaft, roof, interior woodwork and plaster badly damaged recently by fire and water. Will repair at once.

Grain elevator contemplated by the Canadian Producing Co., 950 Rivard St. Plans in progress.

Medicine Hat, Alta.
Factory planned for Western Canada Threshing Machine Co., Ltd. President, J. E. Davis. By-law providing site, concessions, etc., will be submitted in return for which company will erect large factory for the manufacture of farm implements.

Nanaimo, B.C.
Hotel building planned by A. Henderson, Globe Hotel. Architect, Alex. Forrester, Wentworth. Three storeys, brick, concrete foundation, cement floors, pool room. Tenders will be called.

Ottawa, Ont.
Factory, Aberdeen, contemplated by M. J. O'Brien, Raglan St., Renfrew, for the manufacture of mining tools, equipment, etc. Concrete foundation, solid brick construction. Plans in progress.

Point Edward, Ont.
Grain elevator contemplated for Grand Trunk Railway. Concrete and steel construction. Plans in progress.

Regina, Sask.
Boot and shoe factory, cost $55,000, contemplated for W. G. Downing Co., Ltd. Architects, Storey & Van Egmond, Credit Foncier Bldg. Brick and stone construction, brick foundation, electric lighting, machinery (shoe), cost $15,000. Plans in progress.

Sombra Twp., Ont.
Farm buildings, cost $3,500, for Geo. Catton, Con. 8, Sombra, Courtright P.O. Fireproof construction, stone foundation, corrugated iron or asbestos roofing. Plans in progress.

Summerland, B.C.
Hotel for Roe Bros. 60 x 60, pool room, 12 sleeping apartments. Plans in progress.

Tilbury, Ont.
Plant, cost $20,000, contemplated by Canadian Auto Top Co. Architect to be selected. Two storeys, white brick construction.

Wilberforce, Ont.
Tonkin-du-Pont Graphite Co. has been incorporated to build and operate mills for refining of graphite, etc. Capital $125,000. Secretary, H. G. Tonkin.

CONTRACTS AWARDED

Calgary, Alta.
Stores, cost $4,000, Mt. Pleasant, for R. McMann, 1010 5th St. N. E. Builder, R. Patterson, 4th ave. N.W. Two stys., 22 x 45, frame and brick construction. Excavating done.

Warehouse, cost $4,000, Industrial Heights, for Ogilvie Flour Mills, Ltd., Medicine Hat. General contractor, R. O. Benell, General Delivery. One storey, 30 x 140, frame construction. Excavating started.

Fort Erie, Ont.
Garage, cost $4,000, Niagara street, for Mrs. H. T. Sewell. General contractors and architects, Troupe Bros. Masonry, A. D. Nie. One storey, 50 x 60, artificial stone construction, cement foundation. Excavating started.

Halifax, N.S.
Foundry, cost $9,350, Campbell Rd., for Hillis & Son, Ltd., Campbell Road. General contractor, E. J. Horne, 255 Agricola street. Two storeys, 90 x 44, cement foundation, reinforced concrete construction, felt and gravel roofing.

Hamilton, Ont.
Cattle byres, cost $10,000, Terra Cotta ave., for the Harris Abattoir Co., Ltd., Strathcona ave., Toronto. Plans ready. Work being done by owners.

Additions and alterations to restaurant cost $3,000, King street, for H. L.

Bowles, 149 Yonge St., Toronto. General contractor, Samuel Howard, Mary Street. White enamel brick, tile floors, store front, billiard room, brick bakery in rear.

Foundry and storage warehouse, Clark street, for Otis-Fensom Elevator Company, Victoria ave. north. Architects, Stewart & Witton, H. P. & L. Bldg. Mason, W. H. Cooper, 67 York street. Two storeys and basement, 200 x 45, 100 x 70.

Alterations and addition to store, cost $15,000, James St. N., for M. & S. Epstein, Dom. House Furnishing Co., 120 James St. N. Architect, W. A. Edwards, 7 Hughson St. S. General contractors, Geo. E. Mills, King St. E. Three stys., 70 x 100.

Store, cost $2,500. Owner and builder, E. B. Ratcliffe, 534 Main St. Concrete foundation. Permit issued.

Indian Head ,Sask.

Grain warehouse, cost $15,000, for Angus MacKay Farm Seed Co. General contractor, A. B. Hamilton, Eden street.

Kentville, N.S.

Store and residence, cost $5,000, for Jno. Redden. Work done by day labor. Two storeys, brick veneer construction. Store fixtures required. Foundations in.

McAdam Jct., N.B.

Machine Shop, cost $45,000, for C.P.R. Engineer, Geo. Wetmore, King St., St. John. General contractor, Hy. Post, Woodstock, N.B. Concrete addition will also be asked, 25 x 40.

Montreal, Que.

Alterations and addition to store, cost $3,000, St. Catherine W., for Guarantee Pure Milk Co., 675 St. Catherine W. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, Reid, McGregor & Reid, 14 Guy Block. Heating and plumbing, Jno. A. Gordon, 301 St. Antoine.

Addition and alterations to three stores and three flats, cost $10,000, Bleury. Builder and general contractor, J. E. Wilder, 41 Mayor. Work to be done by day labor. One storey, 40 x 60, cement foundation, reinforced and brick constr. Foundations started.

Office, etc., cost $1,800,000, St. Patrick, for Imperial Wire & Cable Co., 241 Guy street. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractor, E. G. M. Cape, New Birks Bldg. Steel, Dom. Bridge Co., Lachine.

Warehouse, O'Connell. Owners and general contractors, the Grasselli Chemical Co., 102 Nazareth street. Architects, Grasselli Chemical Co., Ottawa Street, Hamilton, Ont. One storey, 61 x 120, cement foundation, brick construction, felt and gravel roofing.

Lumber mill, cost $25,000, 400 William street, for F. Tremblay & Co., 400 William street. Owner will purchase all materials for erection of new building. Some machinery required. Two storeys, brick veneer construction. Work done by day labor.

Steel works, cost $1,000,000, Longueuil, for Sir W. S. Armstrong, Whitworth & Co., Ltd., c/o M. J. Butler, 22 Victoria Sq., Montreal. General contractor, E. G. M. Cape, New Birks Bldg. Mill work, Pringle & Co., Ltd., Belleville, Ont. Roofing and sheet metal, the Metal Shingle & Siding Co., 91½ Delorimier ave. Excavating started.

Greenhouse and conservatory, cost $25,000, for L. H. Timmins, Dom. Express Bldg. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, Reid, McGregor & Reid, Guy Block, St. Cathcart W. Stone foundation and construction. Excavating started.

Structural steel works, cost $3,300. General contractors, International Marine Signal Co., Ltd., Albert and Wellington streets, for furnishing and erecting of 11 steel trusses for buildings at low level pumping station, Atwater ave.

Factory, cost $50,000, 1604 Clarke, for L. H. Timmins, Dom. Express Building. General contractors, Atlas Construction Co., 37 Belmont. Painting and glazing, E. Gross, 98 Inspector. Four storeys, 100 x 100.

Office, etc., cost $11,800, St. Patrick, for Imperial Wire & Cable Co., 541 Guy street. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractor, E. G. M. Cape, New Birks Bldg. Steel, Dominion Bridge Co., Lachine.

Merchants Bank, cost $25,000, St. Zotique, head office 205 St. James street. Architects, Hogle & Davis, 30 St. Francois Xavier. General contractors, Jno. Stewart & Co., Bethune street. Sub tenders will be received shortly by general contractor. Two storeys and basement, 44 x 41.

Garage, cost $4,000, for Bank of Montreal, 109 St. James street, Montreal. Architects, Peden & McLaren, 20 St. Alexis street. General contractors, Reid, McGregor & Reid, Guy Block. Electrical work, Geo. Charwin, 226 Iberville.

Bank building, cost $4,000, St. Lambert, for Royal Bank, 147 St. James. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractor, Wm. Irving, Guy Block. Two storeys, 25 x 40, cement foundation, brick construction.

Ottawa, Ont.

Addition to office for Metropolitan Life Insurance Co., Queen street. General contractor, Alex. Christie, Elgin street. Brick construction.

Quebec, Que.

Woodworking factory, Limoilou, 10th ave., planned for E. T. Nesbitt, 18 Queen street. All work done by day labor. Machinery required.

Regina, Sask.

Office building, cost $15,000, Scarth, for Canadian Financial Corporation. General contractor, H. Black, new Black Block. Two storeys, brick construction, brick and concrete foundation. Foundations in.

Toronto, Ont.

Warehouse, cost $30,000, St. Nicholas street, for M. Rawlinson, Ltd., 612 Yonge street. General contractor, R. Robertson, Confederation Life Bldg. Brick construction and foundation, felt and gravel roofing.

Vonda, Sask.

Cold storage warehouse planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Henry Garvin.

Windsor, Ont.

Store and flats, cost $8,000, Gladstone, for Fred Laforet. General contractor, H. Howe. Two storeys, brick construction and foundation.

Store, cost $5,000, Pitt. Owner and builders, T. W. Brooke & Son, 7 Pitt St. W. Two storeys, 20 x 65, brick construction, cement foundation.

Winnipeg, Man.

Addition to stables, cost $50,000, for Canada Bread Co., Portage ave. and Barnell. General contractors, Grey & Davidson, Wall and Portage streets.

Alterations to office building, Portage ave., for Mrs. J. V. Chalmers, 57 Carlton street. Architects, Jas. Chisholm & Sons, Enderton Bldg. General contractors, Fred Lewis Co., Somerset Bldg. Five storeys, 20 x 30, concrete foundation, brick construction. Canada Furniture Co., Builders' Exchange, are making the alterations and will occupy the building when completed.

The contract for the solid bronze grille work and cages for the new addition to the Bank of Ottawa, Winnipeg, Man., has been awarded to the Geo. B. Meadows Wire Iron & Brass Works Co., Ltd., Toronto. Geo. Northwood, architect.

Woodstock, Ont.

Warehouse for Geo. E. Barbour Co., Ltd., North Market Wharf, St. John. Architect, F. Neil Brodie, 42 Princess St. General contractor, Fred Ryan, Fredericton, N.B. 1½ storeys, 40 x 80. Foundations in.

Residences

Montreal, Que.

Ten flats, cost $5,000. Owner and builder, Alderic Jolinqolieur, 2764 Diolet. General contractor will call private tenders. Three storeys, 30 x 50, concrete foundation, brick construction.

Residence, cost $10,000, Outremont (Outremont), for G. N. Clarmont & Co., 97 St. James street, Montreal. Architect, J. A. Ouellette, 250 Amherst street, Montreal. Two storeys, 44 x 42, stone foundation, brick construction. Plans drawn.

Twelve flats, cost $12,000, De Villiers. Architect and builder, Russell Aubertin, 44 Blvd. Monk. Tenders received by owner for masonry, heating and plumbing. Other work done by day labor. 3-storeys, 75 x 40, concrete foundation, Montreal stone construction, felt and gravel roofing.

Ottawa, Ont.

Residence, cost $6,500, Daly ave., for T. A. Armstrong, 384 Wellington street. Architect, F. C. Sullivan, Castle Bldg., Queen street. 2½ storeys, brick construction, stone foundation. Plans drawn.

Residence, cost $6,500, Daly avenue, for Mrs. Catherine Whelans, c/o architect, F. C. Sullivan, Castle Bldg, Queen street. 2½ storeys, brick construction, stone foundation. Plans drawn.

Regina, Sask.

Residence, cost $5,000, Garnet. Owner and general contractor, F. Bruce, Garnet Street. 2½ storeys, brick construction, concrete foundation. Foundations in.

Toronto, Ont.

Three residences, cost $15,000, High Park ave. Owner and general contractor, S. Solodinsky, 2122 Dundas street., will receive tenders. 2½ storeys, brick construction and foundation.

Four detached residences, cost $16,000, Lauder ave., for Dr. F. A. Sellery, 530 Bloor west. 2½ storeys, 17 x 42, brbick construction, stone foundation. Plans drawn.

Forty-eight residences, cost $2,000 to $2,500 each, Sandown Park Estate, stop 33, Kingston Road, contemplated by A. Gordon, c/o Toronto Canadian Land Ltd., 41 Adelaide E. Brick construction, stone foundation. Company capitalized at $48,000. Building to commence in fall. Grading, sidewalks, etc., about completed.

One detached residence, cost $5,000, St. Leonard ave., planned for J. H. Galloway, 23 Toronto street. Tenders received by owner. Two storeys, 30 x 38, brick construction and foundation.

Victoria, B.C.
Apartments, cost $12,000, Superior St., for Thomas & Dawson. Architects, Jesse M. Warren, 503 Central Building. Plans ready.

Winnipeg, Man.
Three residences, cost $4,000 each, Sherburn. Architect and general contractor, R. Robson, 284 Simcoe street. Frame, concrete foundation. Excavating started.

Residence, cost $5,000, Sherburn, Architect and general contractor, R. Robson, 284 Simcoe street. Two storeys, frame, concrete foundation. Excavating started.

Residence, cost $5,000, Sherburn. Architect and general contractor, E. F. King, Suite H. Amulet Apartments. 2½ storeys, frame, concrete foundation. Excavating started.

CONTRACTS AWARDED

Edmonton, Alta.
Residence, cost $10,000, Connaught, for E. C. Pardee, 1543 Victoria ave. General contractor, G. T. Clyde, 2215 Jasper ave. east. Two storeys, 42 x 48, frame construction, cement foundation. Excavating started.

Hamilton, Ont.
Residence, cost $25,000, Queen street, for J. W. Lamereaux, 26 Canada street. General contractor, W. H. Yeates, Jr., 24 Leeming street. Roofing, Wm. Findlay, 317 Aberdeen ave. Plastering, Chapman & Son, 69 Hughson street north. Carpentry, Murray & Connor, 230 Locke St. S. Electrical work, Culley & Breay, King street. Plumbing, Adam Clark, 7 Main street.

London, Ont.
Residence, cost $6,000, Sherwood ave., for John Gunn, c/o McClary Mfg. Co., Architect, John M. Moore, 442½ Richmond street. General contractor, John Putherbough, 1002 Wellington street. 2-storeys, 26 x 38, pressed brick construction.

Residence, cost $7,000, for S. A. Manness, 745 Waterloo street. Architect, W. G. Murray, Dom. Savings Bldg. General contractor, W. Trott. 2½ storeys, 32 x 36, white brick construction, stone and concrete foundation. Excavating done.

Medicine Hat, Alta.
Residence, cost $9,000, Roberts street, for A. C. Patterson. Architect, A. Redden, 331 Queen street. 2½ storeys, 40 x 52, brick construction, cement foundation. Plans ready. Excavating started.

Montreal, Que.
Alterations to Astoria Apartments, cost $5,000. Architects, MacVicar & Heriot, 104 Union ave. General contractor, Wm. Irving, Guy Block. Changing foundation work and small alterations, stone and concrete foundation.

Alterations and addition to residence, cost $17,500, 74-76 McTavish, for Henry H. Lyman, c/o Lymans, Ltd., 474 St. Paul street. Architects, MacVicar & Heriot, 104 Union ave. Masonry, Jno. Stewart & Co., Bethune street. Roofing, Richardson, Simard & Co., 745 Clarke. Plastering, W. S. Cook, 11 Concord. Marble and tile, Jas. Walker, Hardware Co., 252 St. James. Stone and concrete foundation, brick construction. Excavating started.

One detached residence, cost $5,000, Brock, for A. Kennedy, Westminster ave. Architects, Benois & Girard, Dom. Bank, cor. St. Catherine and Bueury streets. General contractors, Montreal West Realty Construction Co., 130 Westminster ave. Heating and plumbing, P. L. Binns, Montreal West. Carpentry, iron and steel, roofing, painting and electrical work, general contractor. Two storeys, 25 x 50, cement foundation, veneer and brick construction.

Nine flats, cost $8,000, Chabot. Owners and general contractors, Cordeau & Cordeau, 1896B Christophe Columbe. Architect, E. Cordeau, 1896B Christophe Columbe. Three storeys, 50 x 21, cement foundation, brick construction. Excavating started.

Three flats, cost $8,000, St. Hubert, for L. Clement, 30 Christophe Columbe. Architect and general contractor, owner. Masonry, O. Martineau, 371 Marie Anne E. All other work done by day labor. Three storeys, 25 x 70, cement, stone foundation, Montreal stone construction.

Three residences, cost $22,000, Outremont, Bloomfield, for A. Corbin, 1149 Van Horne ave. Architects, Vian & Venne, 76 St. Gabriel, Montreal. General contractor, masonry, carpentry, plastering and painting, owner. Roofing, heating and plumbing, Jos. St. Amand, 109 Laurier ave. west. Electrical work, Martel & Frere, Bernard street. Three storeys, 20 x 77.

Residence, cost $12,000, Cedar avenue, for C. B. Robin, 16 The Marlborough. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Masonry, Murray & McRithie, Coristine Bldg. Carpentry, A. K. Hutchison, 4404 St. Catherine W. Plastering, McNulty Bros., 181 Mountain. Painting and glazing, Alex. Craig, 41 Jurors. Heating and plumbing, McKnight & Blackader, 91 Inspector. Electrical work, Archibald & Brotherhood, Herald Bldg.

Addition to five flats, cost $9,000, Park ave., for the Alpha Raffa Kappa Fraternity. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, Z. Beaudry, 2420 Hutchison street. Four storeys, 44 x 18, addition brick, concrete foundation. Work started.

Ottawa, Ont.
Residence, cost $6,000, Rockwood, for Dr. W. Gatoury, c/o architect, F. C. Sullivan, Castle Bldg., Queen street. All work being done by day labor, under supervision of architect. Excavating started.

Residence, cost $10,000, Powell, for Mr. Quinn, c/o architect, F. C. Sullivan, Castle Bldg., Queen street. General contractor, T. A. Shore, 41 Chamberlain St. Three storeys.

Quebec, Que.
Residence, cost $11,000, Limoilou, for J. & Thos. Lamontagne, St. Nicholas. General contractor, J. Lamontagne, St. Nicholas. Steel, Eastern Canada Steel & Iron Works, St. Malo. Other contracts not yet awarded. Three storeys, 100 x 90, stone foundation, Scotch brick construction.

Regina, Sask.
Curran Bros., Scarth street, will erect fifty residences in Eastern Annex.

Residence, cost $6,000, 16th ave. Architect and general contractor, A. W. McGregor, Darke Block. Frame and brick construction, concrete and brick foundation. Foundations in.

Residence, cost $7,000, Athol street, for D. T. McConnell. General contractor, W. G. Dand, 1826 Scarth street. 2½ storeys, brick construction. Foundations in.

Apartments, cost $25,000, Dowling. Architect and general contractor, A. W. McGregor, Darke Block. Stone and brick construction, concrete and brick foundation. Excavating started.

Residence, cost $6,000, Scarth Street, for D. T. McConnell. General contractor, W. G. Dand, 1826 Scarth street. 2½ storeys, brick construction. Foundations in.

St. John, N.B.
Bungalow, cost $6,000, for W. P. Queen, Canada Life Bldg., Prince William street. General contractor, R. A. Corbet, Douglas ave.

Toronto, Ont.
Residence, cost $8,000, for Rev. A. McCaffrey, Port Credit. Architect & general contractors, Jno. Miller & Son, Port Credit. Two storeys, 37 x 31, brick construction. Foundations in.

Walkerville, Ont.
Residence, cost $6,000, Devonshire, for F. C. Thrall, c/o Wilt Twist Drill Co. Architect, R. H. Marr, 1529 Ford Bldg., Detroit, Mich. Mason, Geo. Goodman, 191 Goyeau St., Windsor. Iron and steel, Tom Eansor, Pitt St. Two storeys, 30 x 30.

Power Plants, Electricity and Telephones

Dorval, Que.
The Town of Dorval has applied to Lachine Council to supply them with electric power if they install lighting system. Request referred to Light Committee. Sec.-Treas., Alph. Decary Quebec Bank Bldg., Montreal.

Elora, Ont.
Hydro-electric power system planned. Clerk, Henry Clarke. Meeting to discuss problem will be held August 28th.

Fergus, Ont.
Hydro-electric power contemplated by Village Council. Clerk, James Beattie. Meeting to discuss problem will be held August 28th.

Montreal South, Que.
The Board of Trade are taking active

(Continued on page 76)

Tenders and For Sale Department

Bridge Tenders

Sealed tenders will be received by C. E. Willoughby, Island Grove, Ont., up to September 2nd for the construction of an 82-ft. 6-in. steel bridge with concrete abutments for the Twp. of North Gwillimbury, about 2½ miles from Sutton. For plans and other information apply to Mr. Willoughby or to

BOWMAN & CONNOR, Engineers,
35 36 Toronto St., Toronto, Ont.

TENDERS

Whole or sepatare tenders will be received up to 12 o'clock noon, of **Tuesday, September 2nd**, for the several trades in connection with the erection of a Carnegie Free Library at Dresden.

Plans and specifications may be seen at the office of the architect, W. A. Mahoney, Guelph, or at the Library Building Dresden.

Lowest or any tender not necessarily accepted.

THOMAS CONVAY,
35 Secretary.

Sealed tenders addressed to the undersigned and endorsed "Tender for Jetty and Dredging at the North Arm of the Fraser River, B.C.., will be received at this office until 4.00 p.m., on **Tuesday, September 30, 1913**, for the construction of Jetty and Dredging at the North Arm of the Fraser River, B.C.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; W. Z. Earle, Esq., District Engineer, Winnipeg, Man.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C.; J. L. Michaud, Esq., District Engineer, Post Office Building, Montreal, P.Q.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 18, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. -45074. 34-35

CITY OF KINGSTON

Tenders for Pavements

Sealed tenders will be received by the undersigned up to 3 o'clock p.m., **Friday, September 5th, 1913**, for the construction of approximately 4,250 square yards of Asphalt Block Pavement, 1,330 lineal feet of Concrete Curb and Gutter, 1,040 lineal feet of Concrete Gutter and 2,000 square feet of Concrete Walk. (widening walk).

Plans and specifications may be seen and all other information obtained at the office of the undersigned.

A marked cheque for five per cent. of the amount of the tender must accompany each bid.

The lowest or any tender not necessarily accepted.

R. J. McCLELLAND,
City Engineer.

City Buildings,
Kingston, Ont., Aug. 26, 1913. 35

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, September 2nd, 1913**, for the construction of the following sewers:—

Turner Rd. from Davenport Rd. to Tyrell Ave.
Kingston Rd. from Main St. to Victoria Park Ave.
Conrad Ave., from Hillcrest Drive tc Tyrell Ave.
Orchard Park Ave. from Queen St. to North End.
Frichot St., from Yonge St. to E.S. McMurrich St.
Frank Crescent, from Hillcrest Drive to Braconदale Hill Road.
Hillcrest Drive, from Christie St. to Tyrell Ave.
St. Mathias Place, from Claremont Street to Bellwoods Ave.
Lane first north Bloor St., from Euclid Ave. to Manning Ave.
Lane first south Adelaide St., from Charlotte St. to Lane first west Peter Street.
Lane first south Humberside Ave., from Keele St. to 144 ft. East.
Lane first west Euclid Ave., from Lane first north Bloor Street to London Street.
Lane first north King St., from Charlotte St. to the east end.
Lane first west Sherbourne St., from Duchess St. to 142 feet south.
Lane first north St. James Ave., from Rose Ave. to Parliament Street.
Midway Drainage System, viz., Felstead, Lamb and Danforth Aves.
Divisions No. 1 and 2, West Toronto, Bloor St.
Lane first west Peter street, from Adelaide St. to lane first west of King Street.
Lane first west Berkeley St., from lane first north Wilton to lane first south Gerrard St.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, Aug. 20, 1913. 35

Tenders for Concrete Bridge

Tenders marked "Tender for Bridge," addressed to the County Clerk, Lindsay, Ont., will be received until **Saturday, August 30, 1913**, for the erection and completion of a reinforced Concrete Bridge and relative work across the Narrows of Mud Lake in the Township of Carden in the County of Victoria, according to plans and specifications prepared by Mr. George Smith, County Engineer, all to be finished not later than November 1st next.

The steel for reinforcement will be purchased and supplied by the Municipalities interested and at their expense, tenders will not, therefore, include a price for that material.

Plans and specifications may be seen at the office of the County Clerk, Court House, Lindsay, or copies supplied on application, on and after Wednesday, August 20th, 1913.

The lowest or any tender not necessarily accepted.

A. E. BOTTUM,
Chairman of Committee.
Lindsay, Aug. 16th, 1913. 34-35

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913**, by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
32-37 Cayuga, Ont.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Tenders Wanted

Sealed tenders (marked tender for heating), and addressed to the undersigned will be received up to **Thursday, September 4th, at 12 o'clock noon, for Heating and Ventilating a four** room School Building at Beachville, Ont.

Plans, specifications, etc., may be had at the office of the Architect, Woodstock, Ontario.

B. McNICHOL, Architect.
Woodstock, Aug. 24th, 1913. 35

Town of Neepawa, Manitoba

Tenders for Machinery

Sealed tenders will be received up to noon, **September 1st, 1918**, for machinery for additions to the power plant at Neepawa, as follows:—

Specification Section No. 1 Two 72-in. x 18-ft. Boilers.
Specification Section No. 2 One 187½ h.p. Engine.
Specification Section No. 3—One 150 k.v.a. Generator, Switchboard, etc.

Specifications may be seen at the offices of the Electrical News, or obtained from W. F. Skinner, Limited, 204 Sterling Bank Bldg., Winnipeg, or from the undersigned:

J. W. BRADLEY, Sec.-Treas.,
35 Neepawa, Man.

CITY OF LONDON

Tenders for Steelwork

Sealed Proposals addressed to the "Chairman and Members No. 2 Committee" will be received at the office of the City Clerk up to 5 p.m. on **Thursday, the 11th day of September, 1918**, for the supply and erection of three 130 feet spans rivetted truss steel highway bridge over the River Thames, the substructure for which is already under construction.

Plans, specifications and all particulars can be had at the office of the City Engineer.

No tenders will be considered unless accompanied by a deposit cheque for 5 per cent. amount of the bid.

The lowest or any tender not necessarily accepted.

B. W. BENNETT, Chairman No. 2 Committee.
WM. N. ASHPLANT, City Engineer. 34-35

AGENTS WANTED

High Class Artificial Stone Company requires agents in every city to sell building stone, ornamental work, pipes, roof and floor tiles, etc. Liberal commission allowed. Address C. P.., c/o "Contract Record," Toronto. 35-36-37

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, AI $700
Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new $2,500
Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1 ... ... $3,500
Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1 ... ... $2,800

TRACTION ENGINE

Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?
TRY US!

WILLIS SHAW MACHINERY CO.
La Salle Street, Chicago. Ill,

Power Plants, Electricity and Telephones

(Continued from page 73)

steps to have an electric lighting system installed.

Montreal, Que.
Supt. of Lighting Department, Mr. Parent, will shortly call tenders for electric lighting, suitable for a conduit system of lighting. Possibly cluster lights. Enough required for several miles of streets. Board of Commissioners. Sec., L. N. Senecal.

Regina, Sask.
Power house equipment planned by City Commissioners. Coal bunkers, ash hoppers, coal and ash conveyors and crushers. Specifications at office of E. W. Bull, Supt. of Light and Power Department. Tenders received by Commissioners till noon October 1st.

St. Jerome, Que.
Improvements to electric lighting system, cost $23,500, planned. General contractors, The Maisonneuve Constr. Co., Maisonneuve, Que.

Souris, Man.
Lighting system, cost $40,000, planned by Town Council. Clerk, W. J. Breaky. By-law to be voted on on September 2.

Winnipeg, Man.
Tenders received by Board of Control till September 20th. Plans and specifications at office of Engineer, J. G. Glassco, 54 King St., for erection of duplicate transmission system on present right-of-way between Winnipeg and Point du Bois.

Miscellaneous

Athabasca Landing, Alta.
The Town Council contemplate purchasing a steam fire engine. Information from Town Clerk.

Ottawa, Ont.
Fire Chief Graham, City Hall, recommends the purchase of a motor driven steam fire engine. Fire Department. Supt., Controller Kent.

Toronto, Ont.
Chief Thompson recommends the expenditure of $100,000 for motor equipment to modernize Fire Dept. Board of Control. Mayor, H. C. Hocken.

Valleyfield, Que.
Fire alarm system planned by Town Council. Mayor, S. H. Ostiguy. General contractors, Sevigny & Lalonde, 115 Geo. Etienne Cartier Square, Montreal.

Winnipeg, Man.
25,000 lbs. of weatherproof copper wire required by Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Canada Wire & Cable Co., 272 Main. $18.95 per 100 lbs.

Business Notes

Boute de L'Isle, Que.
Saw mill, owned by The McLaren Co., burned. Loss, $50,000. Will rebuild.

Bridgeburg, Ont.
Planing mill, owned by O. C. Teal, burned. Loss, $20,000. Partially covered by insurance.

Cobalt, Ont.
The Prospect Hotel, burned. Loss, $40,000. Building occupied by several firms, as follows:—Claud Morrison and R. C. Lowrey, tobocconists; Bank of Ottawa; F. J. Fenlan; Northern Ontario Light & Power Co.; Willis Abbott, stock broker; Frank McKay, tailor; Walter Bellsham, jeweller. Building completely destroyed by fire.

Harcourt, N.B.
Residences, burned. Owners, L. J. Watson, loss, $18,000; Miss B. Pride, loss, $3,000. Partly covered by insurance. Will rebuild.

Ottawa, Ont.
Planing mill, owned by H. F. Fraser, Bronson Ave., burned. Building valued at $10,000, and machinery at $10,000.

Second Hand Model 41 Marion Steam Shovel

FOR SALE

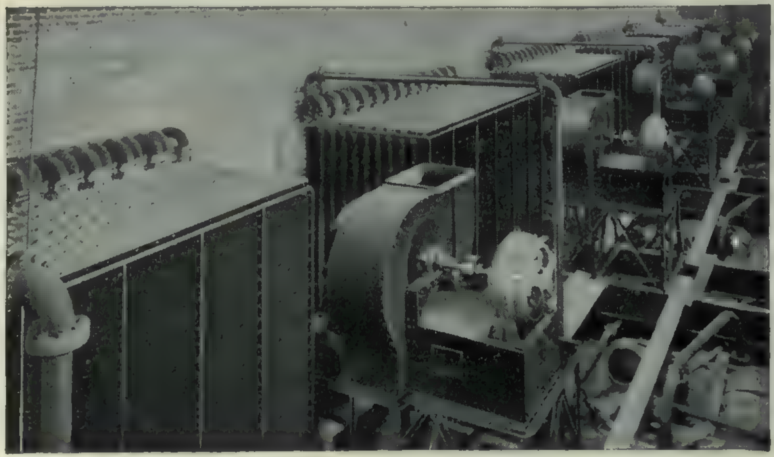
At A Very Reasonable Figure

We have to offer for immediate delivery, subject to inspection and prior sale a Model 41 Marion Latest Type Steam Shovel, equipped with 1½ cubic yard dipper; on railroad trucks, complete.

This shovel is not one year old and has been operated very little Shovel is in fine condition and is offered at a very low figure.

Full details, prints and specifications sent on request.

Apply Box 862 Contract Record, Toronto, Ont.
34-35



At the Power Plant of The Denver Tramway Co.

are installed

6 Sturtevant (REG. U.S. PAT. OFF.) Metal-to-Metal Joint Economizers. *No Gaskets.* Capacity 300 lbs. Pressure.

6 Sturtevant (REG. U.S. PAT. OFF.) Multivane Induced Draft Fans direct connected to Electric Motors.

All working in connection with 6 Sterling Boilers 4200 B. H. P.

"Economical Fire Room Methods," by F. R. Low, Editor of Power; Sturtevant Bulletin No. 187-Z describes the operation and equipment of one of the most efficient and economical power plants in the world, The Wood Worsted Mills, Lawrence, Mass.; told in a most interesting manner by one of the foremost technical writers in this country. It is yours for the asking.

B. F. STURTEVANT CO. OF CANADA, Limited

GALT, ONTARIO

Office for Eastern Canada—**919 New Birks Building, Montreal**

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FILE YOUR PLANS

Free of charge at any of the four offices of the

"CONTRACT RECORD"

AND ENGINEERING REVIEW

Contractors and manufacturers of building, municipal, railway, and power plant equipment not only expect to see your tenders advertised in the "Tenders' Department" of the "Contract Record," but they will also find it a great convenience if you place your plans and specifications on file at any or all of our four offices, viz. Toronto, Montreal, Winnipeg and Vancouver.

Send along your next Tender Advt. together with Plans and Specifications

CONTRACT RECORD

AND ENGINEERING REVIEW

220 King St. West, TORONTO

MONTREAL
Board of Trade Building

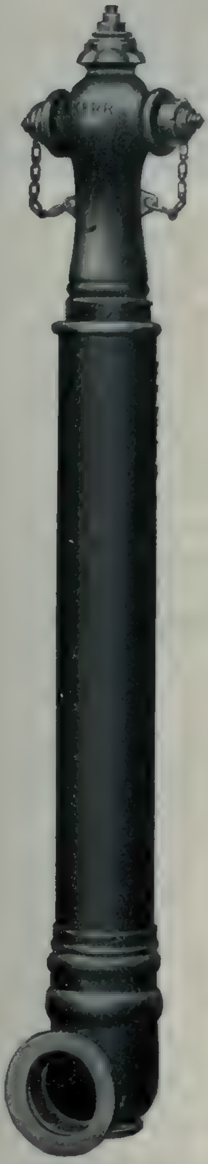
WINNIPEG
Travellers Building

VANCOUVER
Hutchison Block

KERR

Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.



Standard Compression Hydrant

Send us your Specifications and Enquiries.

Prompt attention given.

6″ Hubbed

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

Residence of A. J. Gough of Sellers-Gough Fur Co., Ltd., Toronto

Efficiently Cleaned by TUEC

Stationary Air-Cleaning System

EQUALLY WELL SUITED TO THE LARGEST BUILDING OR SMALLEST RESIDENCE

CANADIAN TUEC DISTRIBUTORS
Tuec Co. of Vancouver—601 Pender St. West, Vancouver.
Tuec Co. of Winnipeg—419 Portage Ave., Winnipeg, Man.
Tuec Co. of Calgary—812 First St. West, Calgary, Alta.
Tuec Co. of Montreal—406 New Birks Bldg., Montreal, Que.

Canadian Factory—B. O. T. Building,
159-61 Richmond St. W., Toronto—Jas. J. Martindale.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$27 00	
2 x 4 to 2 x 12, 16 ft.	27 00	
2 x 4 to 2 x 12, 18 ft.	30 00	
1 in. Hemlock, No. 1	26 00	28 00
No. 1 Hemlock Decking	26 00	28 00
No. 2 Hemlock dimension and 1-in.	20 00	22 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¼ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $9.00 per 100 lbs.

Boiled Linseed Oil in bbls., 6 c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 6 c per gallon.

Turpentine, in barrels, 56c per gallon.

Pure Red Lead, dry $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls. 3½c.

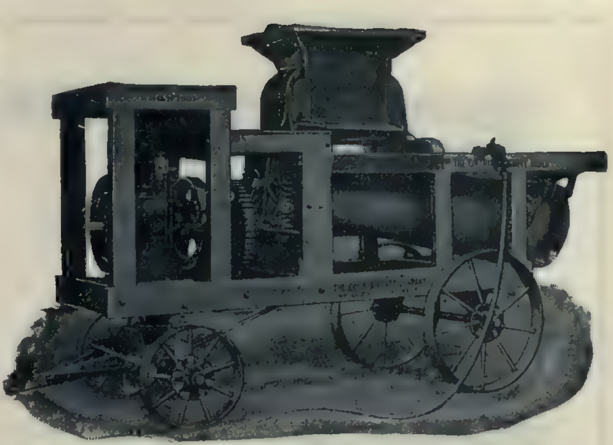
Putty, pure linseed oil, in 25-lb. tins, 4c.

Argenteuil Granite Co., Limited
42 Craig Street West, MONTREAL

We are in the market to bid on your plans for granite on buildings.

Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

SEND US BUILDING PLANS TO-DAY



Coltrim Concrete Mixer No. 9

The housing is removed to show the heavy gear drive. Note also the solid construction throughout. "BUILT TO LAST."

There it is Gentlemen!

The mixer that eliminates the wheelbarrow.
The mixer that will pour a continuous stream of perfectly mixed concrete—mixed in *absolutely accurate batches.*

And right here we want to say that if you are skeptical about the absolute accuracy of our mix, we want to send you a few of the actual letters we are receiving daily from contractors—municipal engineers and architects. They are from real, practical, money-making men. Send for the letters to-day—we'll send our Concrete Book with them.

THE KNICKERBOCKER CO., - JACKSON, Mich., U.S.A.

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

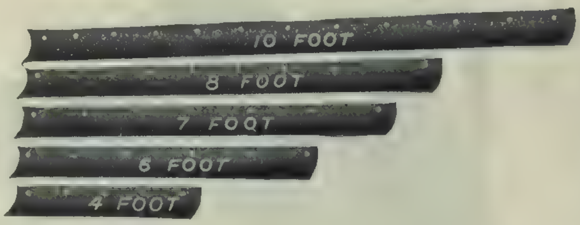
That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.



We manufacture and carry in stock road plows, scraper blades and moldboards ½ inch thick and lighter, of the very highest quality of steel and workmanship, for all makes of road scrapers. Blades guaranteed to be of the very best quality. Write for prices, discounts and list No. 20.

THE
SHUNK PLOW COMPANY
BUCYRUS, OHIO

Canadian Agents Wanted

THE Underwood embodies in one machine all that can be expected in a typewriter. It is sold at the price which should be paid for a machine of its quality.

United Typewriter Co., Ltd.
All Canadian Cities

Jennings & Ross
Limited

Engineers and Contractors

Royal Bank Bldg. - Phone Adelaide 292
King and Spadina
Toronto

Kingston Road Sewer
Showing heavy timbering necessary owing to depth of excavation.

CAST IRON PIPE

for all services :—

Water and Gas Supply, Fire Protection, Road Culverts, Sewers, Drains, Exhaust Lines, etc.

Bell and Spigot - Flexible Joint
Flange Pipe - Plain End Pipe
Standard Fittings - Special Castings

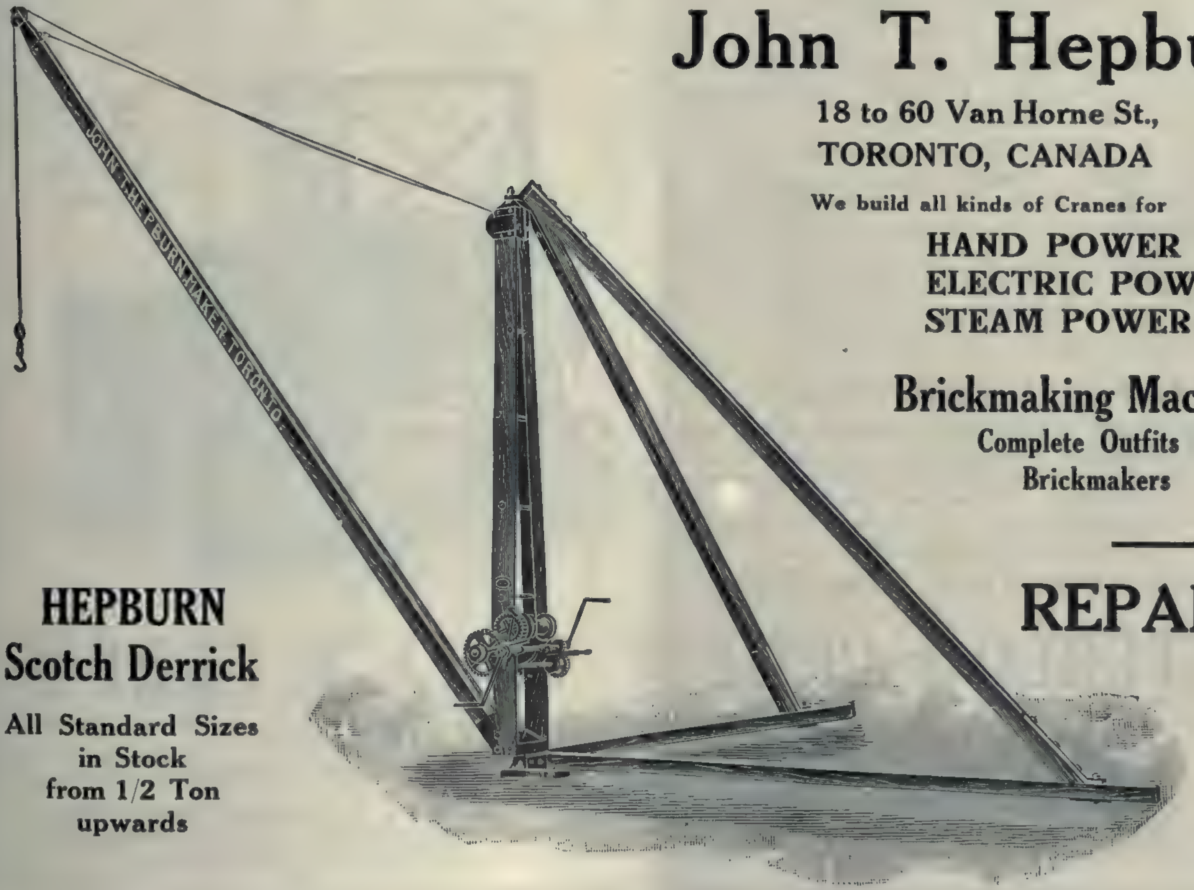
Apply to Nearest Office

United States
Cast Iron Pipe and Foundry Co.

General Offices :—BURLINGTON, NEW JERSEY

Branch Offices :—PHILADELPHIA, NEW YORK, CHICAGO, ST. LOUIS, SAN FRANCISCO, PORTLAND (Ore.) BUFFALO, PITTSBURGH, CHATTANOOGA

Test of Philadelphia Fire Lines


JOHN T. HEPBURN MAKER TORONTO

HEPBURN
Scotch Derrick

All Standard Sizes
in Stock
from 1/2 Ton
upwards

John T. Hepburn

18 to 60 Van Horne St.,
TORONTO, CANADA

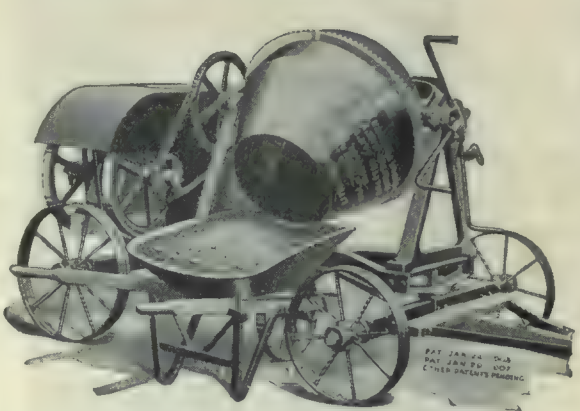
We build all kinds of Cranes for

HAND POWER
ELECTRIC POWER
STEAM POWER

Brickmaking Machinery
Complete Outfits for
Brickmakers

REPAIRS

Grasp this Idea



Little Wonder "Five" without Side Loader

You have to make money faster these days than ever before. You must do it by making time.

SPEED, EFFICIENCY, UTILITY--these are the keys to success. These are the winning features in WONDER Concrete Mixers. Not to know the machines is to be behind the times. Not to take advantage of them is to neglect a real opportunity.

LITTLE WONDER "FIVE"

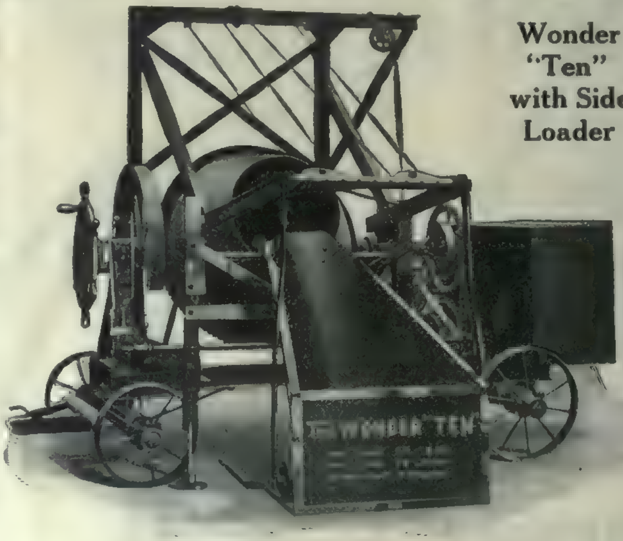
"The Small Job Money-Maker"

THE WONDER "TEN"

"The Big Job Money-Saver"

THE LITTLE WONDER "FIVE" is the swiftest, simplest, strongest mixer ever known for building sidewalks, curbs, drives, foundations, etc. Saves 50 cts. per cu. yd. over hand mixing and pays for itself in a few days by its profits. Capacity 5 cu. ft. per batch. Mixes 35 to 50 cu. yds. per day. Side Loader practically doubles this capacity with only small extra investment. Endorsed by thousands of contractors all over the country.

The WONDER "TEN" is a 1-3 yd. "Sack to the Batch" mixer for **heavy work.** It will do the work of machines costing two or three times the price and make twice the money by its speed and greater utility. Embodies the same unique features that have made the LITTLE WONDER "FIVE" the fastest seller in the history of the concrete business.



Wonder "Ten" with Side Loader

TEN DAYS' FREE TRIAL

We will send you either size of the WONDER, with or without Side Loader, for Ten Days' Free Trial on your own work. If you're not fully satisfied with the machine in every particular, notify us within the ten days and we will tell you where to ship it and refund the freight you have paid. You are under no obligations whatever.

All we ask is to show you. Write TODAY

WATERLOO CEMENT MACH'Y CORP'N

117 Vinton St., WATERLOO, IOWA, U.S.A.

Mfrs. Concrete Mixers, Builders' Hoists, Elevators and Cement Tools

CANADIAN REPRESENTATIVES:—Waterloo Cement Mach'y Corp'n, 127 Coristine Building, Montreal, Que.; General Mach'y Co., 22 Mulock Ave., Toronto, Ont.; J. W. Anderson, 3 Bank St. Chambers, Ottawa, Ont.; J. A. McTaggart & Co., Winnipeg, Man.; Strumbert, Virtue & Co., 319 Pender St., Vancouver, B.C.

MORRIS
Street Lighting Poles

Modern Ideas in Street Lighting

Send for Descriptive Bulletin and Prices.

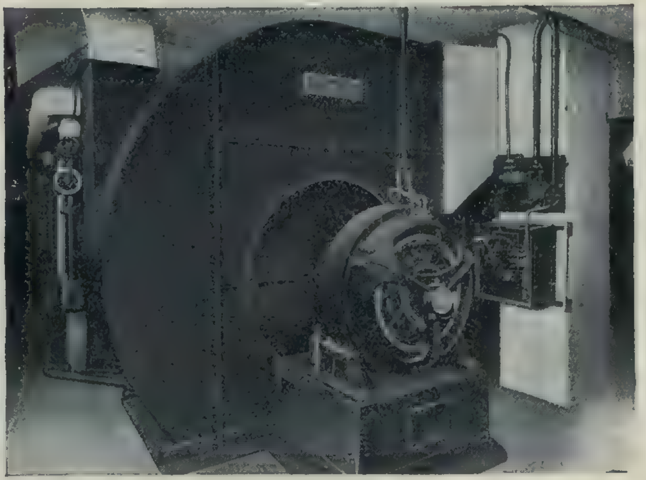
Canadian Distributors

L. H. Gaudry & Co., Ltd.
76 Peter St.
QUEBEC, P. Q.

American Agencies, Ltd.
Aull Block
CALGARY, ALTA.

Sturtevant
(REG. U. S. PAT. OFF.)

MULTIVANE FANS
For Heating and Ventilating Work



STURTEVANT No. 12 Multivane Fan direct connected to STURTEVANT 5C Motor, installed at Mississippi Valley Trust Co., St. Louis, Mo.

STURTEVANT Multivane Fans are especially adapted for heating and ventilating and mechanical draft work because of their exceptionally high efficiency, their compactness and durability.

They occupy less space than other types of the same capacity. They require less power for the same work. They are built for the work they are to do. Breakdowns and delays are practically eliminated when STURTEVANT Fans are installed.

Catalog No. 180 Z describes these Fans in detail.

**B. F. STURTEVANT COMPANY
OF CANADA, LIMITED
GALT, ONTARIO**

Sales Office for Eastern Canada
919 New Birks Building, Montreal

979

Some of our lines Each line a leader

We specialize on the following:

- Gray Silica Face Brick and Glazed Brick.
- Esco Steel Protective Paints.
- Ceresit Waterproofing Compounds.
- De Lavergne Artificial Ice Plants.
- Keystone Gypsum Blocks.
- Nelson Bronze Iron and Steel Valves.
- Terra Cotta and Faience.
- Feed Water Filters and Grease Extractors.
- Reliance Ball Bearing Door Hangers.
- Sturtevant Ventilating Sets and Blowers.
- Sky Lights and Metal Windows.
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Diagrams vs. Pictorial Reproductions in the Illustration of Technical Articles

ONE of our contemporaries criticises with some point the over-estimated value that many contributors to the technical press place upon "pictorial reproductions." In a day when practically every engineer and contractor of any importance consider it a part of their business to prepare an occasional description of their work for the technical journal, the subject is worthy of more than passing notice.

Undoubtedly, a great deal of time and space have been wasted in the preparation and publication of photographs which by right should find no other place than the souvenir scrap-book of those intimately connected with the work. As a general rule, photos of the exterior of buildings, bridges and sewer work, for instance, convey little to the average reader, who is far more likely to appreciate the illustrated explanation of details of special interest. The writer of the article cannot exercise too much care in this particular. He must make allowance for the fact that his particular knowledge of the work enables him to find far more interest in a photograph of a general character than the reader. We make no apologies for enlarging upon the point to the extent of giving our readers some definite instructions upon drawings for reproduction.

Size is the first consideration, and the most frequent source of unsuitable reproductions. The drawing should be made considerably larger than it is intended finally to appear. The usual widths for illustrations are column and double column. In the case of this journal these measurements would be 3½ in. and 7 1-6 in. For large drawings with much detail a whole page is sometimes used. When several drawings are made on one sheet the question of the relative importance of the various items must not be overlooked.

Any good white paper is suitable, the smoother the better. Ruled paper of any sort is unsuitable, as the lines would appear. Drawings on tracing cloth or paper also give perfectly satisfactory results.

Nothing but Indian ink should be used. The use of coloured ink or ordinary writing ink renders the drawing unsuitable for the necessary photographic operations in preparing the block.

The actual drawing should be carefully executed in good bold lines, and the temptation to finish off small straight lines freehand must be resisted. There should be no confused mix-up of lines at any point, and any large expanse of shading should be left to the engraver.

Nothing is so neglected in most drawings as the printing. The lettering should be bold, and of a sufficient size to bear reduction without any sacrifice of clearness. Small marks, such as the ticks indicating feet and inches, are apt to disappear in the most annoying fashion, and the omission frequently mystifies the reader to an abnormal degree. The best type of letter is one that is bold and instantly translated.

With regard to photographs, these should be glossy prints whenever possible. Plenty of contrast is desirable, and a dull, flat print should be cast aside.

In the course of a year many articles reach us, and in the majority of cases the literary style is very creditable. Sad to relate, however, in the majority of cases, also, the value of the article is reduced to the minimum by unsuitable illustrations. Occasionally, very occasionally, the draughtsmanship is above reproach, but more often the editor is led to wonder whether his careful instructions to the effect that "drawings for reproduction should be in black and white and boldly lettered" have been taken as a joke. The progressive spirit of the age demands of the engineer the ability to describe his work faithfully, yet concisely, in black and white. As a matter of fact the preparation of such work induces care and accuracy and impresses upon the author the special experience that he has gained in the execution of that work. An article well written and carefully illustrated reflects the greatest credit upon the author, but it is otherwise when the reader turns to an illustration for reference and finds that it is next to impossible to make head or tail out of it. In such cases the editor gets a share of the blame—hence, to be candid, this article.

Profit and the Time Element

IF a hundred contractors were asked what their profits averaged, there would probably not be one reply in which the element of time would be mentioned, observes our Chicago contemporary, Engineering and Contracting, in an editorial article which we commend to our readers. Contractors ordinarily indicate profits as a percentage of the cost or of the bidding price. Thus, a contractor will say: "My profit averages 10 per cent." If a man is asked what his salary is, he will give the answer in dollars per week, or other unit of time. And a little consideration shows that profits should also be expressed in terms of some unit of time.

If we exclude the insurance against risk that forms a part of most profit, the profit of a contractor is, in reality, his wage. It is the difference between the price bid and the cost. The cost should always include interest on the capital invested. Since profit is a wage it should be expressed in terms of time. A contractor should say: "My profit averages 10 per cent. on a $100,000 worth of work done each year." Merely to say that a profit was 10 per cent. on a $100,000 job is vague information, for the job may have lasted six months or it may have stretched out over two years.

One of the fundamental rules of commercial management may be expressed thus:

So conduct the business that a maximum profit per annum will result.

The time unit in this rule is vital. It would not be correct to say that the object is to secure a maximum percentage of profit, for that gives neither a statement of the time devoted to the work nor the gross amount of the work.

The general contractor who takes three jobs of $100,000 each, sublets them, and finishes within a year at a 5 per cent. profit, makes $15,000 net. The contractor who takes a year to one $100,000 job, and does it himself at 10 per cent. profit, makes $10,000 net. The advantage of subcontracting to reliable men consists not merely in the greater certainty of securing energetic superintendence, but in the ability to handle a larger volume of work in a given time. This latter point is one that is repeatedly overlooked by many a contractor. In his desire to make, say, 15 per cent. profit, a contractor, will frequently sublet nothing, work only his own outfit, and carry the work along at a slow pace in consequence. Perhaps he does make the 15 per cent., but takes 18 months to do a relatively small volume of work, so that he earns a smaller annual income than his neighbor who sublets most of his work and makes 5 per cent. on a large volume each season.

Subcontractors, it should be remembered, have capital employed in their work. By enlisting the aid of this capital, a general contractor is able to carry a larger amount of construction at one time than would otherwise be possible.

But even where subletting is not practised, work should be planned with the time element prominently in view. Suppose, for example, a contract for 200,000 cu. yds. of earth is involved, and that it can be handled with a given outfit in six months at a profit of 10 per cent. This would mean 1.67 per cent. profit per month. By increasing the size of the outfit, the cost of moving the plant to and from the job would increase the fixed costs and reduce the percentage of profit, let us say, to 8 per cent. But if the time were reduced to 4 months, the profit would become 2 per cent. per month instead of 1.67 per cent. per month. Therefore it would ordinarily pay to do the work quicker and secure a less total percentage of profit if a greater monthly percentage of profit could be earned. In this way a contractor's plant and cash capital are freed sooner for other work, resulting in a greater total annual profit than would otherwise be secured.

Incidentally, we may add, there are other advantages that accrue from the rapid handling of work. Where it is not necessary to train men to handle machinery and tools, it is well known that men will do more work per day where the job is comparatively short than where it drags along for some time. Men "wear out" a job. The new broom principle is a characteristic of human nature that can be put to good advantage by rushing work to completion. Then, too, the contractor who has a reputation for quick work finds it easier to please his employers and the engineers in charge. Quick work cuts down the interest charges, the engineering and other overhead expenses incurred by the corporation or person who employs the contractor. Finally, the banks always favor the business man who turns over his money rapidly. Hence a contractor who has a reputation of finishing a big job quickly finds it easier to secure financial help than a contractor who is known to be slow.

While all that we have said is elementary when reduced to words, it is noteworthy that many an elementary principle finds few followers until the principle is formulated and illustrated by specific example. The time element in its relation to profit is one that has often escaped the attention that it deserves.

Responsibility for Calculations of Subordinates

FEW problems of the engineering executive are more serious than the securing of accurate calculations from subordinates charged with the detailed technical computations which are fundamental in the analysis of operating conditions in field and plant. There is, of course, a legal side to the question, but that is not its broadest aspect. Of far greater importance in the success of an organization and to the reputation of its officers is the extent to which calculations are scrutinized prior to embodying their results in a definite policy or program of action.

In very large concerns it is obviously out of the question for the general executives to give much time to passing upon the accuracy of their subordinates' figures, but some degree of mental checking is a pretty valuable process. From first to last a keen sense of proportions is one of the most important qualifications of a successful executive in any branch of the engineering industry, and with constant practice able men accustomed to think in large figures and to check by rough unit methods often acquire an analytical skill in "sizing up" problems and situations that is almost uncanny. All down the line, from the president of the company to the head of the most humble department, one finds the best work done when, at least, approximate mental checking is regularly practised. The farther one gets from the drafting board and designing pad the briefer must be the analysis accorded each successive set of figures; but what such scrutiny lacks in minuteness it must make up in ripeness of judgment. Fortunately means are at hand through modern methods of statistical and graphical analysis, the study of unit costs and the extension of construction accounting to place in the hands of the executive reliable data upon which to base his judgments. More than this, the increasing use of the staff conference and the larger measure of co-operation required in deciding upon broad engineering plans and policies are aiding executives to preserve their judicial acumen and to acquire new and helpful points of view in dealing with matters involving vast sums of money and important interests.

In theory it sounds very well to advocate the selection of reliable men by executives and then holding the former strictly to account for all work performed; but in practical affairs the best results are not always insured in this way. If an arithmetical error made by a draftsman leads to a loss of $10,000 on a contract through inadequate checking, the situation will not be remedied by discharging the man making the initial mistake. The time to forestall such mischief is before incorrect figures get into the bid. A wide latitude is desirable for every executive and sub-ordinate, but this does not mean that accomplished work shall be exempt from the most acute criticism which the wise seeker after industrial truth can apply. There is a great deal said in these days about outlining to those lower down in the ranks the problem to be solved and then letting them get the results in their own way—a program welcomed by every employee with a spark of initiative in his composition, but none the less to be followed by an executive appraisal competent to detect serious errors or wide departures from the probable truth. A little use of mental arithmetic or the slide rule, coupled with the cool and experienced judgment of superiors sitting upon the calculations and data singly or in conclave, as their importance dictates, and many a concern will go forward with new confidence to a larger and sounder business success than it has been able to command in the past. All the resources of modern business tend to facilitate this weighing of work coming up from lower desks; the comparative ease with which diverse mental equipments and personalities may be massed upon single problems takes the place of the individual's limited judgment and provides multiple checks upon the work of departments and employees which are valuable safeguards against radical mistakes in administration.—Engineering Record.

False Economy in Engineering Construction

ENGINEERS as a class owe it to their profession to diffuse among laymen whenever possible ideas as to higher standards in professional work. In the abstract this will readily be admitted, but unless instances are cited now and then to show that there is great need for a better understanding of the character and requirements of high grade engineering work ardor is likely to diminish and opportunities for service to the profession neglected. For this reason the Engineering Record brings up the much-worn theme of the false economy in neglecting to employ competent engineers.

False economy of this sort is not confined to any one class of engineering work. A good statement of the case, so far as water supply and sewerage systems are concerned, is to be found in the last report of the bureau of sanitary engineering of the Maryland State Department of Health. The report says:

"The search of this office for maps, plans and records of and information concerning the various water supply and sewerage systems of Maryland has shown that many such systems have been built without the engagement of proper engineering services; that in many cases both design and construction are defective; that a large proportion of systems have been built with very meager and utterly insufficient plans; that some have been constructed without any plans, this particularly being the case where the systems have been built in small sections; that in very few cases are plans changed or added to so as to become proper and complete records of the actual work built; and that in a number of places such plans and records as were made have been carelessly kept and have become lost or burned. In a number of places about the only information that can be obtained is by word of mouth, from the superintendent or some other town officer."

Commenting on this state of affairs the report enlarges on the false economy of the procedure, expressing in excellent manner the ideas so often reiterated in these columns. "The effort of many municipalities," it continues, "to keep down expenses on public works by getting along without the services of an engineer, or by engaging an engineer of inferior qualifications, is a short-sighted policy. The usual result of such a practice is the establishment of improperly protected or uneconomically operated water supplies and poorly designed sewerage systems which do not admit of inspection, are uneconomical in construction, unsatisfactory in maintenance and operation, and which create offensive conditions in the bodies of water into which they discharge. An experienced and capable engineer can not only institute sanitary, suitable and satisfactory water supply and sewerage systems, but can usually save a community, by economical designs, much more than the cost of his services. He will leave, also, in the town's possession full plans of the work and complete records for future reference. The value to the community of such information cannot be overestimated, particularly when connections, additions or alterations are to be made, or when street work of another character is to be undertaken."

The conditions described being granted the natural question is as to the remedy. Without a doubt state supervision, which is becoming quite common in water supply and sewerage work, will go far toward lessening repetitions of this false economy. The work of state departments should not be that of design, but merely of checking, criticising and approving or rejecting plans made by engineers and submitted to the department for approval. In some states supervision is being extended also to highway and bridge work.

There will undoubtedly be many cases, however, which cannot be reached by such supervision, and the only remedy in these cases seems to be to raise the appreciation of the work of the engineer in the mind of the layman. In towns and cities of large size this is not very difficult because the magnitude of the work compels the authorities to demand some degree of ability from their engineering advisors, whether on salary or retainer. The small towns, however, are very difficult to reach for they do not, as a rule, number among their inhabitants engineers of competence who will use their influence to direct the town authorities. The correction of the abuse of false economy in these cases will come but slowly, but that should not discourage engineers from exercising what influence they can when brought in touch with the authorities or citizens of small communities.

Ozone Applied to Water Purification*

Editor Contract Record:

Mr. Russell Spaulding has given a short history of the discovery and application of ozone and he has also described some of the European installations. There are some points of interest which could be referred to in this connection, but the subject cannot be fully discussed in a short article, and moreover, I hope at some future time to deal with various methods of sterilizing water.

The name ozone signifies a smell. When an electric machine is operated, a peculiar smell is usually noticeable. Scientists have found that a molecule of oxygen has two atoms, whilst ozone has three, but these three atoms occupy the same volume as the two; in other words, when oxygen is electrolysed there is a contraction in the volume. The scientists have also found that ozone is a most powerful oxidiser, which will rapidly destroy organic matter. It will bleach vegetable colors and act upon many metals.

The oxidising power of ozone is due to the instability of the molecule and the readiness with which it loses an atom of oxygen, leaving the relatively inert molecule of oxygen. The atom which is liberated, in its nascent state, is endowed with great chemical activity (Newth).

Ozone is practically insoluble in water, as only about one-half per cent. by volume is dissolved.

As Dr. G. S. Nasmith explains: "The principle underlying any successful sterilization of water by ozone, is getting the ozone after it is produced into intimate contact with every drop of water, because of the fact that ozone is comparatively insoluble.

This is done in various ways, but as an example take the DeFrise system as installed at St. Maur, Paris. The atmospheric air is strained and dried, then ozonised, compressed and well mixed with the water as it passes through a large cylindrical column. The sterilised water is discharged through one outlet and the surplus air by another. The latter is re-dried, re-ozonised and re-used.

It has been found that the cost of electrical energy to give air a high percentage of ozone is out of proportion to that required for a low percentage. For instance, Chasy found that a seven per cent. charge of ozone in air cost about ninety times as much as one-half per cent. So by experience and research it has been found that a low percentage of ozone is both more economical and practical; that is, the ozone should be highly diluted with air.

In 1908 Dr. Samuel Rideal made a series of interesting tests at St. Maur, Paris, and an average of 1.63 grams of ozone per cubic metre of air or about 0.66 grams per cubic metre of water was found satisfactory. He also found that the volume of ozonized air averaged about 40 per cent. of the volume of water treated, and this decreased the carbon dioxide 2.75 grams per cubic metre, the dissolved oxygen content of the water was increased 3.29 grams per metre, and the oxygen consumed reduced by 28 per cent., while "the result of the bacteriological examination proved that the ozone treatment destroyed all but the more resistent spore form of bacteria present in the filtered water, coli and allied intestinal organisms were entirely eliminated."

The water carried away about 7 per cent. of the ozonized air, and the impurities left in the water as it passed out of the steriliser were further reduced within two hours, as the effect of the ozone carried off.

The water must, however, be clear, and if turbid it must be filtered or clarified by some process, otherwise the ozone process will often be useless.

To ozonize the water it required 57 kw. of electrical energy per one million gallons of water to produce the ozone and 76 kw. to compress the ozonized air and force it into the sterilising column. In all, 133 kw. of electric current were needed per million gallons treated.

Dr. Rideal states that the cost of a plant for ozonising 10 million gallons per 24 hours, in Paris, was as follows: Ozone plant with usual standby, $75,000; motive power, $37,500; buildings, $37,500; total, $150,000.

The annual expenses for running the plant night and day would be, in Paris: Coal, 1,200 tons, $4,500; lubricants, $1,000; repairs, $1,000; one manager, $1,000; two first engineers, $1,600; eight assistants and stokers, $4,800; interest and sinking fund, $9,000; insurance, $500; total, $23,400.

$$\frac{23400}{10,000,000 \times 365} = .64 \text{ cent per 1,000 gallons.}$$

On the basis of the cost of such plant erected in Central Canada, the annual working expenses and capital would probably amount to 1½, or 2 cents per 1,000 gallons apart from the cost of filtration or clarification.

Ozone plants require the constant inspection and supervision of engineers. The plant must be worked without interruption and frequent bacteriological examinations be made. These conditions also apply to most other systems of sterilisation, as the system which will run by itself has not yet been found. Failures are usually due to the absence of skilled supervisors.

Some engineers look upon ozone as an expensive luxury. Others consider that the cost of construction and operation of filters can be materially reduced by introducing ozone plant to finally sterilize the water. An ozone plant was installed at Lindsay, Ont., about 1909, but according to reports issued by the Provincial Board of Health of Ontario in 1910, this installation was a failure, the impurities contained in the water were not reduced and the color was not bleached; and as in the course of experiments and tests Dr. Nasmith's assistant "was nearly ozonized into another sphere" further tests were not made.

In conclusion I may quote two reasons given by Dr. Rideal in favor of ozone.

1. It is only a more active form of ordinary oxygen, already existing normally in small quantities in the atmosphere, and continually assisting in natural oxidations.

2. It adds no residue of any chemical to the water and in doing its work of purification it is simply re-

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*The contribution under this heading is submitted at our request by Mr. R. O. Wynne-Roberts, consulting engineer, of Regina, in criticism of an article by Mr. Russell Spaulding, of the State Department of Health, New York City, published in our issue of August 13th. In view of Mr. Wynne-Roberts' wide experience in many parts of the world and of his international reputation as an expert in municipal problems, his views cannot fail to be received with much interest.—Editor.

solved into ordinary oxygen, which dissolves in the water and adds slightly to its aeration.

Yours truly,

R. O. Wynne-Roberts.

Proposed Test of Sand for Concrete

THE testing of tension briquettes or compression blocks of concrete made from wet mortars having the same consistency as used in the work was advocated by Mr. W. B. Reinke, of Philadelphia, in a paper read before the last annual meeting of the American Society for Testing Materials.

The procedure suggested by Mr. Reinke is as follows: The sand to be tested and Ottawa sand are first made into mortars of normal consistency, using preferably cement from the work. These mortars are then made into briquettes, the whole operation being in accordance with the standard methods for the making of sand briquettes when testing cement. The amount of water necessary to make a mortar of normal consistency having been found, a new batch of sand and cement in the desired proportions is thoroughly mixed dry and placed in a cylinder that can be revolved, together with a number of flint pebbles, so that the proportion of cement, sand and stone will approximate that desired in the actual work. To this mix is added enough water (generally about 50 per cent. more than needed for normal consistency) to make a mortar having work consistency. The cylinder is then closed and revolved for five minutes. The flint pebbles are picked out by hand and the mortar is made into briquettes. This test, Mr. Reinke pointed out, more closely approximates the condition found in actual work, and the strengths obtained from briquettes made from such a mortar, though, as a rule, far below those obtained from a mortar of normal consistency, correspond to those that may be reasonably expected from the mortar if the same sand and cement are used in construction.

In most cases, using the same cement, more water will be needed to bring a natural sand to normal consistency than is necessary with Ottawa sand. This difference in the amount of water required is accounted for by the difference in granulometric grading, the work sand, as a rule, having the greater amount of fine material, and hence more surface to be covered and a larger percentage of voids. The more water used, the greater will be the loss in strength at early periods. The nearer a natural sand approaches the ideal in physical and chemical composition, the less will be the loss in strength for each additional per cent of water added.

The amount of water, therefore, required to bring a given sand to work consistency forms one of the best measures of the quality of sand.

In mixtures using 50 per cent. more water than required to produce normal consistency, Ottawa sand and good natural sands, Mr. Reinke finds, lose from 25 to 35 per cent. of their strength up to the 28-day period, while a poor sand may lose as much as 70 or 80 per cent. of the strength developed when made into mortars of normal consistency.

Reinforced concrete trusses are used instead of plain beams to support the longitudinal girders of a concrete bridge of the girder type across the river Lagan at Belfast, Ireland. The design is described in a recent number of the "Engineer." The bridge is 30 ft. wide and 195 ft. between abutments and is divided by three pairs of piers into two end spans of about 40 ft. each and two center spans of 50 ft. horizontal clearance. There is a clear transverse span of about 16 ft. between each pair of piers. The piers are of 1:6 concrete, without reinforcement, each pair being connected above high-water level by a reinforced concrete truss, the horizontal members of which are 12 x 12 in. in cross-section. The center vertical and two web members are of the same widths, while two other diagonal members are 12 x 16 in. in area. In the lower chord six ⅞-in. rib bars were used; in the compression members four ½-in. bare were sufficient. The bridge is said to have cost about $12,000.

A full-size cornice model for the Kensico dam of the Catskill aqueduct has been made of galvanized iron and erected at a sufficient height to give the observer an idea of the relative foreshortening of its members. Drawings also have been prepared for a full-size granite model of a portion of the top of the Kensico dam. This is about 30 ft. high by 35 ft. long, and according to the annual report of the Board of Water Supply for 1911 it is to be erected near the site of the dam as a standard for dimensions, etc.

The last few years have seen an extensive development in the methods of handling concrete by gravity in chutes. With this development, however, there seems to be more or less of a tendency to use mixtures which are "drowned." This practice is due to a large extent to ignorance of the laws governing the flow of concrete in chutes, and the ordinary contractor assumes that the wetter the mixture the better the flow, which is in reality not the case.

As a matter of fact, the flow of concrete in chutes is half way between a slide and a roll. That is, the material slides in mass or the component parts of the material roll over one another as the material flows. Many factors determine the best consistency of the concrete, but a too wet concrete is a very hard material to handle, and the results in the finished concrete are hard to determine.

Reinforced Concrete in the Construction of Reservoirs

Engineer Luiggi in a recent number of the Annales de la Societe des Architectes at Ingenieurs Italiens, writes very interestingly on dams for artificial reservoirs. After describing the disadvantages of earthen and masonry dams he advocates most strongly reinforced concrete for the purpose of reservoir construction. Beginning with the Assouan dam on the Nile, the writer describes many of the more recent constructions in this country where impermeable diaphragms have been used, such as the works on the Cold Spring and recently on the Rio Grande River in Colorado, and comments especially upon the ideal type which has been used at Morena, near San Diego in California, and also at Relief in the Sierra Nevadas, "These dams," he says, "destroy all the fear of a destruction by earthquake, because the large body of dry masonry can separate and become displaced, but not disappear. The diaphragm can be torn and let the water of the reservoir through, the water going through the cracks slowly, and not in one great body, as is the case in masonry dams. No great destruction would be produced by such inundations as was in the case of the Johnstown and other similar disasters."

Notes on Highway Bridge Construction

Lack of Uniformity in Specifications—Standardization of Design—Outline of Truss—Panel Lengths—Flooring—Reference Tables for Designers

Specially Contributed by F. Tissington*

OWING to the present rapid development of the resources, and to the increase in population in Canada and to the comparative lack of roads as a means of communication, there is a great demand from all parts of the Dominion for the construction of new roads and for the improvement of the existing highways. This incidentally calls for a large output of structural steel for bridges.

So far as can be seen this demand is not spasmodic, in fact there is every indication that it will prove an increasing one and therefore this appears to be an opportune moment to discuss some of the phases of bridge construction as well as that of road surfaces in general, on which so much has been written lately.

In the issue of the "Contract Record" for July 23rd, appeared an editorial under the heading "Economical Engineering," the latter part of which deals with the subject of highway bridges. There is no doubt that if some of the ideas embodied in this comment were adopted a very considerable economy would be effected in a short interval. Innovations are generally regarded at first with some suspicion as we are all more or less conservative. We generally prefer to do something similar to what we have done before, because we are surer of the result.

Uniform Specifications

The first point raised is the lack of uniformity in specifications. Now with one specification only in view, any manufacturer would be able to enlarge his sphere of operations quite easily, as the interpretation of a specification running to perhaps a dozen or more pages is a matter of careful thought and study. Generally there is little likelihood of any organization being able to obtain an exact rendering of all the clauses contained therein, until they have actually manufactured a few bridges and faced the difficulties incident to the circumstances and cope with the ideas of the Provincial Engineer concerned. This feature, unconsciously perhaps in most cases, induces the firm tendering to allow for contingencies in their price, probably causing a larger sum of money to be expended than is actually warranted.

The writer has knowledge of engineers who issue specifications that they themselves do not really understand, as they are copied from specifications drawn up by other engineers. Again, specifications are used which are far beyond the needs of the district for which they are intended, even after allowing for all reasonable increases in traffic for the future.

The writer has had experience with the specifications issued by the Department of Railways & Canals, 1908, and by the Ontario, Saskatchewan, Manitoba, New Brunswick, Nova Scotia and Prince Edward Island governments. The first of these is by far the most logical and concise and appears to cover all the points necessary. This specification is used also by the Quebec provincial government.

Most of the others give results varying slightly from this, so that from a common-sense point of view, there hardly appears to be the necessity for a departure from this standard.

The standardization of design is worthy of a good deal of consideration, particularly in view of the fact that it is proposed to eliminate all odd size bridges, and the independent designing by each bridge works.

The writer suggests that a good service would be obtained sufficient to meet every case, if increments of five feet in the lengths of the spans were adopted.

Most bridge yards no doubt keep records of various types of what they have done and naturally, after a time these become of great use to the estimating department to form the basis of price for new work.

It is only by comparison with what you have done before, that any near approximation can be obtained to the probable cost, and further, the effect that change of design or details has on the weight and price can be more readily traced, if some system of tabulation is used.

Now, if this is true for a single yard turning out only a small percentage of the total number of bridges manufactured in the country, it is evident that by the judicious use of the same principles on a larger scale, that the effect on the cost would be more apparent, and further the necessary staff to obtain that result would be correspondingly smaller in proportion.

No doubt the argument will be raised that better results, so far as price is concerned, will be obtained by competitive design, as each organization could thereby suit its particular style of manufacture, but the writer is of the opinion that if this were the case it would be only temporary, providing an adequate and fully experienced practical staff handled the government designing proposition.

The actual amount of work entailed would in any case be less, as the details of the structure, material lists, weights, etc., would all be carefully worked out once only, and this information guaranteed to be correct, so that it would not be necessary for each manufacturer in tendering to make up an estimate of the weight or in the case of an order, to prepare shop drawings, bills of material, etc.

Distribution of Material

Another important point is the economical distribution of material as it is quite easy to design a bridge or for that matter any structure in a number of different ways, but only one of which can be the cheapest.

It naturally follows from this, that a great deal of research and collection of records is necessary before it is possible to say of any design that the particular one under notice represents the final paring down that is possible for a given specification.

These remarks are not intended to indicate that the danger point is reached so far as stability is concerned, but simply, that you have an exact rendering of every detail within the limits of the specification used and that every pound of material is doing its full share of the work in the most economical way.

Outline of Truss

In starting the design of a bridge, one of the first questions to be settled is that of the general outline of the truss.

The larger proportion of bridges built or building at the present time call for roadways sixteen feet clear between wheel guards, and, adopting the specification of the Department of Railways and Canals as a basis, the arrangement of truss outlines as given below have proved the most economical.

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* Chief Engineer, MacKinnon Holmes & Co., Sherbrooke, Que.

Up to 35 ft. span, I-beam bridges.

From 40 ft. to 90 ft. span, Warren poney trusses.

From 90 ft. to 180 ft. span, through Pratt trusses with parallel chords.

Over 180 ft. span, the same with inclined top chord (hog back).

Panel Lengths

The following considerations to a large extent determine the selection of panel lengths.

(1) That the panel lengths should be as long as possible without using 24 in. I-beams for the floor beams.

(a) This has the effect of transferring directly to the abutments a larger proportion of the load to be carried. For instance with four panels one-fourth of the load is carried by the abutments, and three-fourths by the truss, whereas with five panels, the amounts are respectively one-fifth and four-fifths.

(b) Further, if the number of panels is reduced, the quantity of diagonals and posts will be correspondingly less.

As these members are costly to manufacture, owing to the details and the connections to be rivetted in the field, and the further loss of material entailed each time a rivet section is taken out of a tie, it naturally follows, that in most cases a saving in weight can be accomplished.

Even supposing this is not so and that the weight taken out of the truss is put into the floor system the price would still be smaller owing to the relative cost of the truss members and the floor girders, which will be in the neighborhood of five and three cents per pound, respectively, for the two classes of work erected on the site.

(c) Still another reason for keeping the number of panels down to a minimum is the fact, that in small trusses it is often times impossible to use a section small enough, as the specification referred to calls for a minimum sized angle section of 2½ in. x 2½ in. x 5-16 in., and this must be adhered to if only half the sectional area is required.

(d) Except in special cases it is not advisable to design to use a 24 in. I-beam for the floor beams owing to the extra price required by the rolling mills, over and above the figure asked for the other sizes, and also the greater difficulties in obtaining deliveries.

(2) Where possible the use of a forty-five degrees inclination in the bracing members of the truss will simplify calculations, and in a general way this will settle the number of panels to use for a given span, taking into account the foregoing stipulations in table I., the proportions given for length of span, depth of truss and panel length will be found economical, but it should be understood that the writer does not claim that this is the last word on these features.

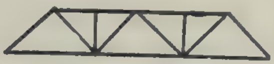
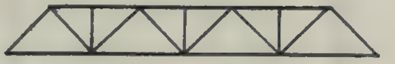
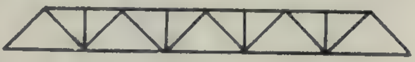
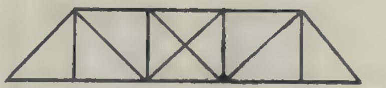
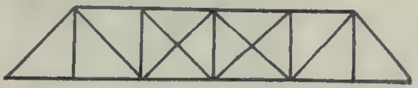
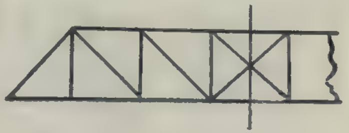
Flooring

Two classes of floor are in general use, viz., timber and concrete.

Whether it is advisable at the present time to lay down so many timber floors, the writer is hardly in a position to state definitely. Owing to financial arrangements this may be unavoidable, but in general, I think the concrete floor to be far more economical in the long run, although in first cost it will exceed the price of a timber floor.

Timber floors as usually laid consist of four-inch planks laid on steel stringers. Occasionally a top

TABLE I

Span Centres	No. of Panels	Depth of Truss	Ratio Span Depth	Panel Length	Type	Diagram
40′	3	6′ 8″	6	13′ 4″	Warren (Poney)	
45′	3	7′ 6″	6	15′ 0″	" "	
50′	3	8′ 4″	6	16′ 8″	" "	
55′	3	9′ 2″	6	18′ 4″	" "	
60′	4	7′ 6″	8	15′ 0″	" "	
65′	4	8′ 1½″	8	16′ 3″	" "	
70′	4	8′ 9″	8	17′ 6″	" "	
75′	4	9′ 4½″	8	18′ 9″	" "	
80′	4	10′ 0″	8	20′ 0″	" "	
85′	5	10′ 0″	8.5	17′ 0″	" "	
90′	5	10′ 0″	9.	18′ 0″	" "	
100′	5	20′ 0″	5	20′ 0″	Through Pratt Parallel Chords	
110′	5	22′ 0″	5	22′ 0″	" "	
120′	5	24′ 0″	5	24′ 0″	" "	
130′	6	21′ 0″	6	21′ 8″	" "	
140′	6	23′ 4″	6	23′ 4″	" "	
150′	6	25′ 0″	6	25′ 0″	" "	
160′	7	22′ 10¼″	7	22′ 10¼″	" "	
170′	7	24′ 3½″	7	24′ 3½″	" "	
180′	7	25′ 8½″	7	25′ 8½″	" "	

Notes on Highway Bridge Construction

By F. Tissington

TABLE II.—Of Moments, Section Moduli and I Beam Sections for Stringers for Highway Bridges

Span in Feet	Bending moments, inch—lbs., timber floor				Sec. mod. at 20000	I Beam section			Bending moments, inch—lbs., concrete floor				Sec. mod. at 20000	I Beam section		
	Dead	Live	Impact	Total		Stand-ard	Beth-lehem	Car-negie Special	Dead	Live	Impact	Total		Stand-ard	Beth-lehem	Car-negie Special
10	10,700	90,000	75,300	176,000	8.80	ins. lbs. 7–15 10.4	ins. lbs. 8–17.5 14.3	ins. lbs. 8–17.5 14.6	46,800	90,000	59,000	195,800	9.8	ins. lbs. 7–15 10.4	ins. lbs. 8–17.5 14.3	ins. lbs. 8–17.5 14.6
11	13,600	99,000	86,400	199,000	9.95	do	do	do	56,630	99,000	63,000	218,630	10.9	8–18 14.2	do	do
12	16,200	108,000	93,500	217,700	10.89	8–18 14.2	do	do	67,400	108,000	66,500	241,900	12.1	do	do	do
13	20,240	112,100	94,500	226,840	11.34	do	do	do	79,100	112,100	75,000	266,200	12.8	do	do	do
14	22,930	138,500	118,000	279,430	13.97	do	do	do	91,730	138,500	84,000	314,230	15.7	9–21 18.9	9–20 18.9	10–22 22.8
15	26,460	145,200	123,000	294,660	14.73	9–21 18.9	9–20 18.9	10–22 22.8	108,000	145,200	83,000	336,200	16.8	do	do	do
16	31,200	162,000	136,000	329,200	16.46	do	do	do	122,900	162,000	91,000	375,900	18.8	do	do	do
17	35,220	180,000	150,000	365,220	18.26	do	do	do	138,720	180,000	102,000	420,720	21.1	10–25 24.4	10–23.5 24.6	do
18	39,470	195,720	163,000	398,190	19.91	10–25 24.4	10–23.5 24.6	do	155,520	195,720	110,000	461,240	23.1	do	do	12–27½ 33.3
19	44,480	213,000	177,000	434,480	21.72	do	do	do	173,280	213,000	118,000	504,280	25.2	12–31.5 36.0	12–28½ 36.0	do
20	50,700	230,400	189,000	470,100	23.5	do	do	12–27.5 33.3	196,800	240,000	134,000	570,800	28.5	do	do	do
21	55,910	248,000	203,000	506,910	25.35	12–31.5 36.0	12–28.5 36.0	do	216,970	264,600	146,000	627,570	31.4	do	do	do
22	61,700	265,000	216,000	542,770	27.14	do	do	do	238,130	290,400	160,000	688,530	34.4	do	do	15–36 54
23	72,450	282,500	230,000	584,950	29.25	do	do	do	260,270	317,400	174,000	751,670	37.6	15–42 58.9	15–38 59.0	do
24	78,620	300,000	238,000	616,620	30.83	do	do	do	290,300	345,600	187,000	822,900	41.1	do	do	do
25	85,310	317,500	250,000	652,830	32.64	do	do	do	315,000	375,000	204,000	894,000	44.7	do	do	do
26	91,730	335,100	263,000	689,830	34.5	do	do	15–36 54	340,700	405,600	220,000	966,300	48.3	do	do	do
27	102,220	356,400	270,000	728,630	36.43	15–42 58.9	15–38 59	do	367,420	437,400	238,000	1,042,820	52.1	do	do	do
28	107,000	382,000	296,000	785,000	39.25	do	do	do	395,140	470,400	258,000	1,123,540	56.2	do	do	do

Notes on Highway Bridge Construction

By F. Tissington

TABLE III.—Of Moments, Section Moduli and I Beam Sections for Floor Beams for Highway Bridges

Span in Feet	Bending moments, inch—lbs., timber floor				Sec. mod. at 20000	I Beam section			Bending moments, inch—lbs., concrete floor				Sec. mod. at 20000	I Beam section		
	Dead	Live	Impact	Total		Standard	Bethlehem	Carnegie Special	Dead	Live	Impact	Total		Standard	Bethlehem	Carnegie Special
						ins. lbs.	ins. lbs.	ins. lbs.						ins. lbs.	ins. lbs.	ins. lbs.
10	105,200	420,000	335,000	860,200	43.0	12–40 44.8	15–38 59	15–36 54	337,000	420,000	235,000	992,000	49.6	15–42 58.9	15–38 59	15–36 54
11	115,720	462,880	385,000	963,600	48.2	15–42 58.9	do	do	370,304	462,880	265,000	1,098,180	54.9	do	do	18–46 81.5
12	126,240	504,960	410,000	1,041,200	52.1	do	do	do	403,968	504,960	283,000	1,191,930	59.6	18–55 88.4	18–48½ 88.7	do
13	136,760	547,040	432,000	1,115,800	55.8	do	do	18–46 81.5	437,632	547,040	300,000	1,284,670	64.2	do	do	do
14	176,736	589,120	455,000	1,220,856	61.1	18–55 88.4	18–48½ 88.7	do	471,296	589,120	325,000	1,385,420	69.3	do	do	do
15	189,360	631,200	485,040	1,305,600	65.3	do	do	do	504,960	631,200	352,000	1,488,200	74.4	do	do	do
16	201,980	673,280	515,000	1,390,260	69.5	do	do	do	538,624	673,280	375,000	1,586,900	79.4	do	do	do
17	214,600	715,360	550,000	1,479,960	74.0	do	do	do	572,288	715,360	400,000	1,687,650	84.4	do	do	21–57.5 116.9
18	227,230	757,440	585,000	1,569,670	78.5	do	do	do	605,952	757,440	420,000	1,783,390	89.2	20–65 117.0	20–59 117.2	do
19	239,850	799,520	620,000	1,659,370	85.0	do	do	21–57.5 116.9	639,620	799,520	445,000	1,884,140	94.2	do	do	do
20	252,480	841,600	650,000	1,744,080	87.2	do	do	do	673,280	841,600	470,000	1,984,880	99.3	do	do	do
21	265,100	883,680	685,000	1,833,780	91.7	20–65 117.0	20–59 117.2	do	706,944	883,680	490,000	2,080,620	104.	do	do	do
22	277,730	925,760	715,000	1,918,490	96.0	do	do	do	740,600	925,760	515,000	2,181,370	109.	do	do	d0
23	290,350	967,840	742,000	2,000,190	100.0	do	do	do	774,272	967,840	540,000	2,282,110	114.	do	do	do
24	302,970	1,009,920	770,000	2,082,890	104.1	do	do	do	807,940	1,009,920	555,000	2,372,860	119.	20–80 146.7	20–72 146.7	24–69.5 16o.7
25	315,600	1,052,000	765,000	2,132,600	106.6	do	do	do	841,600	1,052,000	555,400	2,449,000	123.	do	do	do
26	328,200	1,094,000	840,000	2,262,200	113.1	do	do	do	875,300	1,094,000	610,000	2,579,300	129.0	do	do	do
27	340,000	1,130,000	850,000	2,320,000	116.0	do	do	do	910,000	1,130,000	620,000	2,660,000	133.0	do	do	do
28	356,000	1,180,000	920,000	2,456,000	122.8	20–80 146.7	20–72 146.7	24–69.5 160.7	950,000	1,180,000	665,000	2,795,000	139.8	do	do	do

wearing surface of two-inch planks is placed upon the four-inch timbers.

The permissible pitch of the steel stringers is three feet six inches, and the average weight of the timber flooring will be about eighteen pounds per square foot.

The concrete floors are generally about five or six inches thick, with steel reinforcement to carry the concentrated loads safely. The stringers can be placed further apart say four to four feet six inches, so long as sufficient reinforcement is used. This type of flooring weighs from sixty to seventy-five pounds per square foot.

Loads on Floor System

These consist of the dead weight of floor, and the specification calls for a distributed load of 100 pounds per square foot of floor surface, i.e., between wheel guards, for the live load, or a concentrated rolling load of 24,000 pounds on four wheels, equally distributed, the axles being 8 ft. centres and centres of wheels 6 ft.

Whichever loading produces the greatest bending moment is to be used.

The impact clause in this specification reads:—

$$\text{Impact} = \frac{\text{Live Load}^2}{\text{Dead Load} + \text{Live Load}}$$

If this is investigated it will be seen that an increase in the dead load will reduce the impact, whereas if the dead load is reduced, the value of the impact is thereupon increased.

So that within a comparatively wide range it does not make any appreciable difference to the result if the dead load is not taken very accurately.

A study of Tables II. and III. will make this clear particularly when it is stated, that in this particular instance the dead loads for timber and concrete flooring were taken at about the ratio of one to four respectively.

Stringers

Table II. will be found useful in determining the size of I-beam section to use for a given case.

The first column gives the length of a panel, and lengths varying from ten to twenty-eight feet have been calculated. The next three columns give the bending moments in inch-pounds for dead and live loads, and the increment to be added for impact, the flooring being of timber.

These figures are produced from the data given previously, and it should be noted that in most cases the concentrated live load will determine the amount of the bending moment, and not the distributed live load. With timber floors and panel lengths of 27 ft. and 28 ft. however the distributed live load produces the greater value, whilst for concrete floors figures given in the live load column are determined by the distributed load, and only those referred to as being the same as for the timber floor covering are obtained from the concentrated loading.

The three columns headed, "I-beam sections" for both timber and concrete floor coverings quote the size of section permissible to use so far as Standard, Bethlehem and Special Carnegie sections are concerned, and the figures immediately below the size represent the corresponding section modulus.

This table should prove of value in selecting the most economical section of I-beam to use taking into account the current market price of the three types of beams.

Floor Beams

Table III. is a similar one to that described above for stringers.

Unlike Table II. however, the live load bending moment is in all cases determined from the distributed live load instead of from the concentrated.

The Treatment of Sewage Discharged into Tidal Waters*

By H. C. H. Shenton

IN a paper read before the Engineering Club of Philadelphia, Mr. George C. Whipple gave the results of a series of experiments made in order to ascertain the effect of sewage pollution upon the water supplies drawn from the Great Lakes in America. These experiments have no reference to tidal waters, but they show very clearly that owing to the currents induced by winds, sewage may be carried for miles out in a great lake and cause serious pollution at the drinking water intakes situated 4, or even 6, miles from the shore.

Mr. Whipple gave the clearest evidence that the currents induced by winds may, and do under certain conditions, pollute the water miles from the shore. He shows that "the sewage is projected through the lake water for several miles with relatively little dilution." Experiments made with floats showed that the angle of dispersion of the sewage varies according to the velocity of the wind in the Great Lakes. Undertow currents induced by the wind were found to have an important bearing upon the dispersion of the sewage. During the summer season the temperature of the sewage is ordinarily about the same as that of the surface water of the lakes. Where the sewage was discharged at the bottom of a lake at a considerable distance from the shore it was found that the surrounding water was much colder, owing to currents induced by the winds, and the warm sewage, being lighter than the cold water into which it was discharged, tended to rise into the upper strata and to be carried away from the shore by the outward surface current. On the other hand, when the warm shore water was flowing outward along the bottom, owing to a different wind, the sewage had less tendency to rise, but was carried away from the shore by the outward bottom current. Thus, during the summer the movements of the wind, whether towards or away from the shore, tended at most times to carry the sewage away from the shore rather than towards it. Though in general it was found that the dilution of the sewage discharged into the lakes was ordinarily very great, it was found to be very variable, and under certain conditions, which occur several times a year, the sewage was projected for several miles with relatively little dilution in the direction of the water intakes. Observations of the number of bacteria in Lake Michigan water, taken at different distances from the shore opposite a sewer outfall, showed that there were 1,268,000 bacteria per cubic centimetre at the mouth of the Milwaukee River, 207,000 per c.c. 1 mile east of the river, 2,000 per c.c. 2 miles east, 970 per c.c. 3 miles east, 225 per c.c. 4 miles east, and 45 per c.c. 5 miles east. The water supply intake is situated 3.5 miles in a straight line northeast of the river, and here the average number of bacteria was 1,182 per c.c. at the surface and 694 per c.c. at the bottom, the largest number being 3,720 at the surface and 1,600 at the bottom, and the smallest number being 20 at the surface and 50 at the bottom. Also, taking all the samples collected at points more than 1 mile away from the shore, it was found that when the wind was blowing towards the shore, and thereby inducing an outward undertow current, the bottom water contained four times as many B. coli, as the surface water, but that when the wind was blowing off-shore the surface water contained eight times as many B. coli as the bottom water.

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* Extract from paper read before the Association of Managers of Sewage Disposal Works.

Daily analyses of the water at the North Point pumping station, Milwaukee, showed variations of from 5,900 bacteria per c.c. to 330 per c.c. within a few hours, while coli are often present in 1 c.c., and are occasionally absent from 1 c.c. on the following day. It is therefore sufficiently evident that the dilution afforded by the passage of sewage through 3½ miles of lake water is not sufficient at all times to produce satisfactory purification, and the fact that this occurs in a lake where a distinct current of sewage through the water would hardly be expected shows that there are, no doubt, similar possibilities in the case of tidal waters. It is evidently not sufficient to discharge sewage into deep water of limitless extent, seeing that the sewage may remain undiluted and flow in a distinct current in any given direction, and cause trouble at a point at a considerable distance. The dispersion of the sewage and its thorough mixing with the diluting water must be accomplished before proper purification can take place.

The report of the Metropolitan Sewage Commission of New York, in considering the discharge of the sewage of that city into tidal waters shows that the experts have come to the same conclusion as our own Royal Commission with regard to the importance of dilution. In both cases the degree of dilution afforded by the stream of waterway is taken as the factor to be considered in fixing any definite standard. The New York Commission are of opinion that an immediate test of the present state of the water should show that the dissolved oxygen does not fall below a certain figure.

Standards of Purity

Enough has been said to demonstrate the impossibility of stating that sewage discharged into tidal waters should be of any particular standard of purity. In the most recent works carried out, or in contemplation, near home we see that a very high degree of purity is considered necessary. One may instance Southend, Faversham and Whitstable, where the works are, or will be, of a most elaborate character.

In America, where a great deal of attention has been given to the matter lately, the principles that are being adopted may be gathered from a consideration of the recommendations of the New York Commission, which are as follows:—

(1) Garbage, offal, or solid matter recognisable as of sewage origin shall not be visible in any of the harbour waters.

(2) Marked discoloration or turbidity due to sewage or trade wastes, effervescence, oily sleek, odour or deposits shall not occur except perhaps in the immediate vicinity of sewer outfalls, and then only to such an extent and in such places as may be permitted by the authority having jurisdiction over the sanitary condition of the habour.

(3) The discharge of sewage shall not materially contribute to the formation of deposits injurious to navigation.

(4) Except in the immediate vicinity of docks and piers and sewer outfalls, the dissolved oxygen in the water shall not fall below 3 c.c. per litre of water. Near docks and piers there should always be sufficient oxygen in the water to prevent nuisance from odours.

(5) The quality of the water at points suitable for bathing and oyster culture should conform substantially as to bacterial purity to a drinking water standard.

The meaning of which is that there will probably be several outfalls, some of which will discharge crude sewage, some partially purified sewage, and some sewage purified to a very high degree, as the special conditions may demand.

Following this policy as outlined, it is clear that the treatment of sewage discharged into tidal waters must vary from the discharge of crude sewage or tank effluent at places where it can do no possible harm to the most complete system of tanks and filters, sterilization being generally held in the background as a final possibility. These facts show each case where sewage has to be discharged into tidal waters. The chemist, bacteriologist, pathologist and engineer must each have a great deal of work to do in order to ascertain the exact degree to which it is necessary to purify the sewage at any given place, and such scientific attention will often result in the saving of a very large sum of money on constructional works and maintenance, but where this skilled attention is not given in the first place it will generally be necessary for the authority to put in works of an elaborate nature which may sometimes be altogether in excess of the requirements.

It is not to be imagined that sewage can often be discharged into tidal waters without any purification, but the degree of purification required before the effluent is discharged must vary considerably, and its attainment will depend not only upon the design of the works, but upon the management which they receive. Further, that the judicious improvement and better working of existing systems may be attained by the efforts of the manager is clear, and of this fact the works at Erith are a striking example.

Types of inflammable buildings with inadequate provisions for the safety of the occupants are to be shown in moving pictures at public meetings throughout the State of Arkansas by the Arkansas Fire Prevention Society.

Rough preliminary handling of rails is not entirely objectionable, in the estimation of Mr. W. C. Cushing, chief engineer maintenance of way of the Southwest system of the Pennsylvania Lines and chairman of the rail committee of the American Railway Engineering Association, as expressed at the recent convention of the association. As Mr. Cushing pointed out, rails must be able to stand hard usage in service, and rough handling before use may reveal inherent defects.

Cutting a concrete sewer with a steam shovel was recently accomplished by the New York, Chicago & St. Louis Railroad in grade-reduction work at Cleveland. Through misinformation the railroad engineers believed the 8-ft. circular concrete sewer to be 6 ft. lower than it was, and when it was encountered in the middle of the night it had to be cut through or the work had to be suspended for the time being. The former course was chosen, and it was carried out successfully with the Bucyrus 70 in use on the work. The sewer was of first-class concrete, reinforced with 1½ x 3/8-in. flat bars transversely and ½-in. rods longitudinally.

Method of Distributing Sewage on Bacteria Beds*

THE bacterial system has been adopted at Fenton to treat the flow from 26,000 inhabitants, and has a capacity of 6,300 cubic yards of bacteria beds, together with one fixed spray bed of 520 cubic yards capacity.

The main beds are rectangular provided with two troughs and four arms per acre. The beds are divided into four sections, one complete arm traversing each section of the bed, and distributing on the intermittent principle. Each complete unit is hauled from end to end of the bed by means of an endless rope. The power houses are two in number, oil engines being provided in each house to drive the gear for operating each half of the bed. The gearing in each house is arranged in such manner that upon either engine failing or being temporarily closed down for cleaning one engine has the necessary reserve of power to drive the four complete arms of the beds, and thereby obviate the necessity of closing down and losing half of the available area of bacteria bed.

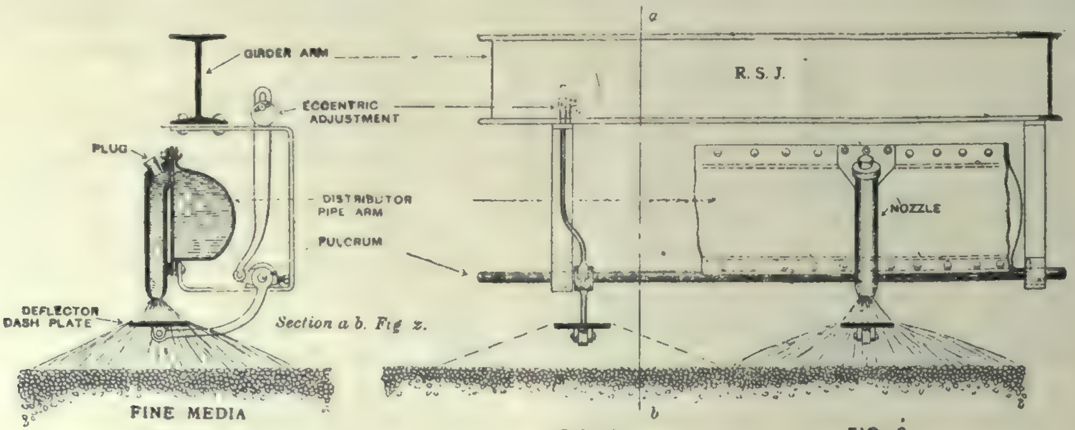

FIG. 1 FIG. 2 FIG. 3

1—Details of jet spray adopted on rectangular beds.

The distributing arms are fed from the trough by means of a syphon, these arms have a gradual taper towards the end farthest from the syphon, and by this construction even pressure is maintained throughout the entire span of the arm, and, naturally, even distribution at each nozzle fixed thereto. Plate No. 1.

The nozzles, it will be seen, are attached to the flat side of the distributing arm, and with the type of deflector plates as shown need be no less than 12 in. to 18 in. apart. An excellent spray is obtained from this type of deflector, and arrangements are made, as shown, for altering the height and angle and obtaining an increase or decrease of spray density. Plugs are provided at the top of the nozzles for cleaning out the pipe when necessary. These nozzles are about ⅝ in. diameter at the point of discharge. The outlet nozzles stand some 3 in. to 4 in. above the bed media and discharge upon either fan or circular deflectors, which throw a fine film which links jet to jet and produces a complete unbroken spray film from end to end of the arms.

These distributors have been running at Fenton over a period of five years, and have given excellent results with practically no wear.

The arrangement of filters in rectangular blocks, taking two troughs and four arms to the acre, reduces waste of space to a minimum, the need of division walls being eliminated, the extra filtration area gained over circular beds erected upon the same site being as 1 is to .7854.

The actual power required to drive these distributors is about 1½ b.h.p. per acre, a small margin over and above this figure being absorbed in the reverse motion which takes place at the end of each journey.

Much experiment and research have been carried out in England and America on the method of distribution known as the fixed spray principle, both continuous and intermittent sprays having been erected and tested. The department has carried on much research in this type of distributor, and with the advice and guidance of the borough sewage engineer admirable ideas and sites have been fixed, and I have no hesitation in saying a fixed spray nozzle of great merit has been evolved, working on the intermittent principle, the mechanical construction having been perfected and patented by Messrs. Hartley, Causton & Richmond, Limited, engineers, of Stoke-on-Trent.

Unlike the whirling or centrifugal spray, or the fine nozzle small cone spray, the nozzle adopted at Fenton has features entirely its own. From a head of 6 ft. the sewage passes from an automatic dosing chamber to the distributor pipes carrying the fixed jet sprays buried beneath the surface of the bed, the curve of discharge and rest controlling equal alternate periods of one cycle. Particulars of this jet are shown in Plate No. 3. The large opening of the jet and also the equally large deflector will be noticed, these being distinct points in the design, the large opening in the nozzle being practically free from the trouble of clogging, and the deflector giving the maximum curve under the discharge force of this nozzle. The nozzles stand 7 in. to 8 in. above the media surface.

It will also be noticed that the deflector may be swung completely over, and should any jet become clogged, which is most unlikely, the time taken during the operation of cleansing it is naturally reduced to

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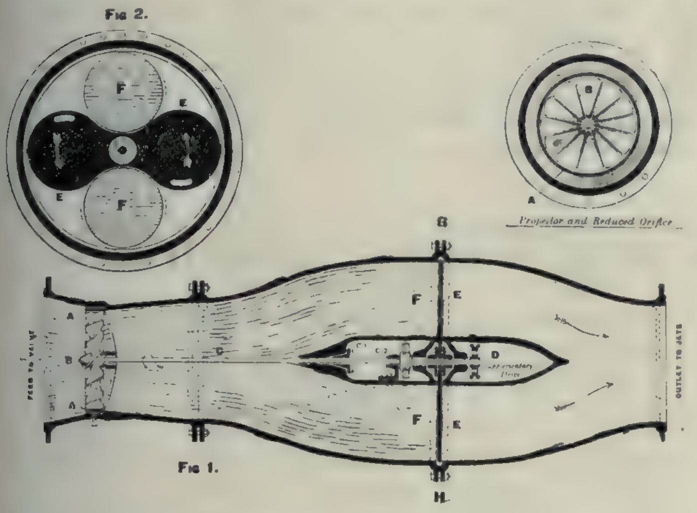
[*] From a paper by U. W. Adams, Chief Assistant Sewage Engineer, Stoke-on-Trent, Eng.

a minimum. It must be borne in mind that unless overlapping of the maximum perimeter of jet upon jet takes place all over the bed 22 per cent. of the area is lost in every design of this type of distributor. Experiments must now be made with a spray nozzle having a deflector fitted of such design and construction that the thrown spray shall cover one complete square unit of the bed surface, leaving no margin between nor overlapping the wetted periphery of any jet in the vicinity, and also the same periphery of this spray should be arranged to reduce from maximum to zero, and vice-versa, with mechanical precision during the period of distribution, thereby effecting no undue overdosing of any area between the maximum and zero points.



2—Adams' automatic revolving dual disc valve

I have drafted an idea for a self-contained automatic revolving dual disc valve, for causing cyclic variations on continuous flow or intermittent dosing distributors, applicable to this type of jet distributor, as shown on Plate No. 2. The soundness of this idea I have not tested in practice and it is only added to this paper to call forth the opinions that must be held by many engineers present who have had experience with this method of distribution.

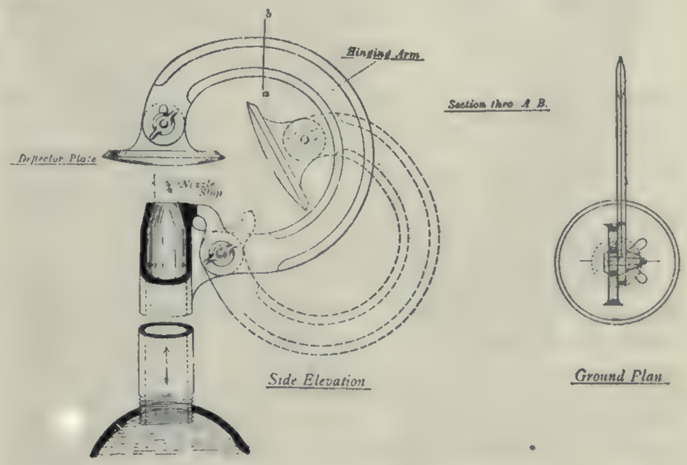
The idea in brief is as follows: from a given head of water maintained the flow is carried by hydraulic main for increase of velocity to a reduced throat or orifice "A" in which is fitted a fan propeller "B" keyed to a shaft "C," which is carried on bearings "C1" and "C2," these being totally enclosed, of the roller or ball type, and fed from the outside with grease through suitable lubricators.

Fitted to the shaft "C" at "C2" is a gear wheel of thirty teeth working in mesh with a wheel of sixty teeth connected to a shaft "D," on which is keyed the dual disc "E," which is arranged to run at half the speed of the propeller "B." The time variation of cyclic discharge could be governed directly by the angle given to the blades of the propeller. In order that the propeller may never come entirely to rest bypass ports of small area are allowed in each disc of valve "E" which do not come into operation until the main orifices "F" are completely covered. The disc valve "E" should by this means therefore never lose entirely its centrifugal force, while acting in the stead of a flywheel to the temporarily retarded propeller.

The orifices "F" are of such area that the unimpeded flow from the main carrier may pass through, thus retaining the maximum wetted periphery of the total jets fed when full open, and reducing in mechanical curves until the discharge has reached zero, which action is carried on in vice-versa variation throughout any fixed period of duration. This arrangement I have called "The Adams Automatic Variation Valve," applicable to fixed jet spray nozzles, and capable of producing cyclic variation of nozzle pressures. In the event of practice proving the inefficiency of the propeller drive arrangement of the valve, the valve could be easily operated by a small geared electric power unit of very small horse power, ¼ h.p. being quite ample to operate the largest valve. The valve barrel and ducts will be self explanatory from the diagram. Fig. 1 shows a side section through the valve, and Fig. 2 a section through G H, showing the ports "F" in open position and the disc valve "E" in its relative position.

Fixed sprays up to the present have played little part in the distribution of the sewage of this department, but from results obtained on the experimental bed at Fenton it appears that this method of distribution, scientifically tackled, holds great possibility of rivalling the more costly methods here employed, where power cost is now at a premium. With the type of variation valve described, perfected, or some similar method adopted whereby each portion of the filter could receive the necessary and even dose, and the same period allowed for very necessary aeration, I see no reason why the very heavy expenditure upon power hauled distributors that is involved from year to year at most works, should not be entirely abolished.

Fixed jet sprays obviously could not be recommended as a means of distribution on works in the close proximity of towns and dwellings, as the fine spray under the influence of prevalent winds could certainly be carried some distance, and should the carried spray contain much hydrogen-sulphide, aerial nuisance would certainly result, to say nothing of the possible distribution of pathogenic and other organisms to the air.



3—Arrangement of fixed spray nozzle.

Many types of distributors in the experimental stage owe part of their subsequent perfection to one or the other of two experimental beds laid down at Hanley, and used for this purpose alone. These experimental beds are rectangular and circular in design. The early type of "Scott-Moncrieff Distributor," with the open drip trough supported by lattice girders of single arm design, driven by an oil engine attached thereto, and running on an outside circuitous mono rail, was first erected on the circular experimental bed, and was subsequently perfected and removed to give place to prototype of the single arm distributors driven by a small motor carriage on the outside rail as adopted at the Burslem works. An automatic fixed jet spray distributor is the latest to be erected on this circular bed.

The first distributor to be fitted on the rectangular experimental bed was known as the "Piggot rectangular experimental distributor," and was fed from a central trough by means of a syphon, the cross arm being fitted with small bent ⅜-in. copper distributing pipes about 6 in. apart without a deflector plate of any description. This distributor was the first model in the experimental stage of the type now so popular, which embody all its principles, only in a more perfected form. This experimental model, which was manufactured by Messrs. Piggots, of Birmingham, was the outcome of ideas and experiments by Mr. Makepeace, to whom, therefore, a great part of the credit is due for the present excellent distributor of to-day.

An automatic distributor of unique design is now being erected, in the experimental stage, on half of the rectangular beds set aside for such tests and experiments, by Messrs. Daniel Adamson & Company, of Dukinfield. This distributor holds great promise when finally perfected. The propulsion is effected by the flow of sewage to rams having a rack attached thereto, which, working in a mesh with a free wheel pinion upon the shaft carrying the traverse rollers, carries the distributor over the surface of the bed, suitable reverse gear turning the water into a duplicate ram for the return journey, and vice-versa. The chief point in this new distributor is that the water used in operating the rams, after propelling the distributing arm and syphon, passes through the spray pipes for distribution on the bed, thereby doing away with the necessity of power haulage.

Foundation Problems and Their Solution

THE foundation of a building is the first part of its construction, and by far the most important to be made exactly right. In the latitude of Chicago there is no such thing as a foundation that is safe from frosts unless it extends, at least, 3 feet 6 inches below the natural grade of the lot on which the building is erected.

Big engineering propositions of foundations for sky-scrapers and extremely large buildings are always taken care of by capable engineering research and application, and have been discussed at length by the technical press from time to time. What we are calling attention to now is the foundation problem of the little cottages, the more pretentious residences, or other smaller buildings, of which there are immense numbers, and which constitute the larger part of all construction as well as the main consumption of all building materials.

Let us look at the foundation problem fairly and squarely. It is customary, when a man intends to build a bungalow, to look for the very cheapest material possible for all that part of the building which is underground, because it does not show. As such foundations have a very insignificant load, almost anything is sufficiently strong to carry it.

Fifteen years ago twenty-four-inch rubble stone walls, laid in lime mortar and having a footing of double-sized rubble stone, was the standard foundation for such buildings. Such basements were invariably damp, and it made very little difference whether the frost got under the footing or not, because there was enough "give and take" in the irregularity of the bearings of the rubble and the soft mortar, to take up any ordinary frost heave, or to conceal the cracks that were the results of minor settlements in the foundation walls, where the footing happened to rest on soft spots of earth or on shifty sand.

At the present time the most popular foundation for such a landing has come to be the 12-inch concrete wall, which, when properly made, is just about as nearly perfect proposition for the purpose as can be devised; but not one out of a thousand is properly made. The contractor who takes the job generally figures from the plans of an architect who has never seen the lot and who assumes that the grade line will represent a level surface of the ground. He shows excavations amounting to a depth of 4 feet, so as to give a 6-inch margin. The ground slopes to one corner of the building in nearly every case, so the excavation on the low side will be no more than 6 inches or 10 inches. In fact, it may not extend through the black loam of the surface, and at that corner the building is entirely unprotected from the attacks of frost.

The contractor cannot afford to furnish any more material than he has figured to use in the foundation, for more than likely he has taken the job so as to simply make his own wages by putting in the foundation. Should he deepen the trench on the low side, and add three additional yards of concrete to his foundation, it would amount to his wiping out all the profit as well as his wages for putting in the foundation. The result is that the foundation as put in may be short of cement, but even when there is plenty of cement put into the concrete, the work is done so cheaply that the contractor cannot afford to mix the concrete properly, It is usually just a case of shoveling in some crushed rock, along with a little sand and a little cement to make a spongy, porous concrete which is not worthy of the name and not fit for any structural use.

Naturally, such a foundation has to be first daubed up with plaster on the outside, then it has to be treated with all manner of waterproofing compounds and devices to keep the soil waters from penetrating the wall and so making a wet basement. In spite of all the precautions of waterproofing, close to one hundred per cent. of all such foundations are damp, are wet, and will always be unsatisfactory.

Notwithstanding all that has been published and said by technical men on the subject of mixing concrete and making it wet enough so as to puddle the moisture to the surface, very little puddling of concrete is ever really done. The main dependence for securing solidity by the usual foundation contractor is the weight of the material when it is shoveled into the forms. True, the workmen may walk backward and forward, stepping on the material, and so tamping it down with their weight, but it is incomplete, insufficient and unsatisfactory. If this is not remedied it is quite certain that there will be a return to the use of rubble stone for foundation purposes, which will keep the concrete man out of a very large portion of the business which he now enjoys.

Let us assume that all the materials to make good concrete are assembled on the job, still it takes some additional assembling to that of the materials. It requires sufficient water, and water is not always the easiest thing to obtain on a little foundation job. When the weather is very hot, and the water has to be hauled in barrels or in a tank wagon, there is a very pronounced tendency to skimp on the water, just as there is to skimp on the cement and in every material that is in the work. There is no substitute for water or for adequate mixing in a concrete job.

Half of the contractors who put in residence foundations proceed by the following method: They will spread out on a mixing board, or on the ground, a yard of crushed rock. On top of this they will spread half a yard of sand; on top of the sand they will spread, fairly evenly, four or five bags of cement. Then they will throw on a few buckets of water and immediately begin to shovel the entire mass into the forms, without any pretense of turning it over or mixing it, claiming that the stuff is all loose and wet and mixes as it goes in. They claim that it is impossible to keep it from mixing, and, consequently, there is no use to go to the expense of paying men to shovel several tons of material two or three times, when it can be done with one shoveling.

Mixing, Tamping and Proportioning

This mixing proposition is very seldom improved upon, even when there is a small hand mixer on the job, because it is somewhat of a back-breaking undertaking to grind the crank of a hand mixer, and the laborer who has this part of the work to do does not care a rap about the quality of the material he is producing, and every turn that he can avoid is carefully avoided.

There is no question whatever but that a good solid foundation made of concrete, well mixed, well tamped and properly proportioned, will be just about as tight as a jug. If it extends down to 3 feet 6 inches below natural grade it will be just about as safe from frost and in every way as nearly perfect a foundation as can be secured.

When the excavation for a foundation extends 3 feet 6 inches, or even 4 feet below natural grade, it will not be impervious from an attack by frost, unless the back-filling of dirt against the foundation, when finished, is well rammed into place and the dirt piled up a little higher immediately at the edge of the foundation, so as to throw the surface water a few inches away from the building.

It would be difficult to estimate the amount of money involved in the damages to buildings where lack of depth of the footing allows the frost to go under the building.

There is an idea prevalent among even experienced contractors that loose dirt from the excavation can be piled up against the foundation of the building and so built up to make the 4-foot depth to their footing. Made ground is not a protection against frost until it has had from thirty to thirty-two winters, even though the footings are placed as deep as sixteen feet in made ground.

Made Ground

The writer recently observed the foundation of a building resting on made ground which extends ten feet below the grade of a modern street. The total filling, however, amounts to about twenty feet. Last winter the frost penetrated into the made ground and got beneath the footings, which were ten feet below the present grade, and raised all four corners of that building so that extensive repairs were necessary during the present summer. In fact, made ground never becomes as solidly stratified for the resistance of moisture as the stratification of the natural surface of the earth, and this is why we always use the expression of "natural grade."

Made ground should never be considered as having any value in the placing of the footing of a building. A 3-foot 6-inch or 4-foot excavation below the surface of the natural grade does not indicate that the penetration of frosts in severe winters is limited to that depth. Penetrations of frost into the ground have been found seven and even eight feet. But it does not mean that in the usual construction of buildings the quantity of moisture that penetrates through the various earthly strata to the depth of three and one-half feet is not sufficient to form a crystalline arch of ice which by contraction and expansion disturbs the footing of the building.

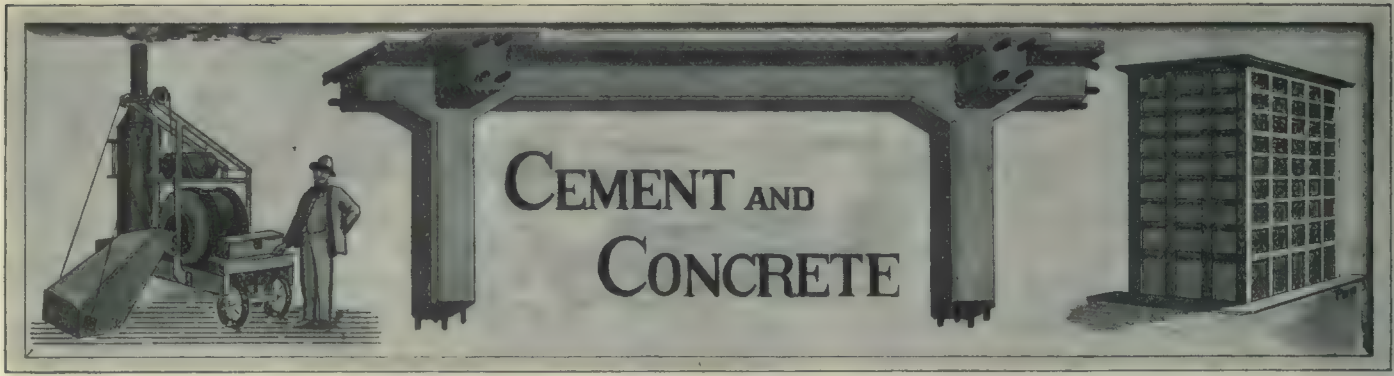
The surface drainage of the building at completion naturally becomes an important matter, for if rain water is kept away from the wall it will not go under the foundation. The owner should always be cautioned with regard to his responsibilty in keeping the walls, especially those of a new building, from standing in water while the fall rains are soaking into the whole surface of the ground, because when the frost period comes this water in the soil will be the vehicle upon which the frost travels to go underneath the footings and destroy the superstructure.

There is no unknown factor to the problem about the construction of a perfect foundation for the buildings of the class mentioned, but there is a very great difficulty in securing the construction of such a foundation which is positively good. The services of a capable architect are very cheap where they result in securing a good foundation. No architect has performed his duty to his client unless he has provided for a foundation which will go down deep enough below natural grade to protect it from the frost danger and dense enough to protect it properly from the seepage of lateral pressures of water.

There is no necessity for a wet or damp foundation, nor is there any occasion for a foundation that heaves with the frost; because it is simple enough to have it extend at least three feet six inches below natural grade, at all parts of the building, and to have the dirt filled in and thoroughly tamped. Then have the outside of the building drained carefully for a year or two, or until the dirt immediately against the foundation has had a chance to assume something very near its former consistency when in its natural state, before the excavation occurred.

The practical foundation men who read these lines will find something which, if applied, is well worth the space devoted to this article.—Rock Products.

Insulating concrete roofs to prevent condensation beneath them is required in certain classes of structures, such as paper mills. According to a United States engineer, a cheap and efficient method of insulating is to use a porous concrete made up of screened cinders and cement. A mixture of this kind that has given satisfactory results consists of one part of Portland cement and ten parts of clean steam boiler cinders. This should be placed as carefully as possible in order to insure its porosity, and after setting should be troweled over with a flat coat of mortar to give a suitable surface for the roofing material.



Coatings for Concrete

By G. D. White.

CONCRETE for building purposes, whether in solid, reinforced, hollow block, tile, brickette, or whatever form, is not consummate. Unless extreme care is exercised in the preparation and workmanship for solid or reinforced work, the resultant concrete is not impermeable, or at least not uniformly impermeable, to water and moisture.

The fact that dry walls are essential to health and comfort is generally known and so well appreciated that the question of dampness has been a restraining agent to a much larger and more extensive use of concrete. The tendency to stain, the frequence of efflorescence, the difference in color due to difference in materials and to intermissions in concrete, are defects of a less serious nature.

If to the strength, cheapness, durability, and fire-resisting properties of concrete can be added impermeability to moisture and decoration, we will have a building material as nearly perfect as the world has ever seen, and this within the means of every builder.

For the sake of convenience, I will divide these into four classes. In my investigation of the various treatments and materials included in these classes, I have endeavored to be unprejudiced and to give to each its true worth and true value.

First—Waterproofing compounds in liquid or powder form, mixed with the concrete in its preparation.

This is a help in that it lessens and retards, in a measure, the moisture-absorption tendency of concrete. It fails in the desired attainment for the following reasons:

Improper distribution, which is difficult of regulation.

When properly distributed, it does not render concrete entirely impervious to moisture.

It has a tendency to weaken the tensile strength of concrete.

It does not decorate. The increase in value is not proportionate with the increase in cost.

It deteriorates with age; that is, a concrete block containing the waterproofing compound on the first application of water will absorb certain varying quantities. On subsequent applications, allowing the block to dry in each instance, large quantities are absorbed.

Second—Treatments preparatory to the use of linseed oil paints.

Naturally, I would be prejudiced in favor of this process if it offered even a partial solution to the problem.

Treatments in various forms have been advanced and recommended by some of our leading master painters and endorsed by most able research chemists.

Three Treatments Recommended

For the sake of brevity I have included in my paper but three of these treatments:

(a) Hydrochloric or muriatic acid wash.

(b) A wash consisting of a solution of zinc sulphate and water.

(c) A wash consisting of ammonium carbonate and water.

From a chemical standpoint, muriatic acid, no matter in what strength, nor what the character of the concrete, is not only less useless as a remedy, but detrimental in its action. Master painters who have endeavored to put it in practice have discovered to their sorrow a confirmation or a demonstration of the chemical theory.

In the manufacture of chemicals and chemical colors, we can standardize our solutions by the use of molecular formulae, and thus produce the product sought without a waste of any single ingredient, except, perhaps, water. Unfortunately, in preparing concrete surfaces to receive paint, we have no way to determine what strength of solution should be employed. Were such a determination possible, we should have to make it for every different piece of concrete, and in case of blocks for every block, because we could not be sure of uniformity.

Even with the required strength of solution, we still lack a method of application that will insure the proper neutralization, and so uniformity of results is uncertain.

Zinc sulphate and ammonia carbonate as applied to concrete, unless fully satisfied by the presence of calcium hydroxide, are still soluble in water, and thus offer difficulties of a serious nature.

The neutralization of calcium hydrate and calcium oxide appearing on the surface of concrete does not always mean that the surface will remain neutral. Moisture finding its way from the inner portions of the block or wall carries with it alkali—the foe to linseed oil paints.

The treatment with zinc sulphate or ammonium carbonate, even though successful, does not offer a solution to the problem, because a linseed oil paint is unsuited for either exterior or interior painting of concrete. The gloss robs the surface of the appearance of stone or masonry. Linseed oil has water-absorbing, and lacks water-resisting properties. It cannot be applied over a damp or wet surface, which means that following a rainstorm or rainy season a painter must wait weeks and perhaps months before he can commence work on or complete a contract already begun.

A series of practical tests developed the fact that a wash of zinc sulphate or ammonium carbonate was a help in some instances, but the lack of uniformity in results, and low degree as well as non-permanency of improvement, demonstrated their inefficiency to cope with this important problem.

Before passing this phase of my subject, I want to say that the above is intended as no adverse criticism of the master painter or chemist recommending the use of these treatments. On the contrary, the master painter is to be commended for his wisdom and research in figuring out, in the absence of anything better, a method or process that helped, in a measure, at least, to overcome the difficulties confronting him.

Third—Colorless liquid coatings.

Certain of these may be of some value or service in retarding moisture, absorption and efflorescence, but they are all alike found lacking in the following respects:

They serve to emphasize any defects in, or difference in, color of concrete construction.

They impact to concrete a soggy, water-soaked appearance.

They do not render impermeable to moisture for any length of time.

They do not decorate.

Fourth—Paint for concrete:

Paint Required and Its Properties

If there is any truth or logic in the foregoing, it would appear that we need, and the building trades demand, a paint peculiarly adapted to the coating of concrete surfaces. The requirements of such a paint must be exacting, and from my study of this question I conclude that such a paint to meet the needs must be—

A durable protection, resisting disintegration of concrete by the elements.

A preventive of dampness through resistance to water and moisture.

A paint that can be applied directly to the concrete surface without any previous treatment.

This paint must be economical.

After weathering, it must offer a good surface for repainting.

It must be adapted to receiving and holding a plaster coat.

It must be so constituted that it will be artistic, appropriately pleasing to the eye.

Its consistency and nature should be such that it will spread easily, work well under the brush, penetrate the voids, fill and cover hair cracks, and act as a bond of connection between the concrete and succeeding coats. Not only must it penetrate and fill up the voids, but it should, in a measure, level up the rough portions of the surface.

It must be suited to painting over damp and wet surfaces and dry even when surrounded with moisture. When dry it must adhere to the surface, be sufficiently elastic to conform to changes in temperature, and remain hard in the presence of moisture or water.

A paint composed of both pigment and vehicle in a paint for concrete is a very immentally affected, physically or chemically, by the liberated calcium hydroxide.

As in all paints for wood and iron, the vehicle in a paint for concrete is a very important factor. It must not be linseed oil, blue, casein, or any other substance with like characteristics. It should be difficult of saponification, and of low saponification number. I am convinced that some kind of varnish product, peculiarly adapted to the purpose, is required.

The pigment, as in linseed oil paint, has its function to perform. In opposition to a theory advanced by some, I am going to say that this pigment should not be cement for reasons that are self-evident and self-apparent. It must be, for the first coat, at least alkali-proof. Not only must it decorate, but it must protect the vehicle, and, in conjunction with the vehicle, the surface coated.

A paint consisting of both pigment and vehicle working in unison, with the minimum of opposing forces, favorable of application, serviceable under exposure, resistant to water and moisture, economical to the consumer, is necessary to perform the function, to meet the need, to fulfill the requirements of a paint for concrete.

Cracks in Concrete*

CRACKS in concrete are unsightly but not necessarily dangerous. They may be classified under two heads: Surface Cracks and Body Cracks.

Surface Cracks—These are often referred to as "hair cracks" by reason of their fineness and semblance to hairs, and occur in both plain and reinforced concrete. They are also known as "crazing," and are of very frequent occurrence. They appear to arise from the surface skin of cement mortar being richer in cement than the mortar of the body concrete, thus exposing almost a neat cement skin, which expands, on exposure to the sun's rays, at a different rate from that of the body concrete. This is worse upon the uppermost face in a mold, where the lighter and weaker particles of cement work up to the top and form a skin known as "laitance." If work be kept under water, and sometimes if shielded from the sun, this crazing may not occur. To overcome its unsightliness, the surface skin should be removed either (1) by brushing the concrete, when green, with wire brushes; (2) by rubbing with a stone or piece of concrete and sand and water; (3) by dressing with hand-operated or pneumatic chisels and hammers; or (4) by brushing the surface with hydrochloric acid, and subsequent washing with clean water. The last two named methods are best with completely hardened concrete.

Body Cracks—Cracks extending through the body of concrete may be ascribed to the following:

1. Faulty design and construction so far as statical resistance is concerned.
2. Expansion of cement or concrete.
3. Corrosion of embedded steel.
4. Shrinkage from setting and hardening in air.
5. Difference of temperature in different parts.

Faulty Design or Construction

Under this head the following causes have been noted:

(A) Settlement of the foundations.

(B) Too high a stress in the reinforcement, resulting in excessive deformation.

(C) Too thick a covering of concrete, in particular where the effective depth of beams is very small.

(D) Too early removal of forms. The age of the concrete when the forms are removed must be sufficient to give the usual factor of safety due to the stresses caused by dead load and such accidental load as may at that time be anticipated. Generally the following recommendations are made, subject to the approval of the engineer or architect responsible for the work:

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*Abstract of report submitted to the British Concrete Institute.

For mass concrete walls not subject to thrust, and where the height does not exceed 2 feet, the forms should not be removed under 24 hours. Where the wall is subject to pressure, forms should remain in place at least a week, although a fortnight is preferable. For mass concrete arches of more than 20 feet span, one month is recommended.

For reinforced concrete the following practice is recommended: Slabs, a minimum of 7 days; but otherwise, for slabs carrying only their own weight, an allowance of 2 days per inch of thickness, or 1 per foot of span, whichever is the greater. For sides of beams, walls, and columns not under side thrust, a minimum of 4 days; bottoms of beams, a minimum of 2 weeks, though a month to 6 weeks may be necessary under special circumstances. For arches, the time of removal of the centering is better left to the judgment of the engineer, keeping in view the ratio of rise to span and special circumstances.

If it is intended that the structure shall be used for carrying heavy weights, emergency props should be left in for such time as the engineer or architect may direct.

The foregoing periods to be increased by at least the time during which frost or rain has intervened.

(E) Defective design of forms with inadequate allowance for contraction and expansion due to variation of moisture. Dry timber may expand and crack the concrete unless wetted beforehand.

(F) Careless removal of forms, which may result in cracking the concrete by shock of falling timber, or by levering and pressing on the green concrete.

(G) Vibration, resulting in deficient adhesion and excessive deflection. Forms should be very rigid.

(H) Insufficient allowance for continuity, fixity, and general monolithic nature of concrete work done in situ. Over supports, the maximum degree of continuity and fixity should be provided for. Frequently cracks will be found over supports of continuous reinforced concrete beams and floor-slabs, owing to the omission or insufficiency of steel there. Concrete floors are often built in chases in walls and carried over walls, others standing above; and sufficient fixity is given to cause cracks, if provision has not been made in the reinforcing. Columns and piers, when built monolithic with beams, will give more or less fixity to end of beams resting thereon, both at end and intermediate supports.

(I) Too close spacing of steel, so that there is no room for the concrete to get round and adhere or bond with the bars.

Expansion of Cement or Concrete

Under this head the following causes of cracking are noted:

(A) Over-lined and coarsely ground cements, which were frequently met with years ago, caused expansion, to overcome which it was necessary to leave room for expansion—i.e., expansion joints. Especially was this precaution adopted around the edges of floor-slabs adjoining walls.

(B) Coarse materials containing sulphur compounds, unburned fuel, oxidizable or hydratable iron compounds, unslaked lime, and other deleterious substances. Breeze, clinker, and slag frequently contain sulphur and metallic iron or oxide of iron, while boiler ashes may contain both sulphur and unslaked lime (the latter derived from limestone in the coal). Some bricks contain sulphides and sulphates and lime, and should not be used broken for concrete. Old bricks also sometimes have old plaster adhering to them; the sulphate of lime may cause no trouble in plain concrete while it is kept dry, but, in the presence of water, reacts chemically with the aluminates of the Portland cement, forming sulphoaluminate of lime, which is attended by increase in volume, and may cause blowing if in large quantity, and even a small quantity may result in cracking. Free lime in the same way will swell or contract with water. Black magnetic oxide of iron will become converted into hydroxide of iron in the presence of moisture. Indeed, any iron compounds are dangerous in reinforced concrete as likely to react electrolytically with the steel in the presence of moist air or dampness; and sulphur causes speedy corrosion.

Corrosion of Embedded Steel

Should the steel in reinforced concrete corrode by reason of porosity of the concrete or the presence of deleterious substances in the coarse materials of which it is made, or by electrolytic action, the concrete cover to the bars will crack and burst off.

Shrinkage from Setting and Hardening in Air

This is probably the most frequent cause of cracking. Concrete will expand slightly in water, and contract on drying out, so that cracking is frequently not evidenced from this cause until the concrete is allowed to dry, which requires a period varying usually up to two months; and in thick mass walls, moisture and heat are retained for a long period, and may delay cracking up to six months and even longer. It is usual to keep concrete wet for several days after manufacture, in order to ensure it gaining maximum hardness; and it is specially important to prevent rapid drying by sun and wind, so that the surface of concrete should be shielded against such exposure. A dry mixture of concrete shrinks less than a wet mixture, and concretes richer in cement contract more than lean mixtures. or reinforced concrete work, medium wet mixtures are desirable, and therefore concrete richer in cement than 1 to 5 is not advisable for curtain walls. The coefficient of contraction of concrete on exposure to air appears to be about 0.0002 to 0.0005 at one month, and increases to about 0.0004 to 0.006 at 1½ years. The variation recorded is between poor and rich concretes. Such contraction is usually prevented from taking place uniformly throughout; in retaining walls and pavings, it is prevented by friction of the soil; in other cases, by the holding of other parts. Plain concrete will usually hold together for some distance, so that contraction joints need be inserted only at intervals. The following are advised as suitable distances apart of such joints in plain concrete: Paving, 4 to 5 feet; curtain walls, 10 feet; exposed retaining walls, 15 to 20 feet; basement retaining walls (not exposed) and dock walls or dams, 50 feet.

If curtain walls adjoin heavy columns and beams the rigidity of the latter would probably result in cracking if constructed monolithically, even if reinforced. It is best, therefore, in such cases, to provide joints adjoining beams and columns.

If concrete be laid over the joints of a thicker lower surface of concrete, the joints of the latter will most probably be evidenced in the upper surface.

Large surfaces have been successfully constructed without apparent cracks, by properly reinforcing the concrete and laying all at one operation. The object of the reinforcement is to break down the tensile resistance of the concrete, and cause it to crack uniformly at such close distances as to render the cracks invisible to the eye. If one portion of the concrete be left over-night, great care should be taken to roughen the hardened surface by tooling away; then clean by brushing with water, and apply half an inch of mortar of the same proportion as the mortar in the concrete, and ram the fresh concrete well against it. Such joints will often show, even though well reinforced. In calculating the amount of reinforcement for such purpose, the ultimate tensile strength of the concrete at one month should be equated to the resistance of the steel at the yield-point. Usually, for a 1:2:4 concrete, ½ per cent. of steel is required each way, the bars or meshwork being laid at right angles. The reinforcement should be in small sections and well disseminated through the thickness of concrete, and a layer of bars should be near each face. So-called "distribution bars" near the bottom of floor-slabs are not sufficient if cracking is to be resisted; rods should also be placed near the upper surface. Cracks frequently occur parallel to rods where "distribution bars" are not used, and also occur at right angles to main bars where continuity bars stop; top reinforcement would avoid this. Contraction reinforcement should be in addition to the section of steel required to resist static forces.

The sudden drying-out when heating apparatus is installed, frequently causes excessive cracking.

Difference of Temperature in Different Parts

Considerable difference of temperature will cause cracking, and should be avoided as much as possible. Heavy reinforcement is not always an effective preventative. Most reinforced concrete chimneys in which the internal temperature is over 500 degrees F. seem to be cracked vertically, externally, and often horizontally as well, though possibly the latter could be avoided. This cracking is probably due to the difference in temperature between the outside and the inside, which may be considerable with a cold wind blowing. A continuous lining, with cavity between it and the outer shell, would probably prevent serious cracking.

Recovering Waste Foundry Sand

In the past two years, says the Iron Age, a number of plants in different parts of the country have attempted to recover the values in waste foundry sand. Both dry and wet processes have been used in experimenting. No one manufacturer makes all the equipment necessary for a complete plant of this kind, and this has delayed the development of the best methods. On July 15th a group of Detroit foundrymen met to discuss this problem. A number of them had already had conferences with equipment manufacturers, and the result is that a series of tests will be undertaken, financed by foundrymen in different parts of the country and by the manufacturers of equipment. A complete plant for treating sand either by dry or wet process, for rebonding old sand for use as moulding sand, and for the treatment of new sand to increase its value will be erected in the laboratory of the H. M. Lane Company, Detroit. It will have a capacity of about 15 tons of sand per day. The tests are expected to take five or six months. It is stated that preliminary tests seem to indicate that 70 per cent. of the old sand now being carried to the dump can be recovered and re-used.

Filtration Costs

Filtration costs at Wilmington, Del., amounted to $1,821 per million gallons during the year ended June 30, 1912, according to the report of Mr. John A. Kienle, at that time chief engineer of the water department. The water is taken from Brandywine Creek pre-filtered through sponge clippings and passed through slow sand filters washed by a Blaisdell machine. With a population of 90,000 the per capita daily consumption was 124.7 gal. Preliminary filtration for 4,111,700,000 gal. cost $0.375 per million gallons. Slow sand filtration for 4,012,800,000 gal. cost $0.916 per million gallons, and laboratory charges were $0.530 per million gallons. These figures are gross operating costs and do not include interest and depreciation on plant investment. The slow sand filters were operated at an average rate of $5,400,000 gal. per acre. The hand rakings of the surface of the filter beds employed during the previous year with such good results were abandoned during the past year, and the beds were raked mechanically with the washing machine. At first, four ordinary farm cultivator teeth were attached, but later the regular machine teeth were used.

If we bear in mind the many difficult problems and the great cost involved in changing from steam to electric operation on railways, it must be admitted that great strides have been made in this direction. A recent estimate places the total number of miles of single track that have been changed from steam to electric operation in America at about 1,600 miles, and the same authority finds that approximately 1,500 miles of single railway track will probably be subjected to the same change during the next few years.

A 192-ft. span, single-track railway lift bridge, with a maximum clearance of 55 ft., has recently been built over the Mississippi River for the Chicago Great Western Railroad. It replaces a 412-ft. drawspan built in 1885 and reinforced in 1910 and is of the Waddell-Harrington type, with 225-ton concrete counterweights. The Widell Company and the American Bridge Company were the contractors for the substructure and the superstructure respectively, which were built under the direction of Mr. L. C. Fritch, chief engineer, and Mr. C. Chandler, engineer of bridges.

Trackmen as judges of track are used to determine the awarding of prizes for the best maintained sections on the Norfolk & Western Railway. Mr. Charles S. Churchill, chief engineer, and retiring president of the American Railway Engineering Association, spoke of the system in his opening address at the recent convention of the association. The sections are judged by foremen and supervisors from entirely different divisions, and Mr. Churchill stated that these men, due to the fact that they are acquainted with the requirements, make wise selections in the awarding of the prizes, and that at the same time the judges get valuable ideas from their inspection trips.

The Value of System in Contract Work

Details of Organization Which Make for Success—Advantage of Timing Construction—Suggested Form for Sub-Contracts

By G. D. Crain, Jr. *

HOW does a successful contractor plan his work—by days—by weeks—by jobs? To tell that, in detail, is itself a pretty big contract, and isn't the easiest thing in the world to do; but I have handled a few big contracts in my time, and this may not be too difficult.

I am the senior member of a more or less successful contracting firm in a certain good-sized city on the Ohio River; and while we haven't got everything figured down to the finest possible point, yet there are a number of things which might be said to constitute our system, our plan of doing business, and which we never deviate from.

To begin with, the work is divided between my partner and myself, according to that which we can do best. He is possibly the better superintendent, and he therefore attends to all of the outside work, making the round of all jobs which we have under construction, seeing that material is on the ground and the like—all the numerous details that come up and have to be seen to, in spite of the fact that we have a capable superintendent. I handle the office, making up estimates, attend to the payment of bills, the correspondence, and all that sort of thing. And we are both kept busy enough, too. I don't mean that I never oversee any of the work, nor that he never makes a contract or helps figure an estimate on a job; but I do mean that we make it a point not to be on the same job, at the same time—that's where the system comes in.

We figure that one of us can do a thing, in most cases, just about as well as both of us together could do it, and that it would therefore be poor business to waste the time of one of us helping the other do a thing which he could do alone. The only exception to this is one hour of the day—the noon hour. We make a rule to lunch together whenever it is practicable, because we have found it a good idea to get together at that time, when things are somewhat relaxed, and have a talk while we eat. It's a good time to untangle little matters that have come up, and then each can get any advice he wants of the other. It's a sort of council of war, where plans can be laid and courses of action decided upon, whenever necessary; and we both go back to work feeling that we are not alone—that we have a good man behind us!

Then, we always save some time that others waste, not to mention incidental damage to materials, by not being in too much of a hurry to start on a job. That may sound somewhat peculiar, but it is the exact idea I want to convey. Very frequently, in fact, nearly all the time, as soon as the plans and specifications are complete and the contract is made, the owner is in a wild rush for the work to begin. He sees no reason for an instant's delay, and is utterly unable to understand why the fool contractor stands around with his hands in his pockets and waits for days, and possibly weeks, before beginning the job.

The point is, of course, that we are not standing around with our hands in our pockets, by any means. Why begin excavation on a medium-sized or small building in such time that it will be finished long before your foundation material could be on hand, and be caving and possibly filling with water in the meantime? Or, what is more usual, why complete your foundation, and have your basement open to the weather, before you have completed arrangements for the delivery of frames, so that the job can go right on up? The same thing applies where there is any particular kind of brick to be used, especially, of course, if it is in the nature of a special order. And millwork should be ready at the time when it is needed, in order to prevent delay in the work, having men on your hands idle half of their time. That sort of thing eats into profits, and is entirely useless. A little foresight is all that is necessary. The delivery of every scrap of material can be arranged for in advance, to be on the ground just when it is necessary, according to a definite program; and yet I have seen builders who neglect this first essential to a successful job.

Where the material required is such that it has to be ordered specially, and always where it must come from out of the city, I take particular pains to see that there will be no hitch in delivery—that is, none that will leave me without legal recourse. If it is a small quantity, I usually order it at once, and have it delivered, as the certainty of having it on hand makes the immediate investment worth while. If it is a large quantity, however, I make a formal contract, and have a penalty clause just like that which is contained in our contract with the owner, so that if the factory, or quarry, or whatever it is, falls down on its contract, we are protected.

It goes without saying that we have at hand on each job complete detailed plans and specifications, ready for reference all the time. In addition to these, however, we also have a complete set of the subcontracts made, so that the superintendent and foreman on the job can at once ascertain what sub-contractor is responsible for any part of the work or material, at any time the information becomes necessary.

A Suggested Form

Our sub-contracts, by the way, are made up on a form which we have devised, which we think is pretty good. On one side we have a short proposal blank, running about this way, with date-line and address:

Gentlemen:

We propose to furnish all materials and labor and do the..........for the........... job, or building, located on .... street, between .... and .... streets, being No. .... in the City of ...., County of .... and State of ....; said work and materials to be in accordance with the plans and specifications as prepared by ...., Architect, and in order that there may be no misunderstanding, we will further state [Here is a blank space for such further remarks as may be deemed necessary.] For the sum of .... Dollars.

We agree, upon written notice from you, to start the work within .... days after the receipt of said notice, and push said work to completion as rapidly as possible.

The blank has space for the sub-contractor's signa-

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* In The National Builder.

ture and an acceptance line for us. On the other side of this form are eight ruled spaces, all just alike, under the following printed lines:

"Received of (our firm) partial payments on account of work and material as per contract on the reverse side as follows:"

And in each space is room for the date, signature of the firm, and the amount of the partial payment. At the bottom is a slip, which can be detached by a perforation, in which to sign a receipt and release in full, when all payments are made. The detailed statement of partial payments is filed alphabetically under the name of the sub-contractor, with all other matter relating to his contract, and the slip is turned over to the owner, or placed in his file, as evidence that the property is clear of liens on the part of sub-contractors.

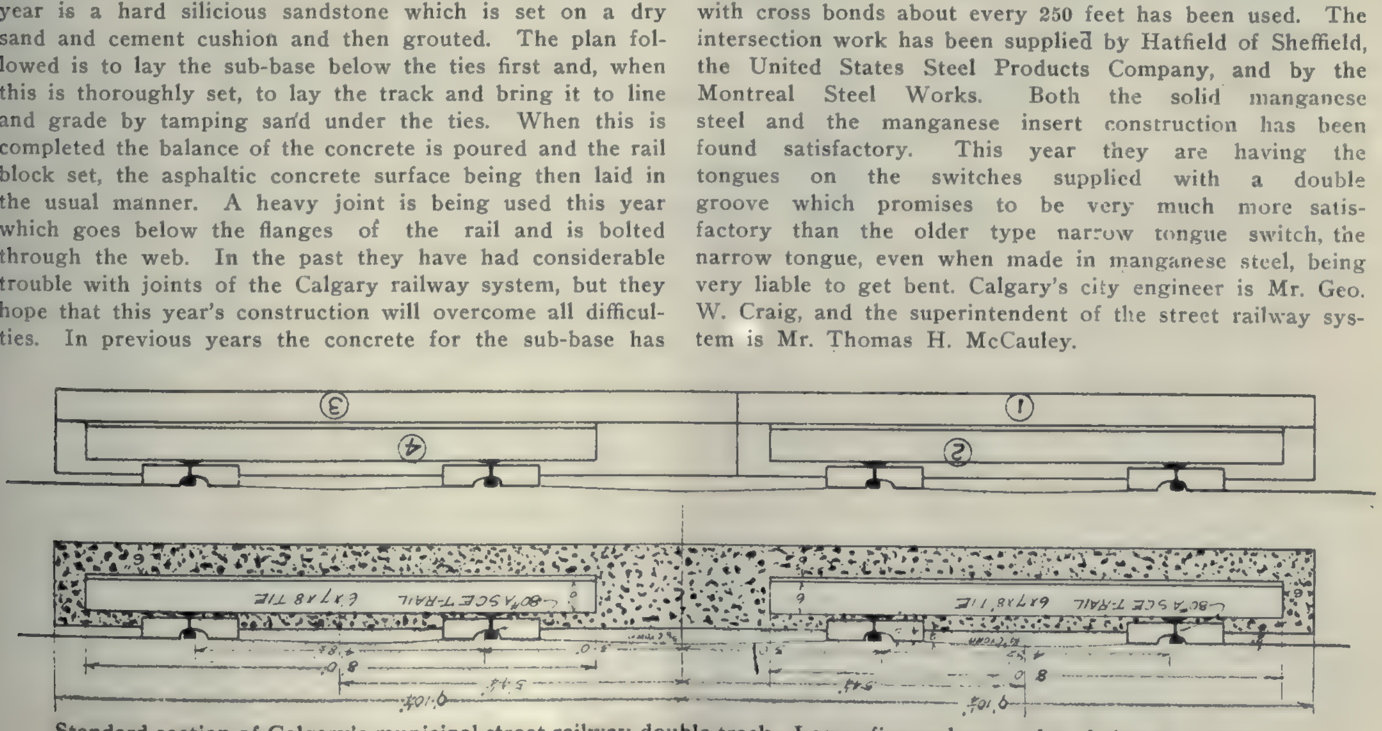
It might be mentioned here that there is but one check-book out of which drafts are made on the firm account, and that is kept at the office. Our pay-roll, of course, is handled by one check, and the men get their money in cash, in the usual pay-envelope. I have known contracting firms, though, who never knew where they stood on a job, because two or three members were issuing checks here and there, and it was simply impossible to keep any track of them.

We do not keep a permanent crew on hand, work or no work. I have known of contractors who do this, but we have never found it necessary. We usually have plenty of work for our good men, and have little trouble in keeping them busy; but in times of slack work, we let them off in the reverse order of their value to us; and I have seen the time when we have as many as three or four foremen working on one job—not as foremen, you understand. They were all practical mechanics, and in order to keep them busy we would simply place them on the job as journeymen. And if we came across a foreman who was too proud to work that way we would immediately fire him, because we have no use for such examples of the artistic temperament in the building business.

We have a bookkeeping system which enables us to know to a cent what a job has cost us, and that is considerably more than some men know; and yet it is absolutely necessary, in order for the contractor to find out what his profit—or loss—is, as the case may be. We have three ledgers, in one of which is recorded all that we buy, with the credits to us by return of material and cash payments; in another, the materials put into the job, and payments made to sub-contractors for work and material; and in the third, our accounts with the owners. There are appropriate accounts in the first two ledgers for every head under which expenditures on a building can fall, and not a cent is spent for even carfare that it not properly charged. When we get through a job we know just what we have spent, and we know just what we have spent it for; we know what we have received in payment for the work. And from these facts, it isn't hard to discover just how we stand on the job.

Track Construction in Calgary

The accompanying reproductions show the standard double track construction on paved streets of the city of Calgary's municipal electric railway system. This system now uses an 80-lb. A.S.C.E. rail, though previously they used a 60-lb. and 80-lb. Lorain I.T. rail. It was found, however, that these cost three or four dollars a ton more than the ordinary A.S.C.E. section. The rail block being used this year is a hard silicious sandstone which is set on a dry sand and cement cushion and then grouted. The plan followed is to lay the sub-base below the ties first and, when this is thoroughly set, to lay the track and bring it to line and grade by tamping sand under the ties. When this is completed the balance of the concrete is poured and the rail block set, the asphaltic concrete surface being then laid in the usual manner. A heavy joint is being used this year which goes below the flanges of the rail and is bolted through the web. In the past they have had considerable trouble with joints of the Calgary railway system, but they hope that this year's construction will overcome all difficulties. In previous years the concrete for the sub-base has not been laid separately—from the balance of the concrete—but the ties have been supported in position on blocks and the concrete poured right around them. In some cases this has given very satisfactory results, but in others, as already noted, the joints have shown signs of giving way, probably due to the pounding of the cars before the concrete had become very hard. A number double 4/0 bond at each joint with cross bonds about every 250 feet has been used. The intersection work has been supplied by Hatfield of Sheffield, the United States Steel Products Company, and by the Montreal Steel Works. Both the solid manganese steel and the manganese insert construction has been found satisfactory. This year they are having the tongues on the switches supplied with a double groove which promises to be very much more satisfactory than the older type narrow tongue switch, the narrow tongue, even when made in manganese steel, being very liable to get bent. Calgary's city engineer is Mr. Geo. W. Craig, and the superintendent of the street railway system is Mr. Thomas H. McCauley.



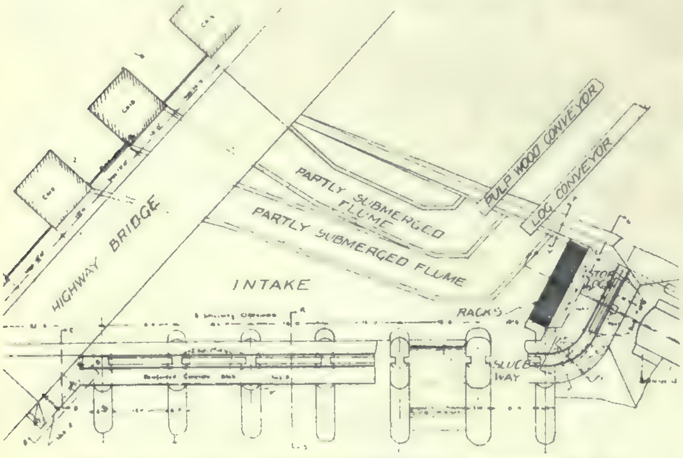
Standard section of Calgary's municipal street railway double track—Lower figure shows order of placing concrete.

Hydro-Electric Development at Dryden, Ont.

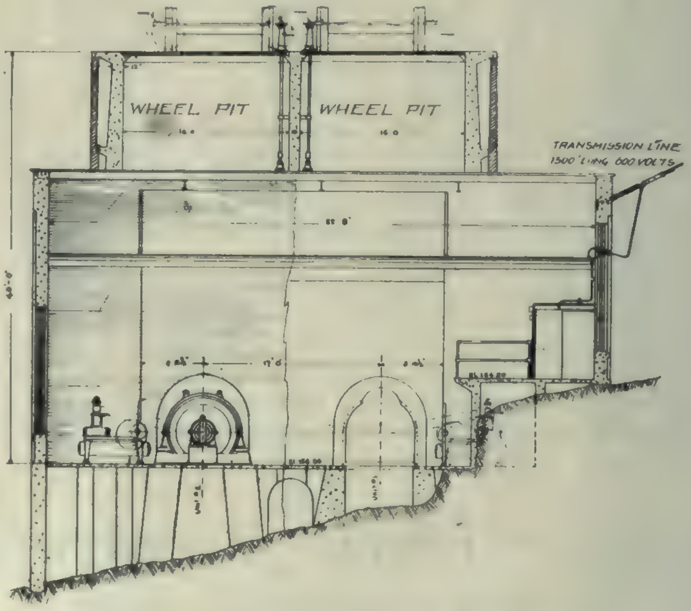
A hydro-electric development of 2,000 horse power capacity has just recently been completed for the Dryden Timber & Power Company at Dryden, Ont. The power will be used for operating sulphite pulp mills of this company and for supplying light and power to the town. The plant is situated on the Wabigoon River at a point about one mile below Lake Wabigoon, and just opposite the town of Dryden, which is half way between Port Arthur and Winnipeg on the main line of the Canadian Pacific Railway.

Lake Wabigoon has an area of some 60 square miles and constitutes a very desirable reservoir for this power development. The water shed area feeding this lake is in the neighborhood of 800 square miles. The river flow is about 400 c.f.s. The development is the result of utilizing three distinct falls which, in a distance of 1,600 feet have a total drop of about fifty feet.

The dam is of concrete, 120 feet long by approximately 25 feet high. It consists of a series of piers placed 16 foot centres with concrete spillways and stop logs between and with reinforced concrete slabs across the top, over which the winches operate on a built-in track. The dam is built at an angle across the river, providing ample spillway area to take care of surplus water in time of flood. A sluiceway is provided which can be opened to the full depth of the dam in case of extraordinary flood. The small forebay formed by the dam, diminishing in width towards the mouth of the pipe, serves also as an approach for the saw logs and pulp logs to the mill.

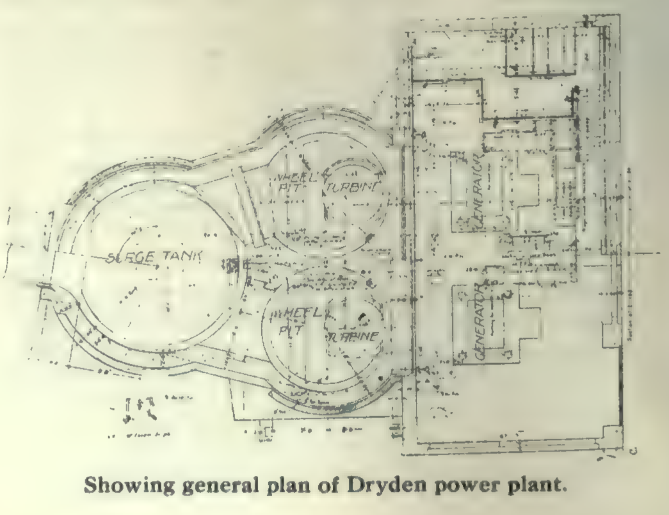


Dam, sluice-way, intake, submerged conveyors, etc.



Section of power house through generators.

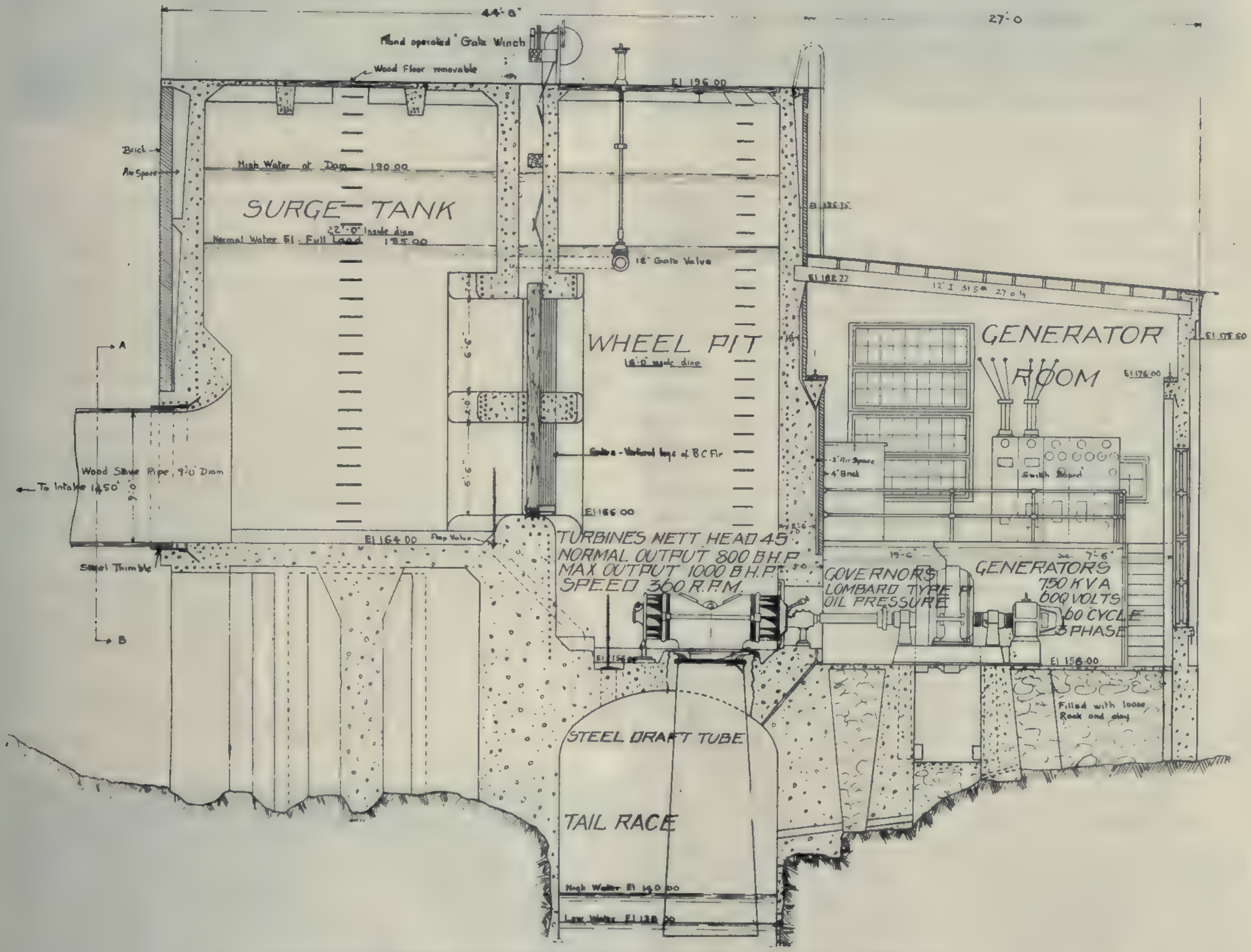
Just above this forebay the river widens out into a small lake which is part of Lake Wabigoon, and the entire season's cut of logs both for pulp and for lumber and ties is assembled here in booms. Across the entrance to the forebay is a series of cribs to which are attached the various booms by which the logs are controlled. Two partly submerged flumes, one for pulp logs and one for saw logs and ties, lead from this line of cribs, through the forebay, to chain conveyors situated near the entrance to the pipe, which lift the logs from the water and carry them to the mill. These flumes serve to guide the logs, and to keep bark and sticks or small pulp logs from approaching the racks. A steel thimble set in the concrete connects the dam with a wood stave pipe 1,500 feet long and 9 feet inside diameter. Stop logs and racks are, of course, placed in front of the pipe mouth. The pipe line is constructed of 4-in. x 8-in. B. C. fir, bevelled to shape. The bands are of 3/4-in. steel, spaced 9-in. apart. The pipe line is supported on wooden blocks spaced about 10 feet apart and for a distance of 200 or 300 feet rests on a wooden trestle at a height of 12 or 15 feet. In passing under the C. P. R. embankment a reinforced concrete pipe is substituted for the wood stave. The wall of the concrete pier is 12-in. thick, treated both inside and out with a waterproofing compound and a coating of asphalt. The pipe is laid on a grade of 0.266 per cent. sloping towards the power house. The design of the power house is shown in the accompanying figures in both plan and cross sections. An important feature is the surge tank and the two open wheel pits designed to secure good regulation. The tank and the wheel pits are built of reinforced concrete and are circular, in shape, the surge tank being 22 feet diameter, and the wheel pits 16 feet each, grouped as shown in the drawing. Owing to the circular form of the tanks, there is no bending moment in the walls, and the stresses due to the head of water are taken up by



Showing general plan of Dryden power plant.

direct tension in the reinforcing steel, the concrete serving merely as an envelope to contain the water. This form of construction takes considerably less concrete and reinforcing steel than would be required in rectangular tanks. The walls of the tanks are 24-in. thick at the bottom and 12-in. at the top and 40 ft. in height. The velocity of the water entering the wheel pits is about 2 feet per second. The wheel pits may be isolated from the surge tank by the lowering of wooden gates composed of vertical timbers operated by hand winches.

The turbines are placed on the floor of the wheel pits which is about 18 feet above extreme low water and the water is carried off by two steel draft tubes which empty into the same tail race above which the wheel pits are supported on a concrete arch.



Cross section showing surge tank, wheel-pit, turbine, generator, draft tube, etc.

The turbines, of which there are two, are of the Francis twin central discharge open flume type, each designed for a working head of 45 feet and capable of developing 800 B.h.p. with a water supply of about 190 c.f.s. at 360 r.p.m. The turbines have a maximum capacity output of 1,000 B.h.p. Each unit is provided with two runners constructed with buckets of heavy flanged mild steel plates cast into a centre boss and surrounding ring of cast iron. Each runner is mounted inside a cast iron guide casing provided with a set of cast iron adjustable guide plates fitted on steel spindles. of cast iron adjustable guide plates fitted on steel spindles. The turbines are mounted on a cast iron sectional type central discharge casing provided with two large manholes fitted with covers for giving access to the runners and fitted with heavy cast iron foundation plate for setting in floor of turbine pit. Each turbine is fitted with a rivetted steel tapered suction tube 16 feet long with flange on the upper end for connection to the foundation plate and bell-mouthed at the lower end.

The governors are of the Lombard oil pressure quick acting returning relay type, complete with pressure and exhaust tank relay valve, main controlled cylinder, etc. They are fitted with high speed sensitive governor heads with suitable balanced piston valves for operating the relay valves and are of ample power to operate the regulating guide blades in the turbines. The governors are capable of controlling the speed within the following limits:—

Ordinary gradual load changes—speed variation not to exceed 1½ per cent.

Twenty-five per cent. sudden change of load—speed variation not to exceed 3 per cent.

Fifty per cent. sudden change of load—speed variation not to exceed 6 per cent.

One hundred per cent. sudden change of load—speed variation not to exceed 16 per cent.

The fly wheel effect of each generator is 1,000 ft. tons at 360 r.p.m.

Two sets of independent triple oil pumps are provided for operating the governors, each arranged for belt driving from the turbine shaft and each set of sufficient capacity

Dryden power house—discharge side.

Intake side, also showing 4-pole tower.

for the proper operation of the two governors, if required.

The turbines are guaranteed to develop not less than a maximum of 1,000 B.h.p. each under an actual working head of 45 feet at 360 r.p.m., the efficiency of the turbines to be as follows: full load 81 per cent., 7/8 load, 85 per cent., 3/4 load 83 per cent., half load 75 per cent.

The generators are 3-phase, 60 cycles, 600 volts, 360 r.p.m., 750 kv.a. each, of the revolving field water wheel type. They are constructed on cast iron bed plates with two main pedestal bearings provided with ring lubricated bearings. Each generator is guaranteed to develop its rated output continuously with a temperature rise not exceeding 40 degrees C. and of developing 25 per cent. overload continuously with a temperature rise not exceeding 50 degrees C. and of developing 50 per cent. overload momentarily without danger. Each generator is provided with a direct-coupled exciter mounted on an extension of the main base plate, each exciter being large enough to feed both generators at full load. The efficiency at unity power factor is guaranteed as follows: ¼ load, 83.4 per cent.; half load, 90.5 per cent.; 3/4 load, 92.7 per cent.; full load, 93.5 per cent.; 1¼ load, 93.8 per cent. The regulation at unity power factor is 8 per cent. and at 80 per cent. power factor is 16 per cent.

The switchboard consists of five panels of black enamel slate mounted on an iron frame work. The two generator panels are each fitted with three ammeters; one triple pole oil break switch fitted with two maximum over load trip coils; one set of synchronous plugs; one set of volt meter plugs; one integrating watt meter; one double pole field switch and one alternator field regulator. The exciter panel is fitted with a volt meter; two sets of volt meter plugs; two double pole exciter switches; two field rheostats; one lighting switch; two ammeters. The two feeder panels each carry one ammeter and one triple pole oil break switch fitted with two maximum over load trip coils and one no-volt trip coil. A swinging bracket fitted on the end of the switchboard carries a rotary type syncroscope, a busbar volt meter, an incoming machine volt meter and a frequency meter. The board also carries a recording watt meter of the unbalanced load type.

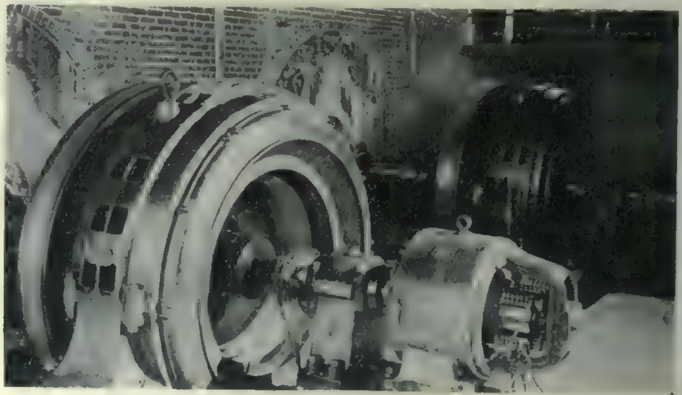
On account of the comparatively short distance between the pulp mill and the power house, it was not advisable to step up the voltage and energy is therefore transmitted at the generated voltage of 600. On this account very large cables are used. These are of aluminium, 960,000 circular mils in cross section. There is a double 3-phase circuit carried on a two-pole line. At certain points where terminal towers are required, these are of the four-pole type. Poles are spaced approximately 90 feet apart.

The sub-station equipment consists of a distributing board of enamel slate fitted with 800 ampere, 3-pole, slow break knife switches for controlling the lines from the power house. From this switchboard four circuits are distributed, each fitted with one ammeter and a 3-pole slow break knife switch. Choke coils and lightning arresters are also supplied at this point for each of the six lines.

The distributing cables run on porcelain insulators, a distributing box being provided at every junction, these containing switch fuses, one set for each motor. These fuses set very high, being chiefly intended for protection against line troubles, each motor starter being provided with no-volt overload features to care for ordinary overloads.

The motors used to operate the various equipment throughout the mill vary in size from 7 to 250 h.p., 31 motors in all being installed. The various motors with the uses to which they are put are as follows:

One 7 h.p. for conveyor; four 7 h.p. for pumps; two 8 h.p., conveyors; three 10 h.p., recovery pumps; one 13 h.p., chip conveyor; one 20 h.p. boiler feed pump; five 25 h.p., barkers; one 25 h.p., liquor pumps; one 50 h.p., main water pump; one 50 h.p., induced draft fan; one 50 h.p., pulp wood conveyor; one 75 h.p., line shaft; one 90 h.p., screen room; two 90 h.p., recovery room; one 90 h.p., slasher; one 90 h.p., hog; one 180 h.p., beater room; one 150 h.p., conveyor and pump; one 250 h.p., saw mill.

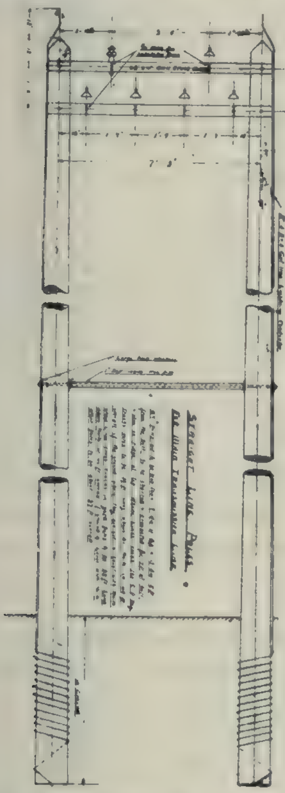


Two 700 kv.a. generators, with exciters.

Of these motors the two largest are the wound rotor type, but all the others are squirrel-cage motors.

The various pumps with their sizes and the uses to which they are being put are:—one 1,000 gal. unit for pumping caustic liquor; one 1,400 gal. unit for main water pumping operating at a 105 ft. head; three 450 gal. 33 foot head, caustic liquor pumps; four 375 gal. 25 foot head, pumps specially installed for operating the digesters under 125 lbs. pressure, and one 1,000 gal. boiler feed pump working under a 370 foot head. All the above pumps are centrifugal type and direct-connected to the motors. The main water and boiler feed units are medium and high lift turbine types respectively.

The dam, pipe line and power house were planned and constructed under the supervision of the engineering firm of Harris & Harris, Confederation Life Building, Toronto. Mr. A. L. Cavanagh was resident engineer on the work. The turbines were manufactured by Jas. Gordon & Company, of London, Eng.; the stop-log and gate winches were supplied by the Wm. Hamilton Company, Peterboro. The structural steel racks, etc., were furnished by the Jenckes Machine Company, Sherbrooke; steel pipe bands, by the Steel Company of Canada; governors are of the Lombard type; generators were manufactured by the Lancashire Dynamo & Motor Company, Manchester, as were also the motors. The switchboard is of Ferranti manufacture. The pumps were supplied by W. H. Allan, Son & Company. The supply and installation of the turbines, governors, generators, motors, pumps, switchboards and transmission line were in charge of the engineering contracting firm of Chapman & Walker, Toronto.



Design of two-pole tower.

Railroad Construction in British Columbia

Construction is to commence at once, it is reported, on the 38-mile section of the proposed railroad along the Coquehalla River, from Hope, B.C., to the summit of the Hope range, for the joint use of the Kettle Valley and Great Northern Railroads. This 38-mile road is expected to cost over $3,000,000, part of it exceeding $100,000 per mile. Twelve tunnels are called for in this section of the line, and a wagon road for getting in equipment and supplies is estimated to cost $200,000.

Tenders on the work were opened in Vancouver on August 6 by a board presided over by President J. J. Warren, of the Kettle Valley Railway. Other members of the board were Messrs. A. McCulloch, chief engineer of the Kettle Valley lines, Alex. Stewart, assistant chief engineer of the Great Northern Railway, and J. H. Kennedy, chief engineer of the Victoria, Vancouver & Eastern Railroad and Navigation Company. (The latter is a subsidiary of the Great Northern Railway Company.) It was found that MacArthur Brothers Company, of New York, had submitted the lowest bid, and, it is reported, that the board decided to recommend a contract award to this firm.

It is planned to begin wagon road construction at both ends of the proposed line, and to utilize the 13-mile section of the Kettle Valley line, now under construction by Twohy Brothers between the summit of the range and Coldwater Junction, for bringing in equipment and supplies. The contract calls for the completion of the Coquehalla section before November 1, 1914. Coldwater Junction is the point where the Kettle Valley branch line from Nicola Valley meets the V., V. & E. main line from the Boundary and Okanagan districts.

The new line along the Coquehalla River, which is to be built, owned and operated by the Kettle Valley Lines under an agreement according running rights to the V., V. & E., is the last link in two rail systems which will give direct communication between Vancouver and all of southern British Columbia to the Alberta Boundary line. A steel bridge is to be erected across the Fraser River just below Hope, B.C., to connect the new joint line with the main line of the Canadian Pacific Railway, over which the two companies will have running rights into Vancouver. The point where junction with the Canadian Pacific is effected is 89 miles east of Vancouver.

Progress Reports from Regina

Every effort is being made to complete the various programmes of civic improvement works for which contracts have been let during the present year. The Toronto Street trunk sewer has now been completed on the north side of the railway tracks and the trenching machines have been moved to the south side. It will be necessary to tunnel under the Canadian Pacific Railway tracks, which at this point number about a dozen, and extend for a distance of at least 200 feet. This sewer is a continuation of the big Seventh Avenue trunk sewer. It will reach its terminal at the corner of Toronto Street and Victoria Avenue this year, and will mark the completion of the only double sewer in the city.

Casimir Kocot, the new proprietor of the Regina Brewery, has announced that the improvements contemplated will cost approximately $200,000.

F. G. England will erect a large apartment block at the corner of McIntyre Street and Twelfth Avenue. The ground dimension will be 50 feet by 120 feet. The building will contain all modern improvements, and will be of brick construction. Tenders will be called for within the near future.

Messrs. Storey & VanEgmond, architects, are calling for tenders for the construction of a four-storey boot and shoe factory for W. G. Downing, Limited. The ground dimensions are 50 feet by 113 feet. The building will be of brick construction. It is expected that the cost will be about $50,000.

The Anglicans intend erecting a new church in the North Annex at Regina.

Rae Street Methodist congregation are making arrangements for the erection of a new church edifice at the corner of Ffth Avenue and Montague street at a cost of about $100,000.

Canada's Latent Water-Powers

A Brief Report on the Results of Recent Investigation Work in the Prairie Provinces

By Mr. Leo. G. Denis

During the first part of the year a large amount of time was devoted to a report on the Waterworks of Canada. The information which had already been obtained by correspondence was supplemented and brought to date. In some instances, to accomplish this, it was necessary to visit several towns in Ontario and Quebec and obtain from them data which could not be obtained by correspondence. This report is now in the printer's hands and will be ready for distribution in a short time. It contains a summary description of the waterworks systems of Canada, all arranged for ready reference. A portion of the report is devoted to charts and tables emphasising points of special interest, such as increase in the number of water-supply systems, rates, sources of supply, consumption per capita and sewerage conditions.

Water-Powers of Western Canada

To obtain further information for the proposed report on Western water-powers, a trip was made to the northern portions of the provinces of Alberta and Saskatchewan, to investigate water-power possibilities. The principal rivers travelled over were the Peace, Slave, Clearwater, Methy and Beaver.

I left Ottawa on June 16th and reached Edmonton on the 19th. I found that the Hudson's Bay Company's steamer was only due to leave Peace River Crossing for Hudson's Hope, my first objective point, on July 10th. From Edmonton, where railway travel was abandoned, until the Canadian Northern Railway was reached at Big River, I travelled a total distance of 2,100 miles, of which 1,000 were by river steamers, 850 by canoe, and 250 overland, where the mode of transportation varied from automobiling to footing it behind a team of oxen.

Peace River Canyon

I left Edmonton on June 25th, passing through Athabaska Landing, thence by steamer and stage to Grouard and Peace River Crossing, arriving at the Crossing on July 3rd. I left for Hudsons Hope on July 17th, arriving at the latter place on July 25th. As a very complete survey of the Peace River canon had been made during the previous summer by Mr. G. B. Milligan, it was not necessary to make the proposed survey, Mr. Milligan kindly supplying a plan of his survey. As no levels had been taken, however, the portage was traversed to the upper end of the canyon, aneroid readings were taken for difference of levels and the canyon was explored for a few miles at each end. The descent of the water in the canyon is fairly uniform, except near the head where there is a descent of 25 feet in a half mile. The total descent from head to foot is 225 feet in 18 miles.

Vermilion Fall and Rapid

Leaving Hudsons Hope by steamer on July 27th, Fort Vermilion was reached on August 1st. Here men were secured and on August 5th we started down the river for Fort Smith. Next day the Vermilion fall and rapid were measured. The descent in the rapids is 14 feet, while that in the chute is 12 feet, giving a total of 26 feet in a distance of 1¾ mile.

The Boyer or Little rapid was measured on the 9th, and we reached the mouth of the Peace river on the 11th and Smith Landing on the 13th. During the whole trip from Fort Vermilion we were much delayed by heavy head winds and, at times, had to "track" in spite of the fact that we were

At Smith Landing, I found that, to level the descents between that point and Fort Smith, it was necessary to run the rapids, as, from the Sixteen-mile portage road, the river is inaccessible, except in a very few places. I accordingly hired a local guide and started down the rapids. The channel followed for the greater portion of the distance lies between the numerous islands on the east side of the river and the descent is effected by short pitches, some of which have to be passed by portages. In passing the last pitch of the last rapid, I had the misfortune of having my boat upset, losing several instruments and some personal effects. The whole trip through these rapids, including the time spent in taking observations and levels, took almost two days, after which I returned from Fort Smith to Smith Landing by the portage road.

Rapids of Slave River

The following are the descents observed in each of the five rapids:

Cassette rapid	27 feet
Second rapid	37 feet
Mountain rapid	25 feet
Pelican rapid	10 feet
Drowned rapid	13 feet

The total descent in the 16 miles where these rapids occur, including the swift waters between them, is about 135 ft.

I left Smith Landing by the Hudson's Bay Company's steamer Grahame on August 20th and arrived at Fort Chipewyan on the 22nd. Men with provisions and a canoe, who had been sent from Athabaska Landing by my instructions, were waiting for me. Next day, we started by canoe up the Athabaska river, reaching Fort McMurray on September 1st. On the following day, we proceeded up the Clearwater river and reached Methy portage on the 9th. The Clearwater was metered at the Cascades rapid and the descent in the Cascade, Le Bon, Bigstone and Pine rapids and in the Whitemud fall were levelled.

Rapids of Clearwater River

The following is the descent observed in these different rapids:

Cascades rapid	16	feet
Le Bon rapid	31	feet
Big Stone rapid	6½	feet
Pine rapid	21	feet
Whitemud fall	41	feet

Beaver River

I sent men over to the other side of the Methy portage for a team of oxen to portage our canoe and provisions and, after unavoidable delay, we finally reached the Hudson's Bay Company's post on Methy lake on the 12th and proceeded down Methy lake and river. The rapids were levelled and the river was metered above the mouth of the Whitefish river. We then crossed Buffalo lake and reached Ile-a-la-Crosse post on September 21st. Here, after purchasing some provisions we started on our way up the Beaver river on the same day, reaching the Grand rapid on September 24th, where levels were taken and the flow of the river metered. We continued ascending the Beaver river and by way of Cowan river and lake reached Big river on September 28th. We had to wait until October 1st for a train to take us to Prince Albert, which was reached on the same day. From Prince Albert, I sent the canoemen back to Athabaska Landing and left for Ottawa, where I arrived on October 6th.

The Sterling Telephone & Electric Company, Limited, 200 Upper Thames Street, London, E.C., England, announce that at the end of September they will remove to more commodious premises situated at 209-212 Tottenham Court Road, London, W.C., England.

Architectural Convention at Calgary

The following is the programme of the 6th General Annual Assembly of the Royal Architectural Institute of Canada (Secretary, Alcide Chausse, Montreal), which is to be held at Calgary, September 15-16.

Monday, 15th September, 1913

9.30 a.m.—Registration of Delegates and members at the Headquarters of the Assembly.

11.00 a.m.—Meeting of the Council at the Public Library.

12.30 p.m.—Luncheon offered by the City at Kronn's Rathskeller.

2.00 p.m.—Business Session at the Public Library.

(a) Addresses of Welcome by His Worship the Mayor of Calgary, The President of the Alberta Association of Architects, the President of the Board of Trade and the President of the Builders' Exchange.

(b) Response by Mr. J. H. G. Russell, President of the Royal Architectural Institute of Canada.

(c) Reading of the Minutes of the preceeding General Annual Assembly.

(d) Business arising out of the Minutes.

(e) Registration of the representatives of the various provincial associations of architects.

(f) Report of the President and Council.

(g) Report of the Hon. Treasurer and Auditors.

(h) Notices of Motion.

(i) Lecture by Prof. E. Brydone-Jack, of the Civil Engineering Department of the Manitoba University.

(j) New Business.

(k) Announcements respecting the Assembly.

8.00 p.m.—Annual Dinner at the Alexandra Hotel.

Tuesday, 16th September, 1913

9.30 a.m.—Business Session at the Public Library.

(l) Adoption of amendments to the By-laws, Code of Ethics, Regulations for Architectural Competitions and Schedule of Charges.

11.00 a.m.—Automobile ride in and around the city, ending at "Bowness" for lunch, lent by Mr. John Hoxtall, for lunch given by the Calgary Chapter of the Alberta Association of Architects.

2.00 p.m.—(m) Adjourned matters.

(n) Lecture on Ferro Concrete by Mr. F. Goldie Engholm, A.M.I.C.E., A.M.I.M.E., of Vancouver, B.C.

(o) Place of meeting of the next General Assembly to be chosen.

3.00 p.m.—Meeting of the new Council for the election of officers and to consider other matters.

4.00 p.m.—Entertainments and visits.

8.00 p.m.—Smoker offered by the Calgary Builders' Exchange.

Committee of Arrangements.—Messrs. J. H. G. Russell, F.R.A.I.C., President; Roland W. Lines, F.R.A.I.C.; L. M. Gotch, M.R.A.I.C.; G. M. Lang, F.R.A.I.C.; W. D. Cromarty, M.R.A.I.C.; Alcide Chausse, F.R.A.I.C.

Arrangements have been made between the Montreal Board of Control and Mr. Norman McLeod by which the latter will complete the construction of the civic filtration plant at Point St. Charles. Mr. McLeod, who holds the contract, alleged sometime ago that the design was faulty and the site unsuitable, but a commission of engineers reported against these contentions. The Board of Control have agreed to extend the time for completion by 15 months and to remit the fine of $100 per day which was to have commenced on 1st September, the penalty date being postponed to December, 1914. Mr. J. W. McConnell, a well-known financier, has guaranteed the completion of the work. Last winter the work was severely damaged by frost, and this has been repaired by the contractor.

Canadian Railroad Development

Actual work on the Port Dover, Dunnville, Wellandport and Beamsville Electric Railway, which has been hanging fire for several years, will be started next week.

On the old Government House property at Toronto, the C. P. R. will erect their new freight offices, the plans for which are not yet to hand. On the Simcoe street frontage a seven-storey brick office will be built. At least a million dollars will be expended on the scheme in its entirety.

The plans for the G. T. P. yards now under construction at Weyburn, Sask., have been made known, and point to extensive operations by the company in Weyburn. The yards extend one mile in length and will contain about seven and a half miles of tracks. A standard freight shed, loading platform and depot will be erected.

The Canadian Northern Pacific Railway has been completed 114 miles from Port Mann and tracklaying has commenced northward from Anderson Creek. Bridge building will, however, delay further tracklaying for a few weeks and it is expected that the road between Port Mann and Kamloops will not be completed before the end of the year.

The Canadian Northern Railway officials have received definite information from the contractors that the line between Sudbury and Port Arthur, a distance of 450 miles, will be completed and ready for operation by Christmas. The recent enlargement of the C. N. R. elevators at Port Arthur, bringing their capacity up to the ten million bushel mark, was undertaken in order that the elevators might be ready when the steel was laid. With the same end in view, large orders for rolling stock have been given.

Sir Thomas Shaughnessy has under consideration at the present time the details of the 16-storey office building which the C. P. R. intends to erect at the corner of Portage and Main, Winnipeg, on the site of the present Canada Life Building and the adjoining property to the south. It has been arranged that the work of demolition of the present buildings will be begun in 1914 and about two years will be spent in the erection of this new edifice, which will be very similar to the Toronto building recently completed.

The Canadian Northern Railway Company has announced that it expects to be operating trains over its line from the Canadian Northwest to Quebec this fall. All connections between Quebec and Ruel, Ont., 849 miles, will be ready for train service shortly, and the road from Sudbury to Port Arthur opened for traffic a month later, which will give the Canadian Northern Railroad direct communication from Quebec to the end of its present line in the northwest.

The plans for the Transcontinental Railway workshops to be built at St. Malo with copies of detailed specifications, are now at Quebec. The plans in question cover the sewerage and water service, some 15 miles of yard storage railway tracking in connection with the projected locomotive and car shop plant, in detail as follows: locomotive, boiler and tank house, forge shop, store house, oil house, power house, chimney, reservoir, forge stores and scrap bins, indirect heating apparatus, direct heating system, sewer system, water piping system, midway crane runway, office building, freight car shop, planing mill, dry kiln and lumber yard, the whole to cost in the vicinity of $1,500,000.

Personal Mention

Messrs. Campbell & Latimer, railway contractors, have removed their offices from Petrolia to 305 Bell Telephone Building, Toronto.

Mr. Samuel Hill was elected president of the Pacific Highway Association at the 4th annual convention of that body held recently at Vancouver.

Mr. F. L. Fellowes, City Engineer of Vancouver, is reported to have been asked to terminate his agreement with the city at the end of six months as a result of a loss sustained through defective water pipes approved by his representative. Mr. Fellowes went to Vancouver three years ago from Westmount at a salary of $8,000 a year. It is of interest to record that this is the highest figure paid any city engineer in Canada.

Canadian City Engineers

Mr. W. P. Near, St. Catharines. Ont.

Mr. W. P. Near, B.A., B.A.Sc., City Engineer of St. Catharines, Ont., was born at St. Mary's Ont., where he received his early education, entering the University of Toronto in 1898. He graduated in mathematics and physics in the spring of 1903, and the following year was engaged as Assistant Lecturer in Physics.

He entered the School of Practical Science in the second year with the class of 1906, and on graduating succeeded in taking the first General Proficiency Prize in Civil Engineering. In 1907 he obtained the degree of B.A.Sc. with honors.

During the summer of 1905, he was engaged at the Dominion Observatory at Ottawa and was a member of the First Canadian Eclipse Expedition to Labrador to witness the total eclipse of the sun visible there in August, 1905. Mr. Near spent the summer of 1906 on the survey staff of the International Boundaries Surveys, working through the mountains in Southern British Columbia on the 49th parallel of latitude.

After leaving college in 1907 he served one year on the T. & N. O. Rly. surveys as transitman, being engaged on the preliminary survey of the Cobalt-to-Sudbury line and later, during the fall and winter, on the revision of grade and line of the main line between North Bay and Jocko. In May, 1908, he again joined a Boundary Survey party as assistant and journeyed to Alaska and the Yukon to locate the 60th parallel of latitude between British Columbia and the Yukon. Here he spent a strenuous season in mountain-climbing and precise surveying. On his return from Alaska, having completed a journey of 21,000 miles, he decided to settle in Toronto, where he accepted a position as Resident Engineer in the Main Drainage Department under Mr. C. H. Rust, then City Engineer. Later he was given charge of the construction of the whole Trunk Sewers Department, a position which he filled for nearly two years.

Mr. Near is an Associate Member of the Canadian Society of Civil Engineers of four years' standing. He is also an Associate Member of the Royal Astronomical Society of Canada.

Mr. F.L. Fellows, City Engineer of Vancouver, who is retiring.

Mainly Constructional

The News in Brief—From Coast to Coast

The first modern apartment house to be erected there is now under construction at Fort William.

The corner stone of the new Technical School at Toronto was laid by Premier Borden on August 26th.

The work of putting in the foundation for the new city incinerator plant at Fort William has started and will be completed this fall.

The city of Calgary has awarded a contract to the General Supplies Company of that city for valves and steam pipes amounting to $26,000.

It has been stated that construction work will be commenced this autumn on the plant of the Electric Steel and Metals Company, which is to be built here.

The Turbine Equipment Company, Limited, has been incorporated with a capital of $40,000, to carry on business as civil, mechanical and electrical engineers, contractors, etc., with head office at Toronto.

The Toronto Housing Company have plans at the city architect's office for 59 houses on Bain and Sparkhall avenues, Toronto. These are to be two-storey brick buildings, and will mean an expenditure of $120,000.

A permit for the erection of a new grand stand at the Woodbine race track, Toronto, was issued recently. Having a spacious and substantial basement, the stand will be in reality a double-decker, constructed of brick and steel. The cost is estimated at $100,000.

The elevator to be built at Calgary will cost in the neighborhood to begin with of $1,500,000, and will have an initial capacity of three million bushels of grain. It will be built in such a way as to provide for the addition of further units, which will ultimately give it the capacity of twenty million bushels.

The tender of the R. J. Lecky Company for the construction of the new wing of the Regina General Hospital, has been accepted by the Hospital Board. The contract price is $88,107. The contract for the erection of the isolation hospital has been let to Minkley and Traub, their tender for the work being $77,600.

Consulting engineers F. P. Stearns, Rudolph Hering and James A. Fuertes have submitted their report upon the proposal to use Shoal Lake as the source of water supply for the Greater Winnipeg water district. The report is favorable to the project and recommends that the work be undertaken with as little delay as possible.

Building operations in Halifax this year will be greater than those of last year, and value of construction work begun in 1913 promises to double that of 1912. The building permits for July, 1913, amounted to $201,400 as against $143,100 for July, 1912. The total for 1913 up to the end of July was $506,700 as against $352,025 for the same period in 1912.

For some time the Controllers of Montreal have had under consideration the installation of a more economical garbage plant, the present system costing a large annual outlay for haulage. The Controllers have now commissioned Mr. R. S. Lea, of Montreal, a well known authority on the subect, to prepare a report on the subject, making provision for the disposal of 700 tons per day.

Owing to the general financial condition which has rendered it difficult for many municipalities to get the necessary money to continue their municipal work, the city of Prince Albert will temporarily suspend construction work on their hydro-electric development at LaColle Falls. The dam is already nearing completion and is understood to be in such shape that the delay will not cause any deterioration of the structural work.

Tenders for the extensive harbor improvements at Toronto have been received at Ottawa along with those for the Severn River section of the Trent Canal, and for section three of the Welland canal. These great undertakings will involve the expenditure of many million dollars. The different tenders are being extended, and contracts will be awarded shortly. It is understood that for the Toronto harbor works there are six proposals.

The Standard Clay Products, Limited, St. Johns, P.Q., are doubling their plant at New Glasgow, N.S., so as to bring its capacity up to that of their main plant at St. Johns. The kilns are to be increased from 9 to 19, and this will mean the employment of a total of 250 hands. It is hoped to have the enlarged plant in operation by 1st October, giving an output, according to Mr. C. S. Trotter, the manager, of 3,000 cars per annum of piping, flue lining, building blocks and junctions.

The Canada Iron Corporation is to be re-organized, Mr. F. F. Whyte, of New York, being appointed receiver pending a reconstruction of the finances. The company has been affected by the cessation of the bounties on pig iron and keen competition from other countries, the directors stating that their products are not sufficiently protected by duties. The last annual statement showed sufficient profits to meet fixed charges with a balance of $46,566. The corporation has mines at Eganville, Ont., Bessemer, Ont., Bathurst, N.B., and Torbrook, N.S.; furnaces at Midland, Ont., Radnor Forges, P.Q., and Drummondville, P.Q.; and foundries at Fort William, Hamilton, St. Thomas, Midland, Ont., Montreal, Three Rivers, P.Q., and Londonderry, N.S.

Mr. G. M. Gest has been awarded the contracts for two additional sections of the underground conduit system planned by an electrical commission for laying wires underground. Mr. Gest, who is now carrying out the first section, was the lowest tenderer for both new sections. For the section from Guy street to Atwater Avenue, on St. Catherine street, the bids were: G. M. Gest, $45,969, time required two working months; L. A. Ott, $52,449, 90 working days; C. E. Deakin, $46,025; Dietrich, Limited, $62,226, three working months; Quinlan and Robertson, $50,961; Standard Construction Company, $52,199, four working months. For the Bleury street section: G. M. Gest, $128,418, time required four working months; L. A. Ott, $160,898, 125 days; Standard Construction Company, $156,338, 6 working months.

An electrical fire alarm system is being installed at Valleyfield, P.Q., by Sevigny & Lalonde, Notre Dame Street West, Montreal. The equipment consists of Gamewell non-interfering Excelsior fire alarm boxes connected in series, supplied by the Northern Electric and Manufacturing Company. The town is divided into four districts, five boxes being installed in each division, these being connected to the central fire station and also to the waterworks. The system is worked by means of two closed metallic circuits, north and south, which can be used together, or separately in case of necessity. The electro-motive force for operating the system is furnished by gravity batteries, of sufficient power to give 1-10 ampere for each circuit. Lightning arresters are provided in each station, while a switchboard is installed in the central station.

Trade Notes

The exhibit of the Ceresit Waterproofing Company at the recent International Cities and Town Planning Exhibition, Ghent, Belgium, achieved the distinction of being awarded the Grand Prix.

The Squires improved steel trap, for which Messrs. Canadian Allis-Chalmers, Limited, Toronto, are the selling agents, is described in an interesting bulletin. This trap is distinguished by ready access to the few working parts, low cost of maintenance, great capacity, durability and high efficiency.

A catalogue received from the Bradford Pressed Brick Company, Bradford, Pa., is interesting as showing the wide range of possibilities of red pressed brick. The Bradford Company manufacture only the one color and they claim that their product "is probably the most beautiful red brick in America." The catalogue contains colored illustrations of many of their lines.

Catalogue K, of the Brown Hoisting Machinery Company, Cleveland, Ohio, contains a general description of Brownhoist locomotive cranes of various capacities and shows by illustrations how the cranes are used in connection with the Brownhoist patented grab buckets. The illustrations are illuminating as to the efficiency of this equipment under exacting conditions.

A copy of "No-Rim-Cut News," the official organ of the Goodyear Tire & Rubber Company of Canada, has reached us. The paper is made exceedingly attractive by a number of cuts and upon the front page is to be found a view of what is to be the new home of the company in Toronto. It contains considerable information concerning the Goodyear company and their methods of operation. An article on their monthly credit memos is very interesting while the description of their laboratory tests of all raw materials, and the second instalment of the method of making an automobile tire are full of information. "No-Rim-Cut News" should prove interesting reading to the many users of rubber tires.

A new kind of flooring is being tried out in one of the new cars just put into service by the Ottawa Electric Railway Company. It is called "mastic flooring," and is a preparation something like asphalt, but can resist over 400 degrees of heat before melting. It is put on over the ordinary wood floor in practically the same was as asphalt is put on the streets. The makers, the Canada Floors Limited, of Montreal, claim that their new product has several advantages over ordinary wood floors, namely that it is easier to clean, is more sanitary, better in appearance and almost everlasting. If it proves satisfactory it is likely all the cars owned by the Ottawa Electric Railway will be equipped with it.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brockville, Ont.
Rocmac pavement from Park street to east Town limits, planned by Town Council. Mayor, John MacKenzie. Clerk, Geo. Dewey. Plans and specifications at office of Engineer, Geo. Bryson.

Calgary, Alta.
Filtration plant and pumping station for City Council. Waterworks Engineer, A. W. Ellson Fawkes. Contemplated constructing above with a capacity of 40,000,000 gals. daily.

Goderich, Ont.
Tenders received by Clerk, L. L. Knox until September 11th, for approximately 14,500 sq. ft. cement concrete walks on Nelson, Park and Wellesley streets and Britannia road. Engineer-in-charge, J. Ades Fowler, C.E.

Kingston, Ont.
Tenders received until Sept. 5th for construction of approximately 4,250 sq. yds. asphalt block pavement, 1,330 lin. ft. concrete curb and gutter, 1,040 lin. ft. concrete gutter and 2,000 sq. ft. concrete walk (widening walk). Plans, etc., at office of City Engineer. Mayor, T. J. Rigney. City Engineer, R. J. McClelland.

Montreal, Que.
Macadamized roadway, St. Catherine Rd., planned by Town Council of Outremont. Sec.-treas., Mr. Sampson. Granite macadam covered with Tarvia.

Water pipes, cost $14,000, for Longue Pointe Ward. Sec., L. N. Senecal. City Council to be asked for appropriation for replacing small old pipe by new 8 in. pipes.

Levelling and paving, cost $27,000, St. Denis, planning by Board of Commissioners. Sec., L. N. Senecal.

Stamford Twp., Ont.
Waterworks, cost $10,000, contemplated by the Municipal Council. Clerk, C. F. Munroe, Southend. By-law will be submitted to ratepayers.

Toronto, Ont.
Roadways, etc., planned by Board of Control. Mayor, H. C. Hocken. Commissioner of Works, R. C. Harris. Bathurst street, south of bridge, cedar block, $2,633; Gerrard-Leslie to Greenwood, asphalt, $4,686; Huntley street, rocmac, $2,451; Wheeler ave., grading, $8,313; Avondale-Park to Rosedale, rocmac, $2,971; Terauley-Queen to Agnes, asphalt, $11,839.

CONTRACTS AWARDED

Estevan, Sask.
Outfall sewer and sewage disposal works, cost $29,500, for Town Council. Sec.-treas., P. J. Stephens. Engineers, Chipman & Power, Mail Bldg., Toronto. General contractor, H. E. McKenzie. For outfall sewer from trunk sewer, sewage disposal beds, septic tanks and spray filters.

Grey Twp., Ont.
Drains for Twp. Council. Clerk, Alex. H. McDonald, Ethel, Ont. Contract for Pollard Drain, awarded to Henry Alcock, c/o Clerk, at $2,319; Silver Corners Drain, awarded to Daniel Reed, c/o Clerk, at $1,285; Inglis Drain, John Matthews, c/o Clerk, at $2,266.

Montreal, Que.
Paving, cost $330,067.60, planned by Board of Commissioners. Secretary, L. N. Senecal. Contracts awarded as follows: Pavements on four streets, $165,521.49, Bitulithic Paving Co., 745 St. Catherine W.; four streets, $89,087.20, Warner, Quinlan Asphalt Co., Guy Blk.; seven streets, $75,458.91, Sicily Asphaltum Paving Co., Ltd., 45 Prince street.

Port Arthur, Ont.
Pump house, cost $12,995. Commissioner of Utilities, J. J. Hackney. General contractors, Thunder Bay Contracting Co.

St. Frs. De Sales, Que.
Macadamizing 10 miles of roadway. Sec.-treas., Anatole Gascon. General contractors, M. J. Stack & Co., 167 McCord St., Montreal.

St. Vincent De Paul, Que.
Macadamizing roads planned by Town Council. General contractors, M. J. Stack & Co., 167 McCord St., Montreal.

Sault Aux Recollet, Que.
Macadamizing roads planned by Town Council. Sec.-treas., J. A. Cadieux. General contractors, M. J. Stack & Co., 167 McCord St., Montreal.

Winnipeg, Man.
Concrete mixer, cost $2,625, required by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractors, Dom. Equipment & Supply Co., 46 Canada Life Bldg.

Concrete pavements planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractors, Fielding & Sheply, 305 Travellers Bldg., and J. W. Astley, engineer of construction.

Sewers and water mains. Engineer, H. N. Ruttan, 223 James ave. General contractor, J. W. Astley, engineer of construction. Board of Control; Secretary, M. Peterson.

Railroads, Bridges and Wharves

Chatham Twp., Ont.
Construction of new Wade Drain and repairs to Stephen, Henson, Pollock and 4th Concession Drains, planned by the Twp. Council. Clerk, A. McArthur, Tupperville.

Grafton, Ont.
Bridges owned by Haldimand Twp. Council destroyed by fire. Clerk, Reuben Lawless, Grafton, Ont.

Meaford, Ont.
Revetment wall ,extension and repairs, planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Secretary until 4 p.m. Sept. 29th. Plans, etc., at office of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto; J. H. Armstrong, Dist. Engineer, Midland; Postmaster, Meaford, and at Dept., Ottawa.

Montreal, Que.
Concrete wharf, 500 ft. long, planned by Harbour Commissioners of Montreal, 57 Common street. Secretary, David Sneath. Engineer in charge, F. W. Cowie, 57 Common street, Montreal.

Port Arthur, Ont.
Breakwater, cost $500,000, for Dominion Govt., Dept. of Public Works, Sec., R. C. Desrochers, Ottawa. Engineer-in-charge, F. I. Harcourt. Tenders to be called this Fall. Second extension of breakwater, crib work on piles, concrete superstructure.

Province of Que.
Bridge, cost $2,550, over Morissette Brook, planned by Municipal Council of St. David. Sec.-treas., L. W. Joyal. Plans, etc., at office of Sec.-Treas. One span, 20 x 16, concrete, 5-15 in. I-beams, 42 lbs., 24 ft. long, steel and 4 in. red pine.

Bridge, cost $2,450, planned for Municipal Council of St. Hilaine. Plans, etc., at office of Sec.-Treas., Y. E. N. Desrochers. One span, 20 x 20, concrete, steel, 6-I-beams, 42 lbs., 24 ft. long, reinforced concrete.

C. P. Rly. Co. has been authorized to construct bridge No. 113.1 on its Sherbrooke sub-division Eastern Division, Que.

Rainy River, Ont.
Sheet piling, cost $11,000, 80 feet, planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer-in-charge, E. Y. Harcourt, Port Arthur. Tenders to be called for shortly.

St. Malo, Que.
Car shop repair plant, cost $1,500,000, for Commrs. Transcontinental Rly. Sec., P. E. Ryan, Ottawa. Tenders called. Time extended from Sept. 2nd to Sept. 9th. Received by Sec. Plans, etc., at office of G. Grant, Chief Engineer, Ottawa; A. E. Doucet, Dist. Engineer, Quebec City. Deposit required, $50,000.

Sussex, N.B.
Station for Intercolonial Railway Co. Tenders received by Chief Engineer, Mr. MacKenzie, Moncton, until Sept. 3rd. Brick and stone construction.

Twp. of Toronto, Ont.
Railway extension planned by Toronto Suburban Rly Co., 936 Keele St., Toronto. Manager, Geo. C. Royce, c/o Company. Draft of agreement prepared for extension of railway to Erindale.

Victoria Harbor, Ont.
Wharf planned by Dom. Govt., Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Sept., 8th. Plans, specifications, at Dept., Ottawa.

Westboro, Ont.
Bridge for Twp. of Nepean. Reeve, Mr. Honeywell. Engineer not decided. Reconstruction of bridge (McFarlanes), concrete construction.

CONTRACTS AWARDED

Provinces of Alberta and Saskatchewan
Stations for Canadian Northern Rly., Winnipeg. Architect, R. B. Pratt, Co.'s Architect, Winnipeg. General contractors, C. N. R., B. & B. Dept. Will build all stations on the Vegreville-Calgary and Saskatoon-Calgary lines by day labor.

Fort William, Ont.
Electric shop, cost $15,000, McIntyre street, for C. P. Ry. General contractor, J. H. Simmons, Winnipeg, Man. One storey, 32 x 80.

Hope, B.C.
Railway, cost $3,000,000, from summit of Hope range along the Coquahalla River to the town of Hope, a distance of 38 miles, planned by the Kettle Valley Ry. Co. President and general manager, J. J. Warren, Penticton, B.C. General contractors, McArthur Bros. & Co., New York, N.Y.

Island River, N.B.
Dredging planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, W. J. Poupore Co., Ltd., 211 McGill street, Montreal.

Little Current, Ont.
Dredging planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Soo Dredging & Constr. Co., Ltd., Sault Ste. Marie.

Montreal, Que.
Underground conduits for Board of Commissioners. Sec., L. N. Senecal. General contractor, G. M. Gest, 83 Graig St., for work on Bleury St. and Park Ave., $128,418.85, and for work on St. Catherine St., $45,969.15.

Port Arthur, Ont.
Breakwater, cost $1,522,000, Unit No. 1, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer-in-charge, E. Y. Harcourt, Port Arthur. General contractors, Thunder Bay Contracting Co., Port Arthur. Superstructure well under way, to be completed this year.

Dredging, cost $122,000, Main Harbour, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer-in-charge, F. Y. Harcourt. General contractor, W. E. Phin, Dredging Contractor.

Rainy River, Ont.
Pile wharf, cost $5,000, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer-in-charge, F. Y. Harcourt. Work done by day labor. Tamarac, spruce and pine construction.

Rustico, P.E.I.
Dredging planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, V. T. Bartram, 123 Bay St., Toronto.

Vancouver, B.C.
Docks, cost $1,250,000, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Henry, McFee & McDonald.

Walton, N.S.
Extension to wharf planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Albert Parsons, Walton.

Public Buildings, Churches, Schools, etc.

Beachville, Ont.
Heating and ventilating for school. Tenders received by Architect, B. McNichol, Mary St., Woodstock, Ont., until noon Sept. 4th. Plans, etc., at his office. Four rooms.

Comox, B.C.
School planned by Prov. Govt., Dept. of Public Works, Victoria. Minister, Hon. Thos. Taylor. Engineer, J. E. Griffiths. Plans, specifications, etc., at offices of J. Carthew, Sec. of School Board, Comox; J. Baird, Govt. Agent, Cumberland, or the Dept., Victoria. Tenders received by Minister till Sept. 8th, for erection and completion of a 2-room school and conveniences.

Drinkwater, Sask.
School, cost $10,000, for School District No. 969. Treas., Jas. W. A. McIsaac. Two-room brick veneered. Plans in progress.

Halifax, N.S.
Tenders received until Sept. 15th for construction of wooden lighthouse and dwelling combined, also oil shed at Burntcoat, Hants County. Plans and specifications, etc., at Dept. of Marine and Fisheries, Ottawa and Halifax, and post offices at Burntcoat, Windsor, Truro and Maitland.

Jaffray, B.C.
Tenders received by Minister, Hon. Thos. Taylor, till Sept. 9th, for erection of a large 1 room school houe. Engineer, J. E. Griffiths. Plans, specifications, etc., at office of J. S. T. Alexander, Govt. Agent, Fernie; E. S. Home, Sec. School Board, Jaffray, and the Dept., Victoria. Prov. Govt., Dept. of Public Works, Victoria.

Main Duck Island, Ont.
Tenders received by Sec., Alex. Johnston, Ottawa, Dom. Govt., Dept. of Marine & Fisheries, until noon Sept. 16, for the construction of a reinforced concrete tower, wooden residence, boathouse and oil store. Plans, specifications, etc., at Dept., Ottawa, and Post Offices at Kingston, Picton, Bath, Deseronto, Trenton and Gananoque.

Montreal, Que.
Alterations to City Hall, Notre Dame street, planned by Board of Commissioners. Secretary, L. N. Senecal. Architects, Marchand & Haskell, 164 St. James street, Montreal. Tenders will be called by architects in about three weeks.

Preliminary plans are being prepared for the erection of a convent. Architect, L. A. Content, 17 Place d'Armes Hill.

Club house for Pte. Claire Boating Club, Pointe Claire. Architect, Mr. Henderson, c/o Wadsworth & Henderson, New Birks Bldg, is preparing plans.

Preeceville, Sask.
School, cost $2,500, contemplated by School District No 2850. Treas., James Fraser. Plans will be prepared.

Robson, B.C.
School, Ymir District. Prov. Govt., Dept. of Public Works, Victoria. Minister, Hon. Thos. Taylor. Engineer, J. E. Griffith. Plans, specifications, etc., at offices of W. F. Teetzel, Govt. Agent, Nelson; H. R. Townsend, Govt. Agent, Rossland; N. Y. Wickham, Sec. School Board, Robson, or Dept. of Works, Victoria. Tenders received by Minister till noon Sept. 9th, 1913, for erection and completion of a large 10-roomed school.

St. John, N.B.
Tenders addressed to A. Johnston, Deputy Minister of Marine & Fisheries, Ottawa, will be received until Sept. 12th, for the construction of a wooden lighthouse tower at Grande Anse, Gloucester County. Plans, specifications, etc., at the Dept., Ottawa and St. John, and Post Offices at Caraquet, Grande Anse, Shippegan and Bathurst.

Salmo, B.C.
Tenders received by Minister till noon Sept. 10th, 1913, for construction of a lock-up and constable quarters. Prov. Govt., Dept. of Public Works, Victoria. Minister, Hon. Thos. Taylor. Engineer, J. E. Griffith. Plans, specifications, etc., at offices of W. F. Teetzel, Govt. Agent, Nelson, B.C., the Prov. Constable, Salmo, and the Dept. of Works, Victoria.

Toronto, Ont.
Home planned for I. O. F., Temple Bldg. Supreme Chief Ranger, E. G. Stevenson, will build and maintain home for aged members of order. Location not yet decided.

Three Rivers, Que.
Mausoleum for the Quebec Mausoleum Co., Ltd., 136 St. James St., Montreal. Builders and architects, Owners. Three storeys, 50 x 50, concrete construction throughout. Plans being prepared.

Vancouver, B.C.
P. O. Station "B", interior fittings, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans with W. Henderson, Res. Architect, Victoria, at P. O. Vancouver, and Sec., Public Works Dept., Ottawa. Tenders received by Sec., until Sept. 19th.

Viceroy, Sask.
School, cost $5,000, contemplated for School District No. 3007. Treas., Andrew Moffett.

Victoria, B.C.
Public building planned . Tenders will be called shortly by Dom. Govt., Dept. of Public Works, secretary, R. C. Desrochers, Ottawa.

Hospital building planned for Royal Provincial Jubilee Hospital. Architect, Loring P. Rixford, Humboldt & Gordon. Plans were chosen in competition.

West Toronto, Ont.
Lodge hall for Lakeview Lodge No. 272, I. O. O. F. Sec., H. P. Scorer, c/o Campbell's Hall. Site purchased Keele St., north of Annette St. Plans under way.

Winnipeg, Man.
School, Deer Lodge (Linfield St.), for Rural Municipality of Assiniboia. Sec., F. Ness, Kirkfield Park P. O. Architect, A. Melville, 405 Builders' Exchange. New by-law will be submitted to ratepayers on Sept. 13th, 1913.

Fountain, cost $10,000, Central Park, planned by Parks Board, 229 Chambers of Commerce. Sec., J. H. Blackwood. Work will not start till next year. Design not yet selected.

CONTRACTS AWARDED

Berlin, Ont.
Theatre and office building, King W., for H. L. Janzen. Architect, C. Knechtel. General contractor, C. Braun, King street.

Municipal barns planned by City Council. Architect, C. Knechtel. Mason, H. Dunker, Charon street. Foundations in.

Fire hall, cost $18,000, Edward street, planned by Town Council (Fire & Light Com.). Architect, C. Knechtel. Carpenter, Geo. Butcher, Scott St. Plumbing, Hollinger & Durst, Frederick St. Glen William stone and red brick construction.

Cobalt, Ont.
Contract for erection of municipal buildings here has been awarded to Hill-Clark-Francis Ltd., general contractors, of New Liskeard. Concrete foundation, brick superstructure, reinforced with steel.

Elmira, Ont.
Post office, cost $35,000, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, E. A. Bleakney, Gananoque, Ont. Concrete work, J. E. Bowman. Brick work, C. Scheutz.

Halifax, N.S.
Extension to college, cost $45,000, for Roman Catholic Corporation. Archbishop of Halifax, Rev. Dr. McCarthy, Dresden Row. Architect, H. E. Gates, Dennis Bldg., Granville St. General contractors, S. A. Marshall & Son, Keith Bldg., Barrington St. Three storeys and basement., 90 x 40, pressed brick and granite construction.

Moncton, N.B.
Church, cost $52,000, Queen St., for First Baptist Church Congregation. Sec. of Trustees, W. H. Estano. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, J. M. Clark, Summerside, P.E.I. 150 x 100, to be brick with stone trimmings.

Montreal, Que.
Grenadier guard armoury, Esplanade, for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, mason, carpenter, plastering, painting, D. G. Loomis, St. Patrick. Roofing, Campbell Gilday & Co., 663 St. Paul St. Heating and plumbing, Hickey & Aubut, 93 Dominion St. Electric, Montreal Elec. Co., 425 St. James. Marble and tile, Robt. Ball & Co., 174 Mountain St.

Academy "Proulx," cost $150,000, Parthenais, for Commrs. Scolaire St. Gregeire de la Thaumaturge, c/o E. Pinonneault, 880 Mt. Royal. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Marble and tile, Lepage Marble Works, 734 St. Lawrence Blvd. Ornamental iron, F. Gillet, 225a Craig E. Four storeys, 139 x 139, concrete foundation, brick, terra cotta and steel construction.

New Westminster, B.C.
Public building planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, W. Henderson, Res. Architect, Victoria. General contractors, Sloan & Harrison.

Ottawa, Ont.
Stone and iron fence for Rideau Hall planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, A. G. Marshall, 5 O'Connor St.

Regina, Sask.
College, cost $35,000, 6th ave., for Diocese of St. Chads. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. General contractors, R. J. Leds Co., Ltd., Northern Crown Bank Bldg. Painting, Harris & Co., Albert street. Heating & Plumbing, Potts & Smith, 1841 Cornwall. Electrical work, Sun Electric Company, Scarth street.

Toronto, Ont.
R. H. Harman & Son, 156 Dupont, have been awarded the masonry contract for the Webb & Hutchison theatre on Queen street east, Toronto.

Sunday school, cost $55,000, Lowther, for Walmer Rd. Baptist Church. Chairman of Com., R. C. Dancy, 171 Spadina Rd. Architects, Burke, Horwood & White, 28 Toronto St. Carpenter, Jas. McKenzie, 359 Yonge St. Roofing, Rennie & Son, 130 Dupont St. Painting, F. G. Roberts & Co., 104 Wells St.

Theatre, cost $15,000, Elm and Yonge, for Jacob Vise, 290 Yonge St. Architect, Neil G. Begg, Cosgrave Bldg. General contractors, Orr Bros., Queen E. Plastering, Wm. Webster & Son, 183 Major street.

Lodge Hall, 805 Dovercourt, for Sovereign Hall Co., c/o Architect. Architect, W. G. Hunt, 935 Bloor W. Three storeys, 40 x 85, brick construction, stone foundation corrugated iron, felt and gravel roofing. Day labor, under Architect's supervision. Temporary roof to be put on basement. Hall will be used by I. O. O. F. this fall. Foundations in.

Vancouver, B.C.
Theatre, 647 Commercial Ave., for R. J. McLean, 1220 13th Ave. E. Architect, J. Y. McCarter. General contractors, Dominion Constr. Co., Ltd., 509 Richards. Two storeys, reinforced concrete construction.

Winnipeg, Man.
School, Clifton street. Secretary-treas., R. H. Smith. Architect, J. B. Mitchell, William and Ellen. General contractors, Sutherland Construction Co., Carlton Bldg. Heating, Green & Lister, Fort street. Plumbing, C. C. Young, 789 Sherbrooke street. Electrical work, Northern Electric Co., Ltd., Henry ave.

Business Buildings and Industial Plants

Bradford, Ont.
Factory for Watson-Smith Co., Ltd., 161 Geary Ave., Toronto. Woodworking, wire screens, etc. Ratepayers granted bonus of $20,000. Building to be erected this fall, 50,000 sq. ft.

Cumberland, B.C.
Bank building for The Royal Bank of Canada. Two storeys, 25 x 40, vaults and safes, apartments for staff. Plans ready.

Drummondville, Que.
Coal handling plant planned for Intercolonial Railway Co. Forms of tender at office of Chief Engineer, Mr. MacKenzie, Moncton, at either of the above places, who will receive tenders for mechanical coal handling plant.

Montreal, Que.
Shoe factory, 543 Desjardins, owned by Rideau Shoe Co., c/o J. A. Adam, 529 Lafontaine, destroyed by fire. Loss, $45,000.

Bank building, Sandwich street east, for Merchants Bank, Montreal, Que. Architects, Hogle & Davis, 80 St. Francois Xavier street, Montreal. Two storeys, cement and brick foundation, pressed brick construction. The plans for this building are to be forwarded from Montreal and tenders called here.

Offices contemplated for Liverpool, London & Globe Insurance Co., 112 St. James street. Manager, Mr. J. Gardner Thompson. Plans will be prepared.

Regina, Sask.
Office, 11th and Corwall St., for National Trust Co., Ltd., 404 Darke Bldg. Architects, Pratt & Ross, Elec. Rly. Chambers, Winnipeg. This project has been called off this year owing to alterations that will be made to plans. Work will go on in spring 1914.

Hotel, cost $40,000, planned by R. A. Cannan, 403 Darke Block. Architects, Brown & Vallance, Canada Life Bldg., Montreal. Five storeys.

Extension to jewellery store, cost $7,500, for F. G. England, 1776 Hamilton St. Extension 50 ft. long, brick construction, concrete foundation, electric lighting, steam heating. Plans in progress.

Saskatoon, Sask.
Business block, cost $250,000, 1st Ave. and 23rd St., for N. Gardner, Boggs and Sir Jno. Lungham. Five storeys. Plans ready.

Swift Current, Sask.
Warehouse planned for Moose Grocery. Work will be started this fall.

Windsor, Ont.
Addition to paint factory, cost $2,500, for Standard Paint & Varnish Company. Manager, Mr. Straith. Architects, Speir & Rhone, Detroit, Mich. Three storey addition. Plans ready.

Factory, for Burroughs Adding Machine Co., H. O. Detroit, Mich. Assembly plant to be established for Canadian trade. Plans in progress.

Welland, Ont.
Factory, cost $1,000,000, planned for Union Carbide Co. of Canada. Supt. of Co., John White, Niagara Falls, N. Y. Works manager, C. T. Ayers, New York, N.Y. Five buildings.

CONTRACTS AWARDED

Battleford, Sask.
Furniture factory, 1st Ave., for Convery & Sallows. Architects, Stephenson, Evans & Fillingham. General contractor, Geo. Quaadman. Brick work labor only, M. G. Lane. Heating and plumbing, B. N. Lewis. Three storeys.

Berlin, Ont.
Shoe factory, cost $26,000, Kaiser St., for Gourlay & Co., Kaiser St. General contractors, Secord & Sons, Brantford. Excavating, Mr. J. P. Wiber. Three storeys, 150 x 40. Excavating started.

Cochrane, Ont.
Bank building, 6th Ave., for Imperial Bank of Canada. Architect, W. E. Binning. Supt, of Construction, J. Peugh. Heating and plumbing, Louis Gies, King St., Dundas. Contracts for heating and plumbing for Manager's residence also awarded to above.

Fort William, Ont.
Grain drying plant, cost $8,000, Athabasca, for Guy Elevator Co., Graham and Horne Block. Architect and general contractor, S. J. McQueen. 55 ft. high, 12 x 25.

Hamilton, Ont.
Alterations to store, cost $4,000, for Duff Stores, Ltd., York St. Architects, Watt & Blackwell, Lister Chambers. General contractor, R. Somerville, 108 Sanford Ave. N.

Lacombe, Alta.
Bank building, cost $25,000, for Royal Bank. General contractors, Purdy & Henderson, 470 Granville St., Vancouver. Two storeys, 40 x 56, brick, cement foundation, tile and fireproof floors.

Lethbridge, Alta.
Dairy, cost $6,000, 5th Ave. E., for H. Hubbard. Architects and general contractors, Carpenter Bros. Plumbing, Dandson Metal Co. Electric. Chas. Cook. Two storeys, 75 x 75, brick, cement foundation. Excavation started.

Factory, cost $9,000, 3rd ave. and 12th St. N., for Mr. Marnico. Architect, E. E. Caner. General contractor, S. Bario. Roofing, plumbing and heating, Dandson Metal Co. Electric, Roy Electric Co. Painting, G. Emery. Two toreys, 100 x 50, brick construction. Foundations in.

Montreal, Que.
Alterations to tannery, cost $3,000, St. Ambroise, for Montreal Carriage Leather Co., 175 St. Ambroise. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractors, Bonnell Bros., 341 Guy St. Carpentry, R. Ryan, 697 Atwater ave. Three storeys, 34 x 31, concrete foundation, felt and gravel roofing.

Two stores and four flats, cost $18,700, Notre Dame, for Louis Cohen, 516 Notre Dame W. Architect, L. J. T. Decarie, New Birk's Bldg. General contractors and masonry, Purves & Henderson, 214 St. Antoine., will receive tenders for rest of work. 50 x 75, concrete footing, brick construction, store fronts and fixtures.

Addition to office building, cost $7,500, 58 St. Francois Xavier, for F. D. Monk, 58 St. Francois Xavier. General contractors, brick and masonry, Bonnell Bros., 341 Guy street. Carpentry, roofing, glazing, painting, electrical work, R. Ryan, rear 697 Atwater ave. Heating and plumbing, W. J. McGuire & Co., 332 Craig W. One storey addition, brick construction.

Warehouse, shops and offices, cost $40,000, Beaumont, for General Fire Extinguisher Co., 175 McCord. Architect, Robt. Findlay, 10 Phillips Place. General contractors, masons and carpenters, Reid, McGregor & Reid, Guy Block. Iron and steel, Structural Steel Co. General contractors will receive tenders for all other trades. Two storeys front for 60 ft, rest 1 storey, 220 x 120, cement foundation, brick construction.

Wholesale grocery and warehouse, cost $25,000, 1170 St. Lawrence, for P. Adelstein, 1173 St. Lawrence Blvd. General contractors, Gilbert Demers & Sarrazin, 861 St. Lawrence. Roofing, heating, plumbing and electric work, Rock Ouimet, 93 Vitre West. Painting, Donat Valquette, 888C St. Andre.

Factory, cost $75,000, St. Patrick St., for Canadian Tube & Iron Co., Ltd., Victoria St., Emard Ward. Architect, builder and general contractor, Owners. Steel, Structural Steel Co., New Birks Bldg. One storey, 417 x 300, concrete foundation, brick construction, felt and gravel and corrugated iron roofing .

Repairs to offices, cost $10,000, 317-21 Craig St., for Can. Metropolis Realty Co., Ltd., 120 St. James St., Montreal. General contractors, Anglins Ltd., 65 Victoria St.

Store, cost $12,000, St. Catherine St., for Mrs. H. E. Vautelet, 69 Victoria Ave. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Roofing, heating, ventilating and plumbing, J. E. Hardy, 666 Papineau Ave. Plastering, Pascal Larocque, 341 de Lanaudiere. Painting not let yet.

New Liskeard, Ont.
Hill-Clark-Francis Ltd., general contractors, of New Liskeard, have been awarded the contract for a concrete store for J. F. Mulligan, also for erection of a Manse for the Presbyterian Church, concrete foundation, brick veneered.

Ottawa, Ont.
Warehouse, cost $63,000, York St., for S. J. Major & Co., York St. Architect, C. P. Meredith, 126 Sparks St. Heating, A Gauthier & Co., 307 Dalhousie. Plumbing, J. A. Langelier, 310 Wellington. Electrical, Marchand & Donnelly, 128 Sparks St.

Business block, cost $100,000, Bank, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Ornamental iron, Canadian Allis-Chalmers-Bullock, Ltd., King and Simcoe, Toronto.

Business block, cost $100,000, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Mason, T. C. James, 140 Flora St. Plastering, heating and plumbing, not let yet.

Preston, Ont.
Bank building for Merchants Bank of Canada, H. O. Montreal. Architects, Hogle & Davis, 80 St. Francois Xavier St., Montreal. General contractors, P. H. Secord & Sons, Brantford, Ont. Painting and interior decorations, Ed. Radigan, Galt, Ont.

Prince Albert, Sask.
Bank and offices for The Canadian Bank of Commerce, H. O. Toronto. Architects, The Dom. Realty Co., Ltd., King and Jordan Sts., Toronto. General contractors, Johnston & Coleman. Electric, Prince Albert Elec. Co., 108 8th St. Plumbing and heating, Manville Hardware Co. Concrete and tile floors, metal lath, fireproof doors, vaults, safes, grille work, fire extinguishers, bank fixtures.

Swift Current, Sask.
Warehouse for Massey Harris Co., Ltd., Toronto, Ont. General contractors, Tom Barnard, 1121 15th ave., Regina. Basement and one storey nearly finished.

St. Catharines, Ont.
Stable and garage, Ontario St., for J. D. Chaplin. Architect, A. E. Nicholson. General contractor, W. E. Hudson. Three storeys, 30 x 60, brick construction, concrete foundation.

Sackville, N.B.
Stores and flats, cost $4,000, Main, for H. Miller. Architect, W. Doull. Work being done by day labor. Two storeys, 55 x 80, pressed brick construction.

Terrebonne, Que.
Tile plant, cost $18,000, planned for Montreal Concrete Works Co., Ltd., 225 St. James, Montreal. Builders, Owners. Company is in the market for dump carts and all kinds of machinery required for manufacturing concrete, tile and crushing stone.

Toronto, Ont.
Stores and offices, Yonge and Shuter, for Ryrie Bros., 134 Yonge street. Architects, Burke, Horwood & White, 28 Toronto street. Roofing, A. Matthews Ltd., 256 Adelaide W. Painting, F. C. Roberts & Co., 106 Wells street. Heating, plumbing and electrical work, Bennett & Wright, 72 Queen E. Terra cotta, Black Bldg. Supply Co., Mail Bldg. Stone Carving, Watson & Crees, 836 Yonge street.

Addition to factory, cost $5,000, 123 King E. General contractors, Witchall & Son, 163 Havelock street. Two stys., brick construction.

Warehouse, cost $60,000, 439 Wellington street west, for Victoria Paper & Twine Co., 415 King W. Architect, S. L. Yolles, 67 Baldwin street. Five stys., 50 x 210, brick construction and foundation. Old building is being razed. General contractor, architect.

Greenhouse and service building, cost $3,950, for Toronto General Hospital, College St. Builders, King Constr. Co., Dovercourt and Sudbury. Brick and steel construction, asbestos slate roofing, wire glass.

Addition to factory, cost $3,000, for The Armac Press, 42 Agnes St. General contractor, Thos. Lewis, 329 Davenport Rd. Three storeys, brick construction and foundation.

Warehouse, Bloor W., near Railway,

for R. C. Bustard, in trust, Confed. Life Bldg. Architect, J. H. Stanford, Bloor and Ossington. Mason, Hugh Walker, 32 Guelph Ave. Carpenter, F. N. Carr, 146 St. Clements. Two storeys, 90 x 30, brick construction.

Warehouse, 86-90 Chestnut St., for H. Greisman, 68 Adelaide St. E. Architects, Chadwick & Beckett, 18 Toronto St. General contractors, Consolidated Bldg. & Supply Co., 104 Temple Bldg. General contractors will sublet electrical wiring. Four storeys, 48 x 120, brick construction, brick and concrete foundation. Excavating started.

Vancouver, B.C.
Factory, 2034 11th Ave. W., for Alaska Bedding Co. General contractor, F. T. Sherborne. Four storeys, mill construction. Permit issued.

Residences

Dundas, Ont.
Two residences, cost $6,000, James St., for R. L. Biggs, West Flamboro. Architect, Thos. E. Wood, Dundas. Two storeys, brick construction. Plans prepared.

Montreal, Que.
Flats, cost $5,000, Verdun (Wellington), for Hilain Cuerrier, 206 Evelyn. Three storeys, 25 x 60, concrete foundation, brick construction. Plans in progress.

Ottawa, Ont.
Residence, cost $5,000, Brighton, for A. Slack, 282 Flora St. Brick construction, stone foundation. Plans in progress.

Regina, Sask.
Apartment block, cost $40,000, McIntyre and 12th Ave., for F. G. England, 1776 Hamilton St. 50 x 125, brick foundation and construction. Plans in progress.

St. Marys, Ont.
Three residences, cost $7,000. Architect and owner, W. J. Leslie. 1½-stys., cement block contruction, concrete foundation. Plans prepared.

St. Thomas, Ont.
Two residences, cost $6,000, East St., for E. G. Ponsford. Red pressed brick construction, concrete and stone foundation. Plans in progress.

Toronto, Ont.
Two pair residences, cost $8,000, Hounslow Heath Rd., for Wm. Salter, 9 Gillespie Ave. Owner receiving tenders for all trades. Two storeys, 36 x 46, brick construction.

60 residences, cost $2,000 each, Sparkhall and Bain, planned by Toronto Housing Co. Tenders received by owners until Sept. 5th, for masonry, carpentry, plastering and plumbing. Two stys., brick construction and foundation.

Residence, cost $5,000, for H. Seddon, 122 Brock Ave. Architect, E. R. Conlan, 73 Glendale. 2½-storeys, 24 x 30, brick construction. Plans, etc., with owner who wishes general or separate tenders at once.

Walkerville, Ont.
Six residences, cost $9,000, Kildare Rd., for Walkerville Land & Bldg Co. Architects, Stahl & Kinsey, Strathcona Bldg. Two storeys, 29 x 108, pressed brick construction, cement foundation. Tenders received by Architect until Sept. 10th.

CONTRACTS AWARDED

Fort William, Ont.
Apartment block, cost $25,000, for Chas. G. Jenkins, 711 Victoria ave. Architect, R. E. Mason. General contractor, C. E. Ward. Three storeys, 50 x 55.

Hamilton, Ont.
Residence, cost $5,000, Glenfern Ave., for J. E. Lister, 329 Queen St. S. General contractors, Schafer & Stewart, 11 Brant St. Concrete foundation, hollow tile and brick construction.

Residence, cost $3,000, Grosvenor Ave., for J. Novakowski, 30 Clinton St. General contractor, F. Koshewer, 285 Balmoral Ave. Brick construction, concrete foundation.

Montreal, Ont.
Six flats, cost $6,000, Cartier. Owner and general contractor, H. Dubois, 1550 Chabot. Three storeys, 25 x 50, concrete foundation, brick construction.

Four residences, cost $10,000, Belgrave Ave., for John & Wm. Taylor, 2072 Esplanade. Architect, S. Frappier, 2238 Park Ave. General contractors, Owners. Concrete foundation, pressed brick construction.

Residence, cost $16,000, for Carl Riordon, "Amherst House," 374 Cote des Neiges Rd. Architects, MacVicar and Heriot, 104 Union Ave. General contractor, E. B. Evans, 74 St. Denis St. Plastering, Robt. Johnstone, 479 Bleury St. Heating and plumbing, Conroy Bros., 291 Centre St. Tile, Walker Hardware Co., 252 St. James St. 2½-storeys, 23 x 34, stone foundation, brick construction.

Flats, cost $5,600, Verdun (Galt). General contractor and owner, J. O. Mamelin, 246 Church St., Verdun. Three stys., 25 x 53, concrete foundation, brick construction.

Apartment house, cost $190,000, N.W. cor. St. Mark, for P. Du Tremblay, 107 St. James St. Architect, Rene Charbonneau, 15 St. James St. General contractor, roofing, carpenter, painting, heating and plumbing, Alex MacKay, St. Martin and Dorchester. Concrete, Can. Siegwart Beam Co., 17 Place d'Armes Hill, Steel, Dom. Arch. Iron Works, 63 Dalhousie. Plastering, MacIntyre Plastering Co., 55 Latour. Ten storeys, 25 x 93, terra cotta and steel construction.

Ottawa, Ont.
Garage and alterations to residence, cost $10,000, Laurier, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Plastering, Jas. McLaughlin, Clemow St. Painting not let.

Regina, Sask.
Residence, cost $10,000. Owner and general contractor, J. W. G. Mills, 2331 Quebec street. 2½ storeys, brick construction, slate roofing. Foundations in.

Residence, cost $7,000, Montreal St. Owner and general contractor, D. A. Morrison, 2130 Broad street. Brick construction. Foundations in.

Residence, cost $25,000, Victoria ave. for T. B. Marshall. Architects, Reilly, Dawson, Hancock & Reilly, 512 Westman Chambers. General contractors, Mackenzie & Jones, Hamilton street. Brick, reinforced concrete, fireproof construction, cut limestone trim.

Residence, cost $6,000, Cameron, for F. H. Field. General contractors, McKenzie & Minshall. 2½-storeys, brick construction and foundation.

Shawbridge, Que.
Cottage, cost $14,000, for Boys' Farm, Shawbridge, Que. Architects, Barott, Blackader & Webster, New Birks Bldg., Montreal. General contractor, P. Jordan, Shawbridge. Owners intend building several cottages from time to time in Shawbridge. Two storeys and basement, 49 x 47, concrete foundation, reinforced concrete construction.

Toronto, Ont.
Addition to residence, cost $5,000. Owner and general contractor, H. F. Sanders, 162 Dunn ave. Two storeys, brick construction and foundation. Excavating started.

Two detached residences, cost $10,000, Alberta St. Owner and general contractor, R. Mowbray, 4 Howard St. Architect, J. H. Stanford, Bloor and Ossington Ave. Will sublet some trades. 2½-storeys, 25 x 36, brick construction, stone foundation.

Residence, cost $8,000, York Mills Rd., for Mrs. Chas. Catto, c/o Architects, Page & Warrington, Confed. Life Bldg. General contractor, R. G. Kirby, 539 Yonge St., will sublet some trades. 2½-storeys, brick construction, stone foundation.

Westboro, Ont.
Residence, cost $6,000, City View, for J. E. Caldwell, City View. Architect, C. P. Meredith, 126 Sparks St., Ottawa. Carpenter, J. G. Anderson, 126 Sparks St.

Winnipeg, Man.
Residence, cost $16,000, Assinaboine Ave., for Mrs. J. A. Geunell, 84 MacLaren St., Ottawa, Ont. Interested, H. Phillips, 15 Central Ave., Winnipeg. Architect, C. W. W. Chivers, Keewarden Bldg. General contractors, Stainer & Ferguson, 447 Rosedale Ave. Painting, C. D. Haines. Heating and plumbing, Frayer & Magel, 44 Adelaide. Electric, Cowan & Levy, 493 Portage. Tiling, Winnipeg Paint & Glass Co., 389 King St. 2½-storeys, frame and stone veneer construction, stone and concrete foundation.

Power Plants, Electricity and Telephones

Chingaucousy Twp., Ont.
Twp. Council has granted Shale Products Co., Inglewood, permission to erect poles for transmission line on 2nd Concession to convey electric power.

Dereham Twp., Ont.
By-law passed granting Southern Ontario Gas Co. right to lay mains in above Twp. Further information from Alex. Bell, Clerk, Verschoyle, Ont.

Medicine Hat, Alta.
Electric sub-station, cost $10,000, planned by City Council. City Engineer, A. K. Grimmer. General contractors, Sackrider & Turner Co., Main and Railway streets. One storey, brick construction.

Montreal, Que.
Electric lighting system, cost $2,542, planned by Board of Commissioners. Sec., L. N. Senecal. Electric, Sayer Elec. Co., 87 Bleury St.

Ottawa, Ont.
Tenders received by Chairman, Mayor, J. A. Ellis, till Sept. 10th for 95 ornamental iron posts with 475 spring suspension sockets and fittings, each post to carry 4 invester lamps with 1 upright lamp, same design as used on Bank and Queen Sts. Engineer, Supt. Brown, City Hall. Specifications at office of Supt.

Port Hope, Ont.
Extension to electric power system, cost $10,000, planned by the Seymour Power Co.; have been granted ten year franchise.

Strassburg, Sask.
Electric power house. Sec.-Treas., S. L. A. Smith. Con. Engineer, R. L. Biggs, of Winnipeg Engineering Co. General contractors, James & McKay, Semans, Sask. Contract for 1 Ruston Proctor 50 h.p. engine let to the British Canadian Engineering & Supply Co., Ltd., Phoenix St., Winnipeg. Contract for electric apparatus, poles, line, etc., let to the Canadian General Electric Co., Ltd.

Winnipeg, Man.
Generators, cost $103,800. Engineer, J. G. Glassco, 54 King street. General contractors, Canadian Westinghouse Company, Ltd., Portage ave. east., for the manufacture, delivery and installation of generators for the extension of power plant at Point du Bois.

Yorkton, Sask.
Telephone exchange, cost $18,000, planned by Dept. of Railways & Telephones, Regina. Minister, Hon, J. A. Calder, Regina. General contractors, Logan & Black. Heating and plumbing, Parrott & Byers, 4th St. Three storeys.

Miscellaneous

Deep River Islet, Ont.
Lighthouse tower, Renfrew County, planned by Dom. Govt., Dept. of Marine and Fisheries. Deputy Minister, A. Johnston. For construction of wooden lighthouse tower. Plans, specifications, etc., at offices of Dept., Ottawa and Post Offices at Pembroke, Fort William, Fort Coulonge, Chapeau and Cobden. Tenders received by Deputy Minister until Sept. 8th.

Ft. William, Ont.
Addition to car barns, cost $40,000, Walsh. Mayor, R. Graham. General contractor, P. J. Donohue, Room 1 Cameron Block, Mary St. One storey, 270 x 28, brick construction, cement foundation.

Galt, Ont.
Retaining wall planned by town council. Clerk, James McCartney. To be erected on west side of river.

Hamilton, Ont.
Addition to store, cost $5,000, King E., for Walter Howell, Emerald and King Sts. Architects, Malls & Hutton, Bank of Hamilton Bldg. General contractors, Hogan & Farr, 15 Fairholt Ave. Carpenter, Haste & Milne, c/o General Contractor. Painting, W. J. Robertson, 33 Erie Ave. Plumbing, Adam Clark, 7 Main St. W. Two storeys, stone foundation, brick construction.

Humboldt, Sask.
A new public school has been recommended for the town. To cost about $65,000.

London, Ont.
Addition to cold storage building, cost $15,000, for London Cold Storage Co. Manager, M. Mausuret. General contractors, Jno. Hayman & Sons. Two storeys, 100 x 58, white brick construction, stone and concrete foundation.

Garage and warehouse, cost $20,000, for F. G. Mitchell, c/o London Engine Supplies Co. Architects, McBride & Fairfield, Edge Block. Two storeys, white brick construction, stone and concrete foundation. Plans in progress.

Maccan, N.S.
Reinforced concrete dam, cost $11,000, for The Maritime Coal, Railway & Power Co. General contractors, The Ambersen Hydraulic Constr. Co., Ltd., New Birks Bldg., Montreal, Que. 200 ft. long, 20 ft. high. To be used for water supply purposes.

Medicine Hat, Alta.
Stores, cost $10,000, 6th Ave. and Balmoral St., planned for C. J. Hall, Real Estate, Toronto St. Architects, Bourne & Morrison, Huckvale Block. One sty., 80 x 130, red brick and stone construction, cement foundation, store fronts and fixtures. No contracts awarded yet.

Merritt, B.C.
Armory, planned by Dom. Govt., Dept. of Militia and Defence. Secretary, E. J. Jarvis. Plans, etc., at offices of District Officer Commanding Military District No. 11 Victoria, and at Director-General of Engineer Services, Ottawa. Tenders received till Sept. 11th at Dept., Ottawa.

Montreal, Que.
Alterations to moving picture theatre, cost $5,000, St. Lawrence, for Societe St. Jean Baptiste, 296 St. Lawrence. Architect, Eng. Payette, 103 St. Francois Xavier St. General contractor, B. Sauve, 482 Colonial. Stores are to be altered to moving picture theatre. Five storeys, 160 x 115, concrete and stone foundation, felt and gravel roofing.

Ottawa, Ont.
Ice breaker required by Dom. Govt., Dept. of Marine & Fisheries. Sec. and Deputy Minister, A. Johnston. 275 ft. long, 57 ft. wide, 32 ft. deep. Draught 20 ft., 9,000 h.p. To operate between Montreal and Quebec. Tenders to be called.

Additions to city hall, Elgin St., planned. Mayor, J. A. Ellis. Architect not chosen. Two wings are contemplated to be erected. Four storeys.

Stores and offices, cost $110,000, Queen street, for Bryson Realty Co., Queen St. Architect, A. L. Weeks, 75 Sparks St. General contractor, mason and carpenter, Alex. Garvock, Lewis St. Heating and plumbing, M. M. O'Connell, Gloucester St.

Residence, cost $5,000, Cameron St. Architect and general contractor, Sam J. Lucy, 1147 Bank St. 2½-storeys, 24 x 23, brick construction, stone foundation. Excavating started.

Residence, cost $6,000, Woodlawn, for Andrew McArthur, 26 Woodlawn Ave. Solid brick construction, stone and concrete foundation. Plans in progress.

Seaforth, Ont.
Barracks, cost $7,000, for Salvation Army. Major, F. Morris, Clarence St., London. Architect, Major Miller, Toronto. Two storeys, white brick construction.

Stratford, Ont.
Improvement to sewage disposal plant planned by City Council. Mayor, C. N. Greenwood. Clerk, R. R. Long. Engineer, A. B. Manson, City Hall. Plans and specifications at office of Engineer. One Humus bed, chlorination devise, new sedimentation tank and auxiliary gas engine.

Factory, cost $35,000, Douro, for Farquharson-Gifford Co., Douro St. Architect, J. S. Russell, 21 Douro St. General contractor, mason, carpenter and steel, J. L. Yongs, 240 Birmingham St. Painting, G. L. Money. Plumbing, Peter & Sylvester. Roofing and electrical not let yet.

Toronto, Ont.
Two passenger lake steamers contemplated by C. N. O. Ry., head office, Toronto. General manager, M. H. MacLeod, Winnipeg. Probable contractors, Western Dry Dock & Shipbuilding Co., Ltd., Port Arthur.

Winnipeg, Man.
Lead covered cable, cost $4,613. Engineer, J. M. Glassco, 54 King St. General contractors, Imperial Wire & Cable Co. Board of Control, Secretary, M. Peterson.

New Companies

The Westport Rural Telephone Company, Ltd., has been incorporated with a capital of $7,000, to carry on business as a general telephone company, with head office at Westport. The provisional directors are W. S. Ripley, insurance agent, J. F. McNally, and M. E. Mulvill, general merchants, all of Westport.

Model Homes, Limited, incorporated with a capital of $40,000, to carry on business as a general land and building company, with head office at St. Catharines. The provisional directors are W. A. Notman, R. L. Notman, and H. C. Babel, all of Buffalo.

Ormeau Park Land Company, Ltd., has been incorporated with a capital of $40,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are John Ferguson, builder, J. W. Payne, barrister and S. A. Keers, broker, all of Toronto.

Cartier Realty Limited, incorporated with a capital of $50,000, to carry on business as a building company and dealers in building material, with head office at Ottawa. The provisional directors are J. R. Touchette, J. F. H. Laperriere and Hector Laperriere, all accountants, of Ottawa.

Zebrun and Baben Construction Company, Limited, has been incorporated with a capital of $50,000 to carry on a

Tenders and For Sale Department

NOTICE

Extension of Time

Town of Neepawa, Manitoba

Tenders for Machinery

Sealed tenders will be received up to noon, **Friday, Sept. 12, 1913**, for machinery for additions to the power plant at Neepawa, as follows:—

Specification Section No. 1—Two 72-in. x 18-ft. Boilers.

Specification Section No. 2—One 187½ h.p. Engine.

Specification Section No. 3—One 150 k.v.a. Generator, Switchboard, etc.

Specifications may be seen at the offices of the Electrical News, or obtained from W. F. Skinner, Limited, 204 Sterling Bank Bldg., Winnipeg, or from the undersigned:

J. W. BRADLEY, Sec.-Treas.,
Neepawa, Man.

35

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension and Repairs to Revetment Wall at Meaford, Ont.," will be received at this office until 4 p.m. on **Monday, September 29, 1913**, for the construction of an Extension and repairs to the Revetment Wall at Meaford, Grey County, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Meaford, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46238. 36-37

Town of Goderich

Tenders For

Cement Concrete Walks

TO CONTRACTORS

The Municipal Council of the Town of Goderich invite tenders for the construction of approximately 14,500 square feet of cement concrete sidewalk on Nelson, Park and Wellesley Streets and Britannia Road in the Town.

Specifications can be seen and full information can be obtained on application to the Engineer in charge, J. Ades Fowler, C.E., or from the undersigned.

Tenders in sealed covers marked "Tender for Cement Walks," and accompanied by a marked cheque for 5 per cent. of their amount will be received up to and including **Thursday, September 11th, 1913**, addressed to

L. L. KNOX, Town Clerk,
Goderich, Ont.

Neither the lowest or any tender will necessarily be accepted. 36

Sealed tenders addressed to the undersigned and endorsed "Tender for Interior Fittings, Post Office, Port Arthur, Ont.," will be received until 4 p.m. on **Thursday, September 18, 1913**, for the work mentioned.

Tenders will not be considered unless made upon forms furnished by Department, and in accordance with conditions contained therein.

Plans and specifications to be seen on application to Mr. D. McKenzie, Caretaker, Port Arthur, Ont.; Mr. T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
—47186. Ottawa, August 30, 1913. 36

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913**, by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
32-37 Cayuga, Ont.

Some Good Machines

Buckeye Trenching Machine, 12 in. x 4½ ft, A1 ... ... $700

Buckeye Trenching Machine, 27 in. x 8 ft.; just through shops; as good as new $2,500

Parsons Trenching Machine, 2 ft. x 5 ft. to 20 ft. deep. A1 ... ... $3,500

Thew No. 0 Steam Shovel. Overhauled by Thew Manufacturers last year. A1 ... ... $2,800

TRACTION ENGINE

Located in Canada, 30 H.P.

undermounted, double Avery machine, coal burner with rear mounted Steel Water Tank. Also an Avery Steel Water Tank on truck with pump. Cost, new, $3,575. This is in first-class condition $1,800

WHAT DO YOU NEED IN SECOND-HAND EQUIPMENT?

TRY US!

WILLIS SHAW MACHINERY CO.

La Salle Street, Chicago, Ill.

Proposed Government Buildings

OTTAWA, ONTARIO

Architects are invited to submit sketch designs in a preliminary competition for the erection of Departmental and Courts Buildings.

From the designs submitted in this preliminary competition, six will be chosen by the Assessors, the authors of which will be invited to submit more matured designs in a final competition, for which the five unsuccessful competitors shall each receive an honorarium of Three Thousand Dollars ($3,000).

The author of the design placed first by the Assessors will be entrusted with the work which the Government intends carrying out at once.

The competition is limited to British subjects practising in the British Empire.

The Government has appointed Mr. T. E. Collcutt, Mr. J. H. G. Russell, and Mr. J. O. Marchand, as Assessors to act in its behalf.

The design in the first competition must be delivered in Ottawa (carriage paid) not later than 12 o'clock noon, 2nd January, 1914, addressed to the undersigned.

Conditions for both competitions may be had on application to the undersigned, and at the office of the High Commissioner for Canada, 17 Victoria Street, London, England.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 18, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44890. 36-37

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Board of Education

Sealed tenders, whole- or separate, addressed to the Secretary-treasurer of the Board, will be received until

Friday Noon, Sept. 12th, 1913

for the several trades required for the

Enlargement of

Shirley Street School and Parkdale School

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-treasurer at his office in the City Hall not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.
W. C. WILKINSON,
Secretary-Treasurer.

36

New Companies

(Continued from page 75)

general contracting and constructing business, with head office at Toronto. The provisional directors are Leo. Macaulay, J. E. Anderson, law students, and R. D. Moorhead, solicitor, all of Toronto.

Eglinton Park, Limited, has been incorporated with a capital of $150,000 to carry on business as a land and building company, with head office at Toronto. The provisional directors are H. R. Moses, law student, C. W. O. Goshorn, G. D. Waters, cashiers, all of Toronto.

Newcastles, Limited, incorporated with a capital of $200,000 to carry on a general land and building business, with head office at Toronto. The provisional directors are G. D. Waters, C. W. O. Goshorn, cashiers, and J. J. Flint, accountant, all of Toronto.

Goodwin Park, Limited, has been incorporated with a capital of $40,000 to carry on business as a general land and building company, with head office at Hamilton. The provisional directors are G. W. Tinlin, F. H. Jory, fruit growers, and G. A. Tinlin, farmer, all of the township of Clinton.

Emil Anderson Company, Limited, incorporated with a capital of $200,000, to erect buildings and deal in building material, with head office at Fort William. The provisional directors are Louise Kreutzinger and Matilda Kreutzinger, of Palmerston, Ont.

Exmoor Realty Company, Limited, has been incorporated with a capital of $150,000, to carry on business as a general land and building company, with head office at Toronto. The provisional didectors are L. F. Black, H. A. Hall, accountants, and G. D. Waters, cashier, all of Toronto.

Business Notes

Goderich, Ont.
Furniture factory, owned by The Kensington Furniture Co., burned. Loss, $40,000. Manager, J. A. Rumball. Will likely rebuild.

Jarvis, Ont.
Freight sheds owned by Grand Trunk Railway Co., burned.

Kincardine, Ont.
Stables and barns of John McIntyre burned. New buildings to be erected at cost of $3,500, basement of cement or stone, concrete floors.

Lennoxville, Que.
Residences owned by Mrs. Geo. Reed, S. A. and R. C. McFaden, burned; loss about $10,000.

London, Ont.
Exhibition buildings owned by Western Fair Board, burned. Secretary, A. M. Hunt. Machinery Hall, Transportation Bldg., W.C.T.U. Dining Hall, and main horse stable destroyed. Loss $100,000.

Mayfield, Sask.
Implement warehouse owned by White Bros., burned, loss $2,500. E. B. McKay, general store, $4,000.

Montreal, Que.
Cooper shop of John Paxton & Co., Drolet street, burned, loss $8,000. Machinery destroyed.

Melville, Sask.
Barn and residence, owned by T. Mazarch, burned; loss $6,000.

Revelstoke, B.C.
The West Kootenay Steam Laundry destroyed by fire. Loss, $16,600. Insurance, $5,000.

Sault Ste. Marie, Ont.
Power plant of Lake Superior Corporation partly destroyed by fire. Loss heavy.

Ste. Agathe, Que.
Saw mills, owned by The Ste. Agathe Des Monts Saw Mill Co., burned. Loss, $20,000, some insurance. Will rebuild. Chevalier & Co., loss, $15,000 to $20,000. Will rebuild.

Ville Marie, Que.
Store, owned by Bergeron & Freres, destroyed by fire. Loss, $8,000. Company will rebuild. Stock of implements, carriages, etc., destroyed.

Unclassified Items

Ottawa, Ont.
Water pipe material required in connection with the relaying of 40-in. steel water pipe. Steel expansion joints, corrugated steel sleeves, plain steel sleeves, steel flanges, gaskets, bolts, nuts, rivets, etc. Tenders received by Chairman Waterworks until September 6th. Engineer, Arch. Currie.

Swift Current, Sask.
Water works, cost $88,000, planned by Town Council. Mayor, I. E. Argue. Sec.-treas., Geo. D. Arnott. By-law to be submitted to ratepayers on Sept. 8th.

Regina, Sask.
Concrete sidewalks, cost $85,000, planned by City Council. City Engineer, F. McArthur. General contractors, Western Pavers Ltd. 500,000 sq. ft. sidewalks; 10,000 sq. ft. concrete crossings.

Toronto, Ont.
Sewers planned by Board of Control. Mayor, H. C. Hocken. Commissioner of Works, R. C. Harris. East Toronto Section "A" Outlet awarded to Commissioner of Works, $86,000. General contract, Balsam ave., Queen to Kingston Rd., to J. H. McKnight Construction Co., 88 St. David street, $45,900; Woodbine ave., to McLaughlin Bros., $6,490.

St. John, N.B.
Wharf, cost $9,800, East side Ferry Slip. Commissioner, H. B. Schofield. General contractors, Robert Roberts & Sons, 52 Cunard street.

Swift Current, Sask.
Fire Hall, cost $28,000, contemplated. Mayor, I. E. Argue. Sec.-treas., Geo. D. Arnott. By-law will be submitted to ratepayers on Sept. 8th.

Berlin, Ont.
St. Paul's School, cost $4,000, Church street. Architect, C. Knechtel. Plumbing, Hollinger & Durst, Frederick St.

Fort William, Ont.
Addition to Orphanage, cost $25,000, Franklyn, planned by Roman Catholic Denomination. Architect, H. R. Halton, Shanley Block. General contractors, C.

AGENTS WANTED

High Class Artificial Stone Company requires agents in every city to sell building stone, ornamental work, pipes, roof and floor tiles, etc. Liberal commission allowed. Address C. P. c/o "Contract Record," Toronto. 36-37-38

Mathieu. Masonry, Striu Bros. 3½ storeys, 50 x 100, Foundations in.

Brockville, Ont.
Theatre, cost $20,000, for John McLennan. Architect, A. Stuart Allister. Electrical work, A. G. Dobbie & Co.

Hamilton, Ont.
School, cost $136,000, Cannon St. E. Secretary, R. H. Foster. Architect, A. W. Peene, Clyde Block. General contractor, W. H. Yeates, 24 Leeming St.

Winnipeg, Man.
Church, cost $50,000, Cathedral ave., for St. John's Presbyterian Church. Pastor, Rev. J. P. Jones, Bannerman ave. Architect, R. L. Smith, Somerset Bldg. General contractors, Fraser & McDonald, 510 Gertrude ave. For basement only. Remainder of work will be done next year.

East Oakland, Ont.
Cattle and implement buildings, cost $5,000, for Wm. Harkness, West River Rd., Galt P.O. Fireproof construction, stone and concrete foundation, galvanized iron, metal shingle on asbestos roofing. Plans in progress.

Kinloss, Ont.
Cattle buildings, cost $3,000, for Alex. McKenzie, Kinloss, Lucknow P.O. Fireproof construction and concrete foundation. Plans in progress.

Montreal, Que.
Alterations and addition to Molsons Brewery, 906 Notre Dame E., planned. Architect, Mr. Hetlinger, c/o Molsons Brewery. Tenders called by architect for painting and glazing of bottling and beer department.

Toronto, Ont.
Dry kiln, cost $3,000, King and Bathurst, for Otto Higel Co., King and Bathurst. Architects, G. M. Miller & Co., 93 Yonge street. Tenders received by owners. One storey, brick and reinforced concrete construction, concrete foundation.

Hamilton, Ont.
Store, cost $2,500, Balmoral avenue. Owner and general contractor, Wm. Addy, 1 Cedar ave. Brick construction, concrete foundation.

Alterations to hotel, cost $12,000, for Staunton Bros., Revere House, King St. E. Architect, A. W. Peene, King St. W. Roofing, Dennis & Jocelyn, 13 Walnut St. S.

Toronto, Ont.
Garage and storage, cost $2,500, Esplanade. Owner and general contractor, Elias Rogers Co., 28 King St. W. Two storeys, 22 x 46, frame and galvanized iron construction, concrete foundation, felt and gravel roofing, electric lighting.

Vanvouver, B.C.
Can factory, cost $75,000, Railway St., for the American Can Co. General contractors, J. Carver & Sons, 305 Duncan Bldg. Three storeys, brick and mill construction.

Winnipeg, Man.
Bank building, cost $15,000, Main St. N., for Merchants Bank of Canada. Architects, J. D. Atchison & Co., Union Bank Bldg. General contractors, G. A. Fuller & Co., Union Bank Building. Steel, Manitoba Bridge & Iron Works. Roofing, A. B. Ormsby & Co. Painting, R. Crawford. Electrical work, Shipman Elec. Co. Ltd. Interior fittings, Scott Graff Lumber Co., Duluth, Minn. Heating and plumbing not let yet. 2½ stys., 31 x 64.

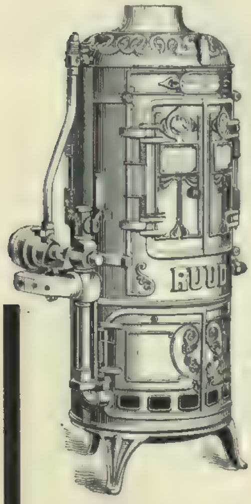
Hamilton, Ont.
Six residences, cost $12,000, Belmont ave., for A. Hines, 21 Barton Street W. Tenders received by architect, J. D. Corrigan, 231 Catherine N. Brick construction, cement foundation.

Montreal, Que.
Residence, cost $4,000, Lachine, 45th street, planned for Mrs. Nap. Vallee, Coteau du Lac. Two storeys, 28 x 38, cement foundation, pressed brick construction.

Halifax, N.S.
Residence, cost $5,000, LeMarchant, for David Gray, LeMarchant St. General contractor, masonry and carpentry, Watson Gray, 60½ LeMarchant St. 2-storeys, 50 x 25, cement foundation, frame construction.

Hamilton, Ont.
Apartment house, cost $18,000, Sherman ave., for P. G. Colvin. General contractors, Sparks & McKay, 133 Cannon St. E.

Montreal, Que.
Residence, cost $4,000, Lachine, 11th street. Owner and builder, T. Legault, 138 11th ave. Three storeys, 40 x 50, stone foundation, pressed brick construction. Excavating started.



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1 Floating Derrick
Hull B.C. Fir 80' x 30' 7"
Hoisting Engines, 10 x 12
Swinging Engines, 6½ x 8
Boiler, Fitzgibbon marine, Cap. 120 lbs.
Boom, steel, 90 ft. long, in 4 sections
Spuds, front 20" x 20" x 45'
" back 16" x 16" x 45'
Spuds are raised by friction hoists
Accommodation for full working crew
also
2 Flat Scow, 110' x 27' x 8'
1 Flat Scow, 107' x 23' x 8'
1 Steam Barge, 200 ton capacity
1 No. 2 Thew Shovel
1 45-ton Bucyrus Shovel } in use
1 18-ton Vulcan Dinkey } 4 months
20 4-yard 2 way Dump Cars, 36" gage

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706 Power Bldg., MONTREAL

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are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

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and HYDRANTS**
exclusive output.

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"Sirocco" Ventilating Fan

TRADE MARK.

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A "Sirocco" Fan will deliver twice as much air as the ordinary steel plate fan of the same wheel diameter. Save one-half the space and one-third the power.

"Sirocco" Fans and Blowers are made in sizes to deliver from 75 cubic feet per minute to 1,000,000 cubic feet per minute.

Our Engineering Department will gladly co-operate with you in the selection of the proper equipment for YOUR needs.

Let us tender on your next requirements. Bulletin No. 3401 is descriptive of the construction and operation of "Sirocco" Fans. You should have a copy.

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 40	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's ...... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

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Pure White Lead, ground in oil, $9.00 per 100 lbs.

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Turpentine, in barrels, 60c per gallon.

Pure Red Lead, dry $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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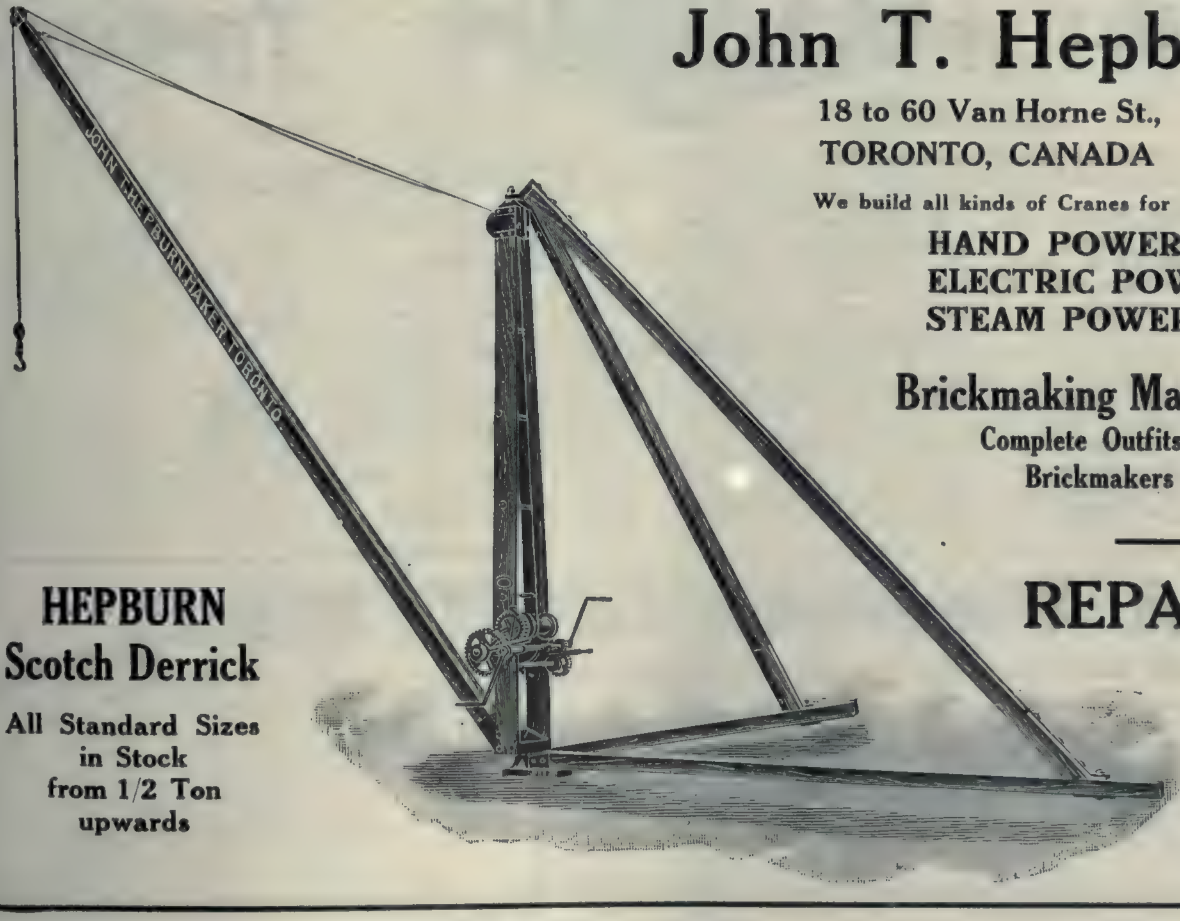
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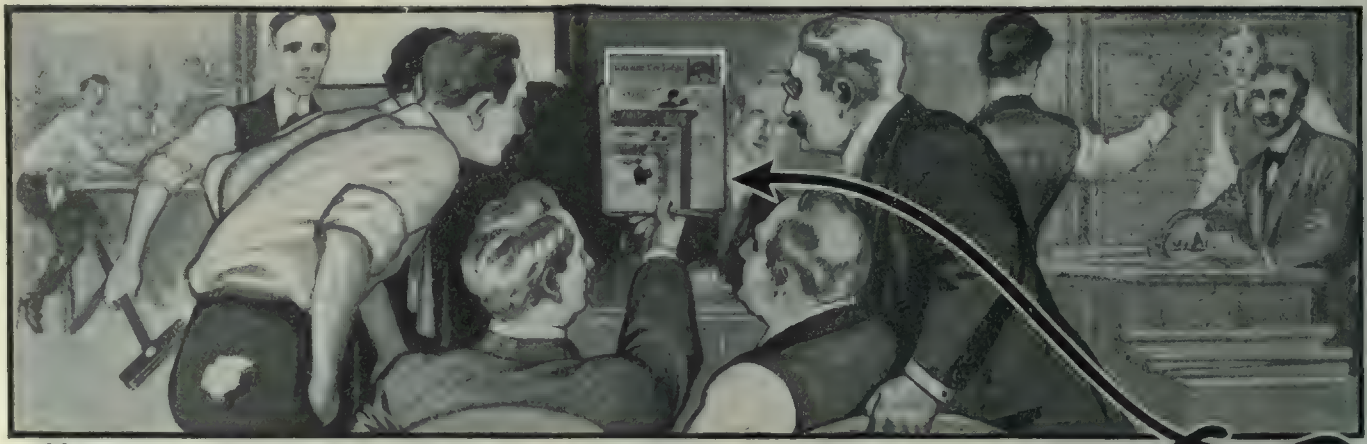

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TRADE MARK

paste has "All of the Good Points and None of the Bad"—for **Basements**—sub-basements, tunnels, dams, reservoirs, swimming pools, walls, bridges, concrete roofs, cement stucco for exterior finishes, etc. **Because it is—**

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2. **Pressure Proof.** Withstands any amount of hydro-static pressure.
3. **Disintegration Proof.** Makes concrete immune from alkali, frost, etc.
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5. **Retains Original Strength** of Concrete.
6. **Absolutely Odorless.**
7. **No Discoloration whatever.**
8. Most Economical. Because it requires **No Expert Labor** to mix properly.

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Book No. 4—Mr. Owner gives testimonials from many nations—telling how Ceresit solves construction problems.

Book No. 5—Mr. Demonstrator shows how to prove the case for yourself. No other manufacturer has ever made such an offer.

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The effect of "Medusa" Waterproofing is everlasting and its permanent quality is due to its being absolutely insoluble and unaffected by water even after years of contact.

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Sun Bricks

Heavy Hard Burned Red
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Stock Face **Inside Gray**
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ESTABLISHED 1886
Contract Record
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Alphabetical Index of Advertisers
Page 16

Vol. 27 **September 10, 1913** **No. 37**

Contractors' Methods on Railroad Construction

IN another part of this issue appears an article on methods contractors should follow in beginning a railroad construction contract. The writer of the article (Mr. D. J. Hauer, in The Contractor) also points out that the experience gained in railroad construction work is so broadening that the training thus gained will enable a contractor to handle many other classes of construction work. In handling the subject, the importance of starting right is emphasized, and in emphasizing them the difficulties of the contracting profession are brought out. The keynote is that a man must so arrange his work that he can make money from the start, which involves management and business capacity of a high order. Getting things started right is both an art and a science and is one of the big fundamentals of life. It means initiative, nerve and knowledge. The advice given in this article is of a nature which has been bought by many years of experience, and its patent logic should be heeded. Many contractors make great promises and many motions, but often find their work in poor shape, not possessing sufficient generalship to handle it efficiently. This can be overcome by close observation.

Another subject touched on is the rather hackneyed problem of harmony between the engineer and the contractor. By use of some tact, many contractors are able to get what they want from the engineer by way of stakes and plans, so that their work is not held up in any way, as harmony is a big factor for the successful prosecution of any kind of work. The history of construction unfortunately shows that many contractors have not paid sufficient attention to the all important subject of starting their work right, and it would be well and profitable for many to give more consideration to this subject. They should keep posted on methods of doing work and should know of the development which is going on in the machinery and equipment used for carrying on work. The old days have passed when contractors could make big profits by a fairly good guess, and contracting, due to competition, is beginning to be an exact science.

Waste in Bidding

MOST of our economic waste is due to a lack of a definite knowledge of costs. For instance, in a building project where seven or eight contractors, all of the same general class are called in to submit proposals on the work, there will be a difference of 30 per cent. between the highest and lowest proposal—all of which means that costs in this industry are largely a matter of opinion.

With costs only as a matter of opinion, the building public has no confidence that one man's judgment represents the lowest market price, so a group of men are called in to spend their time and money in making an estimate, and with no reward—only the hope of reward. All this is wasted effort with them all, save the successful bidder.

Very few people realize what it costs to make estimates on bidding projects, even though the basis of an estimate is not a matter of definite knowledge. Take a court house or city hall, say one costing a million dollars, exclusive of the heating, plumbing and decorations. It will cost each general contractor who submits a proposal $1,000 in travelling expenses and the labor of estimators. Say there are eight contractors figuring on the work. This means that through a lack of confidence, which has been created in the public mind by a lack of definite knowledge, a debt of $8,000 has been accumulated, which society, somewhere, somehow, must pay.

With smaller building projects the cost of making estimates is very much higher in percentage, double in some cases, and when we consider all the estimating of all the building in a year, the amount expended in both money and effort, in order that the owner may know the lowest market price, is a gigantic total and a frightful economic waste.

It has only been within the last few years that there has been any organized effort among building contractors to determine absolutely costs in the detailed operations of building, and with the same certainty and accuracy that the typewriter, adding machine, automobile, and low-price watch manufacturers know their detailed costs. This organized effort for cost finding has only been with the very large contracting organizations, and is of little value because they have the unfair competition of those who do not know their costs.

The average contractor in the average city has no definite knowledge of the cost of a cubic foot of brick work, a square of floor, a yard of plastering or the average cost of putting on inside trim, fitting such and hanging doors. The average knowledge of building costs is inherited—the present generation got their present basis of prices from their fathers or their former employers under whom they learned their trade. These prices have been increased in percentages from time to time as material and labor prices have increased, but no doubt the original basis of them was wrong.

The average contractor's bookkeeping, together with his cost keeping, is so indefinite that he does not know until a contract is completed or until the end of the year, or until he goes out of business, or dies, whether he has made any money or not. He may make money on one operation and lose it on another, or on one contract and lose it on another; he gets too much for one operation or one contract and not enough for another.

Then comes the moral effect of a lack of definite knowledge of costs. The shrewd owner finds that costs are a matter of opinion, and he at once undertakes to change that opinion by applying horse-buyer methods in order to get his building as cheap as possible; the contractor in turn takes this as a moral license to "trim" the owner at every point, even to the extent of slighting the work. The owner comes back with bonds, forfeitures and iron-clad contracts, all of which are childish, for no one can make a man do good work if he hasn't the free will with a profit as an incentive to good work. The building contractor has not made money in the same sense as other industries involving the same skill, responsibility and capital.

The solution of this evil is in very simple local organizations of contractors, not to control prices, but for the purpose of educating each other to costs. Price will take care of itself naturally if each knows his cost; for it isn't natural for a man to sell less than cost if he knows it. It is just the difference between knowledge and ignorance, efficiency and obstruction.

Red-Letter Contracts

IT cannot be but a source of gratification to those of a peculiarly patriotic temperament that in face of close competition with a number of the largest contracting concerns in the world, the Canadian Stewart Company of Montreal obtained a contract for nearly thirty-one million cubic yards of dredging from the Toronto Harbour Commissioners at a cost of five and a half million dollars. The work will be commenced next March and will take eight years to complete. An interesting feature of the contract is that the successful tenderers will have to construct two new dredges, which will be among the largest in the world. It will be recalled that the total amount to be spent on the Toronto harbour development is between nineteen and twenty million dollars and that the whole work will extend over ten years.

The Canadian Stewart Company already holds a contract for part of the harbour works, it having been the successful tenderer on an important section of the construction to be done on behalf of the Harbour Commissioners at the city's expense. Other large works in Toronto now being carried on by the Stewarts are the new Dominion Bank Building, at King and Yonge streets, the Canadian Pacific freight sheds on King street west, and the new Government House in North Rosedale. The Stewart brothers, partners in this concern, have offices in many cities, but are Canadians by birth.

* * *

THE award of a ten-million dollar contract for the new Welland canal to Messrs. O'Brien & Doheny will undoubtedly awaken interest in this section of the country and cause a fair-sized boom in a number of towns situated in the canal zone. It is of interest to note that the deposits put up on this work amounted to nearly half the total estimated cost. Ten tenders were received and each tender was accompanied by a deposit of $400,000. The successful contractors will make their headquarters at Thorold and will start work immediately. It is a condition of the contract that the work be completed by April, 1917.

Comparative Statistics for Municipalities

RATHER a good suggestion was made by Mr. Geo. H. Lees, Mayor of Hamilton, at a recent meeting of the Ontario Municipal Association in Toronto. Mr. Lees suggested that a considerable saving would be effected by municipalities if they were to pay more attention to the preparation of comparative statistics. The end in view would be to show every detail of cost in construction, maintenance and operation, and to enable one municipality to profit by the experience of the other.

In order to make this work really worth while, it would be necessary to have a government branch to act in a supervisory capacity. The whole scheme would entail a great deal of extra work and much re-organization, but carried out on the thorough lines which Mr. Lees evidently has in view, undoubtedly the scheme would redound to the advantage of the community at large. Mr. Lees knows of a large city in the Western States which saved $15,000 a year in its Fire Department by putting into effect an efficient accounting system. Possibly some attention to this department of municipal enterprise in Canada would be productive of interesting results. Every year a considerable amount of experimental work is carried out by the municipal authorities throughout the country. Much of this is costly and is ultimately proven to be of little value. If, then, the statistical plan which Mr. Lees has in mind will reduce the sum total of experimental work and give a clean-cut finish to our accounting systems, much as we dislike statistics, we say that it should be hailed with acclamation.

Below we quote verbatim from Mr. Lees' address:

"The efficiency of any government or management can only be judged by comparison. The immense value of comparative statistics is now well known in large business enterprises and I am satisfied that it would be an equally efficient instrument for supplying the information required for the intelligent and satisfactory administration of public affairs, and with a view to promoting a more efficient and economical administration of municipal affairs. I would recommend that the Ontario Government—or better still, the Dominion Government—be petitioned to appoint a properly qualified commission to devise a system of accounting to be used uniformly by all municipalities, requiring each to furnish regularly to the government such information as would enable them to compile and annually publish comparative statistics of the cost of constructing the different works, operating the various municipal services, the costs of civic government and other physical and general statistics of each municipality.

"These comparative statistics should contain among other things the total and per capita costs of government; costs of maintaining public services, police and fire departments, lighting, waterworks, street cleaning, scavenging, schools, hospitals, vital statistics, health conservation, etc.; the cost per foot, square yard, or other standard unit of constructing pavements, sidewalks, sewers, water mains, etc.; the total and per capita revenue obtained from each source. These statistics should be arranged for the convenient comparison of one municipality with another, and each with its own previous records. Such publications would become measures not only of municipal economy and efficiency, but of fiscal fidelity and honesty."

Calgary's Bad Example

MEMBERS of the Builders' Exchange at Calgary recently petitioned the city commissioners to institute the practice of calling for tenders for all work costing five hundred dollars or more. They suggested that the city engineer should tender at the same time and that if his tender were the lowest he should carry out the work. One would think this a very fair argument, but according to our information the matter received scant treatment at the hands of the commissioners, who thought that the local contracting community had received all the consideration to which they were entitled.

If this is the kind of thing to be expected under the commission form of government it would appear to be a strong argument against it. In making their representations Calgary contractors were reviving an argument that must be a most familiar one to readers of the Contract Record. The administrators of municipal affairs should have no authority to spend public moneys without competition. Lack of adequate restriction on this score has brought about many abuses the practice of which has left a stain upon the reputation of several of our larger cities.

Contracts involving the expenditure of $500 provide a fair margin of profit. In all such cases competition is essential.

C. N. R. to Spend Millions

SIR William Mackenzie, president of the Canadian Northern Railway, has secured the money necessary for the fulfilment of the C. N. R. Pacific coast terminal plans, and they are to be proceeded with without delay. Sir William stated last week that of the capital he had secured in London—an issue of $2,000,000 of 4½ per cent. terminal bonds, and an issue of $7,500,000 of five per cent. five-year notes—a large portion would be used immediately for western terminal development and the remainder for the building of an extension of the C. N. R. lines in Western Canada. Included in the C. N. R. Pacific coast plans are large yards and shops to be erected at Port Mann; terminal stations, etc., at Victoria and New Westminster, and at the city of Vancouver a project which involves an expenditure of $10,000,000, and which will take five years to carry out.

Montreal's Excellent Record

UPON more than one occasion this season, commenting editorially upon trade conditions and prospects, we have asserted that in spite of the alleged tightness of money it was not difficult to finance sound constructional undertakings; that speculative enterprises alone found it difficult to obtain backers. No better exemplification of the truth of such statements can be found than in the report of building operations in the city of Montreal. The total rolled up by the eastern metropolis during the eight months ending August 1 was $13,816,622, compared with $11,179,376 for the corresponding period of 1912.

The most conservative business man will admit that such an increase—some two and three quarter million dollars in less than eight months—is significant. It is estimated that the building permits of Montreal proper for 1913 will represent the expenditure of twenty-three or twenty-four million dollars. If the returns of the various suburbs were included the total would be augmented by about twelve million dollars. This gives a sum total of thirty-five million dollars—an impressive figure even in this day when we in Canada have become accustomed to many ciphers in statistics.

Building Inspector Chausse—guide, philosopher and friend to all those who are interested in the promotion of building enterprise in Montreal—is most optimistic concerning the outlook for 1914. When Mr. Chausse takes the responsibility of saying that prospects were never brighter it is fair to look for big things from Montreal during 1914.

Wanted—Work

The following verses appeared in a recent number of Colliers. They were written by Berton Braley, the official poet of the construction field:

Here we are, gentlemen; here's the whole gang of us,
Pretty near through with the job we are on;
Size up our work—it will give you the hang of us—
South to Balboa and north to Colon.
Yes, the canal is our letter of reference;
Look at Culebra and glance at Gatun;
What can we do for you—got any preference,
Wireless to Saturn or bridge to the moon?

Don't send us back to a life that is flat again,
We who have shattered a continent's spine;
Office work—Lord, but we couldn't do that again!
Haven't you something that's more in our line?
Got any river they say isn't crossable?
Got any mountain that can't be cut through?
We specialize in the wholly impossible,
Doing things "nobody ever could do."

Take a good look at the whole husky crew of us,
Engineers, doctors, and steam shovel men;
Taken together you'll find quite a few of us
Soon to be ready for trouble again.
Bronzed by the tropical sun that is blistery,
Chockful of energy, vigor and tang,
Trained by a task that's the biggest in history,
Who has a job for this Panama gang?

How to Start on a Railroad Contract

Practical Discussion of Methods to Follow Throughout—Success Dependent Largely Upon a Systematic Plan of Development

By Daniel J. Hauer.

THE writer has received numerous letters during the past few years from contractors as to how construction jobs should be started, and he has from time to time given suggestions along these lines, but railroad construction has not been touched upon, although several requests as to methods to be followed in this class of work have been received.

To some extent the suggestions that will be given are applicable to other classes of construction, especially wagon roads, aqueducts, canal building, and all work that has a long center line and a narrow right of way, in other words construction stretching over a number of miles of territory.

Railroad construction embraces many different classes of work, as earth and rock excavation, masonry work of all kinds, foundation work, timber and steel construction, landscape gardening, track laying and ballasting and the building of telegraph lines, fences and structures of many kinds. There is hardly any other class of construction that embraces so much or broadens a man as much as building railroads. A contractor, who has had experience in railroad construction and is proficient, is competent to undertake almost any class of work and carry it on in a satisfactory manner. His exacting and broad experience fits and trains him to solve almost any problem.

Without infringing upon the technical and theoretical side of the subject of railroad building, a treatise could be written on the practical side of this important work that would be an aid to both engineers and contractors. They both have many things to solve in common.

In fact there exists a need for such a book, touching on the survey surface and subsurface, the measuring up of work, the estimating of costs, the keeping of records, the staking out of work, the making of monthly estimates, the methods of handling the work, the finishing up and many other details. All of these things could be set forth so that there would be a greater uniformity in the work, and many mistakes could be avoided.

Some railroad construction jobs are advertised to be let but a more common way to obtain bids on railroads is for the company to have lists of contractors from whom they ask proposals. These contractors have in some way shown their ability and are selected to do certain kinds of work by the company. A contractor of experience can often have his name placed on these lists by seeing the proper officials of the railroad and furnishing references as to work he has done.

No matter how the invitation has come the contractor or a competent assistant should always be ready to go. The job may be one of some magnitude, and may call for numerous outfits to be placed on it, or the railroad company may have divided the work up into sections, and may let one or more sections to a contractor. At times the work may be the construction of a wharf, coal bin or some job that is confined to a limited area. Some railroads prefer to let an entire new line, terminals and all to one contractor, who completes it with his own forces or with the aid of other contractors.

Quotations First

When the call comes to bid, the first thing to do, before starting to visit the work, is to arrange to obtain prices on the various materials that may be needed. If ample time is given and unfortunately for contractors it seldom is, letters can be written to various dealers and manufacturers for quotations. Answers can be made by letters to the home office. If the time is short, these quotations can be obtained by telegraph and the telegrams sent to the place of bidding as there may not be time to come home to make out the proposal.

Quotations should be obtained on terra cotta and cast iron pipe, on explosives, on cement, on the common grades of lumber, on reinforcing metal, on piles and sheeting, and other articles that are generally used. Always ask for a delivered price. This gives an exact price to go upon to make estimates of cost, and at the same time the quotations if later accepted by letter, makes a contract for the material needed that prevents the contractor paying higher prices afterwards. Do not use market quotations published in papers, they are seldom reliable and they do not contain freight allowances. Many young contractors have gotten into trouble by using them. Get quotations from more than one dealer on each class of goods to be purchased, as only in this way is it possible to know that you are obtaining the lowest prices.

As soon as you arrive on the job ask for a schedule of quantities of work to be done and materials necessary. If it is found that unusually large quantities of any materials are to be used or special information is given as to the quality or character of the materials, communicate it at once to your dealers so as to obtain lower or more exact quotations.

Detailed Examination of the Work

The work of quotations attended to, the contractor's mind is now free to examine the work in detail. Don't do it from a car window, or any rapid moving vehicle. Take time to examine everything in detail. The best way is either walking or on horseback. See the entire line from one end to the other. If the contract is landed this trip can be the means of saving many dollars in carrying on the work, and it means, likewise, starting it promptly and conducting it throughout in an efficient manner.

Careful notes should be taken on the work and recorded so as to have all data and necessary information, not only for bidding, but for managing the work. The knowledge so gleaned will likewise assist in making a more intelligent bid. First of all the different classes of excavation should be noted and their location. This not only affects the methods of doing the work, but likewise the making of embankment and the distribution of the wasted and borrowed material. The line should be divided into sections, not by the mile, but according to the character of the work and the kind of plant needed to do the various sections. For each one a camp site should be selected, one that is convenient to the work and also situated so that supplies can be hauled to it.

The hauling of supplies is very important. Notes should be made of all receiving stations, both on railroads and water routes, the distances from various parts of the line, and the roads over which materials and supplies must be hauled. The conditions of the roads must be noted and the hills on it. A few steep hills may mean to double the cost of hauling, as the steepest hill will govern the sizes of the load to be carried. Routes should likewise be selected for bringing heavy machinery to the different parts of the work, and estimates made of the probable cost, as in beginning the job this is an important factor in keeping down the cost, but also in putting the job on a paying basis.

Quarries of suitable stone, sand pits, and supplies of timber and piles must be located, and information obtained as to the cost of developing and furnishing these things. Where tunnels are to be driven special attention must be given to these details, and also to the location of a power plant.

All of such information will be valuable for bidding and just as much so for planning methods of carrying on the construction. The quantities of excavation to be made should be tabulated, with the distribution of the excavated materials, and from this tabulation, which should include culvert work, masonry and bridges, a plan can be mapped out to carry on the entire job.

All such data will be valuable not only if the construction is to be done entirely with the contractors' own forces, but also if all or a part of it is to be sublet. Frequently subletting is attended with much worry and trouble, due to the fact that the work is not divided up into the proper sections and that the character of the work is not suited to the outfit of the subcontractor. See to these things and few subcontractors will fail, instead they will make money for themselves and for the general contractor.

The contract once landed and signed, the contractor is ready to begin work. He can now be likened to a general starting a campaign. He must assemble his forces and plan the method of his attack. With the information gathered in making the proposal he should now be prepared to go ahead. First of all a competent man must be placed in charge of the job. If all or any part of the work is to be sublet, he should be the one to do it. With the data gathered this subletting can be done to advantage, and the subcontractor will be able to get to work quicker for he will know the quantity of work he will have to do, the kind and amount of outfit he needs, the location of his camp and all other important details.

Selection of Plant and Equipment

The most vital thing in preparing for any job is the plant needed for it. With the data gathered as described and before the contract was awarded, the outfit needed could all be decided upon. Any tools or machines that had to be purchased could be arranged for at once by obtaining prices from the various manufacturers in that line, and asking for dates of delivery. This last is often overlooked, causing costly delays. With this information in hand orders can be placed for new machinery as soon as the contract is awarded. Dates of delivery can be fixed so that the machinery will arrive on time, and not ahead of time, causing unnecessary expense of rehandling and making expenditures for labor ahead of time, using up money that could be put to other purposes.

There are two ways in vogue of starting jobs. One followed by many contractors is to spend large sums of money and much time on preparing to do the work. They do not start any work until all tools and machinery have been assembled, and they are "organized," as they term it, to do the work.

The other method is to get men and teams with small tools at work at once, earning some estimates from the start, and thus develop the work for the larger installation of machines and allow the work of preparation to be carried on at the same time. By this method the work is developed so that some income is devised from the start. The machines as they are installed do their maximum work, and the heavy expense of starting the job is extended over some weeks.

The first method the writer does not approve. It is all right in theory, but does not work out in practice. On a large job, where many different kinds of machines have to be installed, the cost can run into many thousands of dollars, and although the machines themselves ought not have to be paid for at once, part payment is generally demanded, but the great item of cost is labor and this means a large expenditure of ready cash. Thus the expenses are running up and not a cent of income is derived. This money must earn for itself some interest and by this method it is slow in doing it. Thus, before the job is fairly started, it is in debt. In many cases this means that the contractor is hard pushed throughout the life of the job, and he does not derive any profit from the work until it is completed. Meanwhile he has lost many thousands of dollars in interest that would otherwise have been his.

This has been demonstrated by the way a number of contractors have handled their work on the Catskill aqueduct, being built by the city of New York, and on the New York State Barge Canal. Some have followed this plan and, after six or eight months, they have been compelled either to go into the hands of a receiver or to make some kind of a working agreement with their creditors, both of which are costly. In nearly every case that the writer knows of this could have been prevented by different management.

Method of Development

For these reasons consideration only will be given to the method of developing the work while the preparation is going on. The first tools needed on a railroad job are some axes, a grindstone, some cross cut saws, cant hooks, log chains and such tools as are needed for clearing the right of way. Men can be set to work on this at once. Native axmen can often be employed to advantage, while laborers are being brought to the job. A few hired teams can be employed to haul lumber. At once some kind of a shelter can be built for horses and mules, a large canvas will serve the purpose or boards and poles can be used and the structure improved after it is put into use. The stock for the work can be shipped to arrive as soon as this shelter is made. This will stop hiring teams and allow horses to be used in moving logs.

Meantime a cook shanty can be built and the feeding of men started at once. Also a large building for sleeping. These can be arranged for within a day or two.

As soon as a few hundred feet of right of way is cleared men can be put to work on the road opening up grade points in rock cuts or where steam shovels are to work. For a few days wheelbarrows can be used, then vehicles can be put to work. For scraper or grader cuts a gang of men can be put to work taking out stumps. For this a stump puller should be used and explosives should have been ordered at such time to have had them on hand to assist in this work. A cut cleared of stumps within a day or two will allow of scrapers and graders starting to work.

If there is any side hill rock work, where a cross section of the roadbed is partly in cut and fill, a large gang of men can be placed on this at once, and by blasting done with judgment a large estimate can be earned quickly to help carry on the work.

Pipe for culverts should have been ordered at once, but only in such quantities that it could be placed as it is received. To shove it and rehandle it is expensive, eating up much of the profit on this part of the work. To do this, the necessary foundations must be prepared and gangs organized to place the pipe as it is unloaded. There will be plenty of work for teams and everything should be planned to keep them busy, as idle teams mean a quick money loss.

While this work is going on the camp is being built and used. An office and commissary with a storehouse is needed promptly, and a good blacksmith shop. This, too, at first can be a makeshift building to be improved as the work progresses. If these buildings are constructed according to a well-thought-out plan, they can be used before completed, be built at a minimum cost and will serve their purpose much better than when the carpenter or foreman is allowed to build as he pleases.

Likewise the buildings for men can be built as the work is being developed. Men for a while will put up with inconveniences, but they will soon begin to grumble if the camp is not put in shape for them promptly. Doing this under their inspection will often please them much more than if everything had been completed before they arrived.

If one or more tunnels are on the line the portal work should be started as quickly as possible, and the power house site selected and cleared up. Then the building can be raised, one side being left out to take in the machinery. If there is no approach to the tunnel to be excavated the heading can be started so that the machine drills and columns can be set up as soon as they arrive.

Concrete and rock culverts should be started within a week or two. For these and other masonry work quarries should be opened up and developed. To start crushed rock work it is often possible to use up large boulders and surface stones, so that foundations can be placed promptly.

For steam shovel work, the ends of the cuts being graded, the tracks can be laid and temporary trestles built so that as soon as the shovels arrive they can be put in position and worked day and night if necessary. A steam shovel put to work in a cut that has not been properly opened up is worked to a disadvantage for some days and possibly weeks. Meantime the operating expenses are as great as though the maximum output is obtained.

Avoid Delay in Masonry Construction

One thing frequently overlooked in starting jobs is the masonry construction. Delays on this work mean delays on other parts of the work, and there is no reason, in most cases, why the masonry cannot be started promptly and carried on ahead of the grading. One reason for this is that the engineers for the railroad company are not always prompt in making up the plans for such structures, causing the contractor to lose valuable time. The contractor, by insisting, can often get the engineers to act more promptly. One thing he can do is to have his forms, material and cement on hand. Don't overbuy, especially at the start, but have a fair stock on hand and arrangements made to have orders filled promptly.

In starting a job do not do any work without stakes. Payments for work are often short or confused by it. Then in many cases mistakes will be made that will be expensive to correct. Ask for stakes and have them before starting any work. Foremen and others should be made to open up and keep in first class condition all classes of work so as to complete the job as it is carried on and save much dressing up in the end.

A job started in this manner will earn some estimate during the first month, while the second month a large and profitable amount of work can be done. It will be on a paying basis much sooner than by the first method and will be finished sooner, as the writer's experience is that even when everything is prepared before starting the work, there still remain many details to be attended to and the job has still to be developed. The time of preparation is to some extent wasted.

This method of starting is applicable to a long line, or to each section, or for each camp or sub-contractor. Try it and it will be found practical and business-like.

Possibility of Water-Tight Concrete

THE question of whether concrete can be made in itself waterproof was recently asked Leonard C. Wason, president of the Aberthaw Construction Company, Boston. In reply, Mr. Wason was very emphatic in stating that not only can concrete be made impervious under ordinary pressures, but even under extraordinary pressures. By "ordinary pressures" is meant pressures due to heads 10 feet or below, while "extraordinary pressure" refers to standpipe pressure. It is simply a question of well-graded materials, proper proportions, and thorough workmanship, to get the maximum density. With good work, the Aberthaw Company have found that for maximum density a mix of 1:2:3½ is about correct, the aggregate varying from 3½:4. The time that should be given to mixing the materials is very important. On the best work done by the company the materials were kept in the mixer for five minutes. The amount of water is also very important. The point of plasticity can be judged by the eyesight, and the concrete should barely quake. The materials, after being mixed, must be handled very carefully so that there will be no separation of the same. To make impervious concrete structures, great care must be taken also in getting the joints clean before going on with the next day's work. In Mr. Wason's opinion, 99 per cent. of all leaky concrete building work is due to poor workmanship.

These considerations relate, of course, only to the possibility of obtaining impermeability in the concrete material itself. In structures where seepage occurs after placing, or where cracks admitting water are developed through settling or shrinkage or expansion, the problem is one of a different character calling for a corresponding difference in waterproofing treatment.

Design and Erection of the Boucanne Viaduct of the National Transcontinental

THE National Transcontinental Railway crosses the Boucanne River at a point 167.2 miles east of the Quebec Bridge, which is the St. Lawrence River crossing of the same line. The crossing occurs just north of the peak of Maine where this state geographically juts into British territory. Although the river at this point is but a shallow stream with a depth varying with the seasons from a few inches to 5 ft., and a width of some hundred feet, the valley in which it flows is quite a considerable depression. This condition, together with the fact that the line follows generally the "height of land," necessitates a crossing of 799 ft. length with a maximum height of 127 ft. from base of rail to water level. The bridge is therefore of the trestle type with the general outline indicated in Fig. 1. The viaduct will there be seen to consist of five towers of 30 ft. spans and two of 40 ft., with intermediate spans of varying lengths. Beginning at the west end there is first a 60-ft. span from an embankment about 55 ft. high to tower bent No. 1. The succeeding three open spans are 56 ft. and then over the river between the 40-ft. towers is a 150-ft. truss span. Continuing up the east bank, there are three open spans of 60 ft., the eastermost resting on the embankment which here also is about 55 ft. high. The line is on tangent except for about 135 ft. at the west end where it lies on the approach spiral to a 6 deg. curve (radius—977 ft.), which commences 165 ft. west of the bridge. The transition spiral is thus 300 ft. long and is laid out as a cubic parabola with equation $Y = KX^3$, Y being the offset from the tangent, X the distance from the beginning of the spiral measured along it, and K is a constant, in this case equal to .00000058232; so that at the end of the transition spiral when X = 300 ft., Y = 15.722 ft.

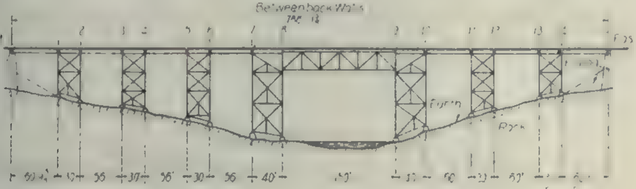


Fig. 1—Diagram elevation of Boucanne river viaduct.

The viaduct is of the deck type, and the track is laid on ties placed with a 4-in. space between them. The ties are 10 ins. wide by 12 in. deep and generally 14 ft. long, dapped ½ in. over the top flange of the girders and held from bunching by longitudinal timbers running along the ends of the ties and dapped over them. The girders are 9 ft. apart on centers and are uniformly 6 ft. deep. The transverse batter of the towers is 1 in 6 and this, together with the depth of the truss and its detail brings the width of the truss span to 17 ft. 2¼ ins. on centers. The viaduct is also on a grade of 1.10 per cent. falling toward the east. The grade is, of course, affected by the vertical spiral at the west end whereby the super-elevation of the 6 deg. curve is gradually attained, but not to any larger extent than can be adjusted by the size of the ties used on the end span. The necessary tilting of the track is also small enough on the bridge to be looked after in the ties.

The ground at the site is principally earth and boulders with solid rock about 10 ft. below, so that concrete pedestals and abutment walls were well founded on the bed rock.

Specifications for Design

The viaduct is designed in accordance with the specifications issued by the Dominion Government in 1908 with one or two further restrictions imposed by the Bridge Engineers of the National Transcontinental Railway, and which will be specifically alluded to later. The steel was proportioned for a live load known as class "heavy." This consists of two engines with tenders, the whole weighing 180 short tons, with a combined wheel base of 104 ft., followed by a uniform train load of 4,750 lbs. per foot of track.

The specification for impact calls for an extra allowance of load equal to the figure obtained by dividing the square of the live load by the sum of the dead and live loads. In addition to this gain, for all spans under 80 ft., including the stringers and cross floor beams of the truss span, the live load itself is increased by a percentage depending upon the length of span, and having a maximum of 40 per cent. at the theoretical span of zero, diminishing according to the formula $.40 - \frac{l}{200}$ where l is the length of span, vanishing at 80 ft. In the Transcontinental Railway bridges this increment in live load is introduced into the live load figure used in the impact formula as well as the pure live load, so that for the girders of the Boucanne River Viaduct the impact load was obtained by dividing the square of the increased live load by the sum of the increased live load and the dead load. The sum of the dead load, the increased live load and the impact thus obtained is treated as the total load both for shears and bending moments. For this load a unit shear of 10,000 lbs. per square inch is allowed on the gross section of the webs of plate web girders, and on the net section of the tension flange a unit fibre stress of 16,000 lbs. per square inch is permitted.

The gross area of the compression flange is made equal to the gross area of the tension flange and 75 per cent. of the gross bending value of the web plate is considered as effectively assisting the flanges to resist the induced bending moments.

Under these specifications the weight of steel in the 60-ft. deck plate girder spans is 57,000 lbs. per

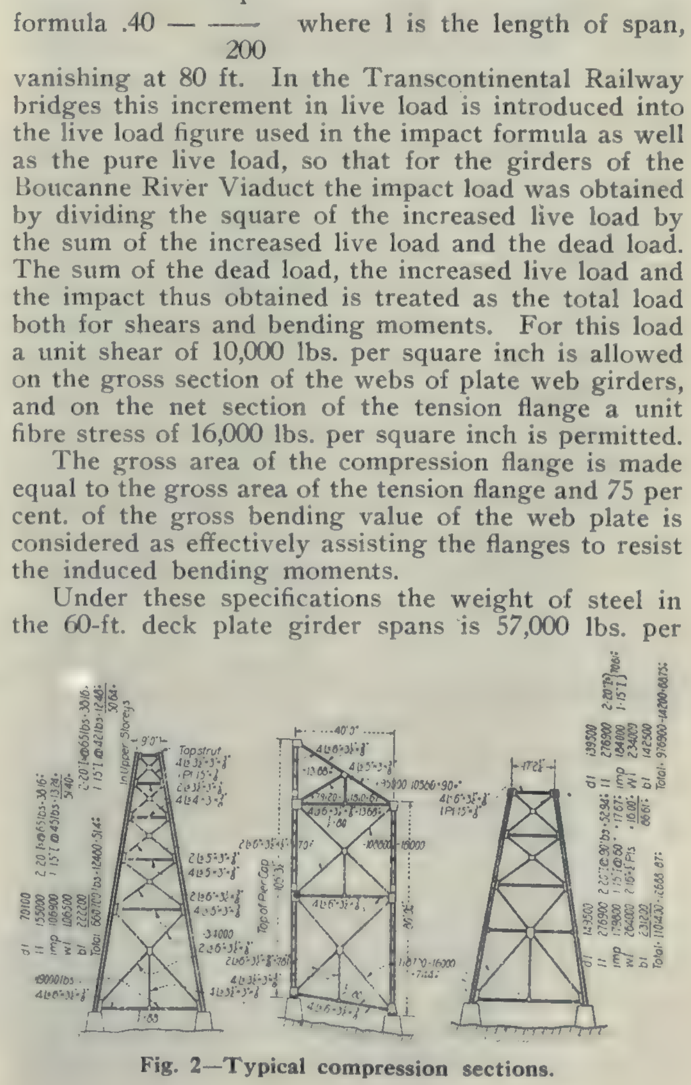


Fig. 2—Typical compression sections.

span, including both girders and all wind and sway bracing. In the 56-ft. spans the corresponding weight was 51,000 lbs. in the 40-ft., 29,000 lbs. and in the 30-ft. spans 17,500 lbs. per span.

Towers and Truss Spans

The trusses of the 150-ft. span, as will be seen from Fig. 1, have six panels of 25 ft., are in vertical planes, are 25 ft. deep between centers of gravity of chords, and are of the Warren type. The cross girders or floor beams at the intermediate panels are 4 ft. 4¼ ins. deep over flange angles and are riveted to the vertical members of the truss just under the top chord. The end floor beams which have to support the 40-ft. girder spans are 5 ft. ¼ in. deep over flange angles and are 1 ft. lower on the truss than the intermediate ones in order to accommodate the difference in depth between the 40-ft. girders mentioned, and the stringers of the truss span. These latter are also plate web girders, their depth thus being 5 ft. ¼ in. back to back of angles against the uniform 6 ft. ¼ in. of the girder spans. It will thus be seen that the stringer girders sit on top of the floor beams and are 9 ft. apart on centers, being in fact 25-ft. deck plate girder spans. The floor beams are similarly single-web plate girders with webs of 7/16-in. thickness and flange angles 6x6x 9/16 ins. on the deeper and 6x6x⅝ ins. on the shallower. The truss itself has a top chord section composed of a cover plate, two web plates about 14¼ ins. between them and four angles 6x4 ins., all being ½ in. thick, the web plates 20 ins. deep, and the cover plate 23 ins. wide. Figure 2 will illustrate this make-up. The bottom chord consists of two web plates 22 ins. deep and four angles 6 x 4 ins., all 7/16 ins. thick in the first two panels at each end and all ¾ in. thick in the two central panels. The web system of vertical and diagonal members is consistently of H shape, the plate being uniformly 12¼ ins. wide with a thickness of ⅜ in. except in the compression diagonals where ½-in. plate is used. The angles are 9 x 3½ x ½-in. bulb angles, in all the diagonals and the end verticals, whilst in the verticals that are merely hangers they are 6 x 3½ x ⅜-in. angles, and in the intermediate compression verticals 7 x 3½ x ⅝-in. angles. The main or end compression diagonal is further reinforced by 19 x ¾-in. plates on the outside of each pair of bulb angles. These sections are also indicated by Fig. 2

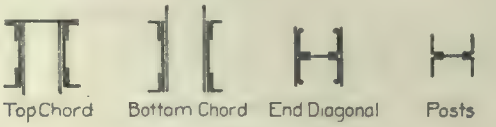


Fig. 3—Towers.

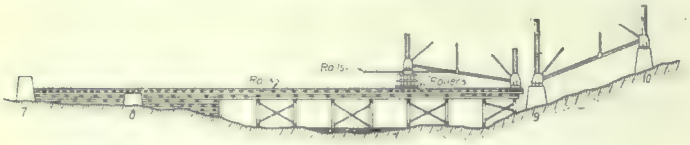


Fig. 4—Staging track on which tower was moved.

The maximum top chord stress, composed of dead load, live load and impact load, amounts to 678,000 lbs., for which a section of 50.5 sq. ins. is provided, the maximum unit compression allowed by the Transcontinental Railway engineers being 13,600 lbs. per square inch. The bottom chord receives a possible maximum stress of 768,000 lbs., which at 16,000 lbs. per square inch requires 48 sq. ins. of net sectional area. To meet this is supplied 48.76 sq. ins., being the effective net section obtained from the 60,760 sq. in. gross section provided. The Transcontinental Railway prescribes that the government formula for free ended compression members shall be used for their vertical struts, whilst for the compression diagonals the intermediate formula $16{,}000 \div (1 + \frac{l^2}{1{,}200\ r^2})$ is used, the constant before r^2 being 9,000 for free ends. By this means the units are obtained and by their aid the necessary cross section. The tension unit is 16,000 lbs. regularly.

The trusses are braced together horizontally by both top and bottom lateral systems, the top consisting of crossed single diagonal angles in each panel connected to the under side of the chord angles and to the bottom flange of the stringers. The bottom lateral bracing consists of transverse horizontal struts of four angles laced in pairs and of cross diagonals similarly constructed. They are made the full depth of the chord for the sake of simplicity and efficiency in connection. Under each floor beam is supplied a sway brace consisting of cross diagonals connected to the vertical members of the trusses and to the bottom struts.

An interesting item, perhaps, is the size of the lattice bars and the clauses governing their dimensions. The lower side of the top chord is of course latticed between gusset plates, and here 5½ x 9/16-in. single lacing is used. The bottom chord is laced in both its upper and lower faces with 3 x ½-in. double lacing, whilst the lacing of all the lateral struts and diagonals is 2½ x ⅜-in. The clause in the specification that determines the thickness is that the bars should be at least 1/40 as thick as the distance between the rivers that connect their ends to the two leaves of the members which they lace, if singly laced, and 1/60 if doubly. On the upper chord the web plates being 14¼ ins. apart, the gauge line on the angles are 20¼ ins., which with approximately 60 deg. lacing gives 23 ins. between rivets and 23/40 in. or .575 in. as required thickness, for which 9/16 in. was used. The width is governed at each end, and these could not be obtained with the necessary edge distances on the lattice bar, under 5½ ins. Similarly on the bottom chord the same 20½ ins. with 45 deg. lacing gives 28½ ins. between end rivets and calls for $\frac{28.5 \text{ ins.}}{.60}$ or .48 ins, thickness in the bars. One rivet being sufficient connection, a 3-in. bar was adopted. The latticing in bracing members need only be made 75 per cent. as heavy as the above specification, and so ⅜ in. is the usual dimension.

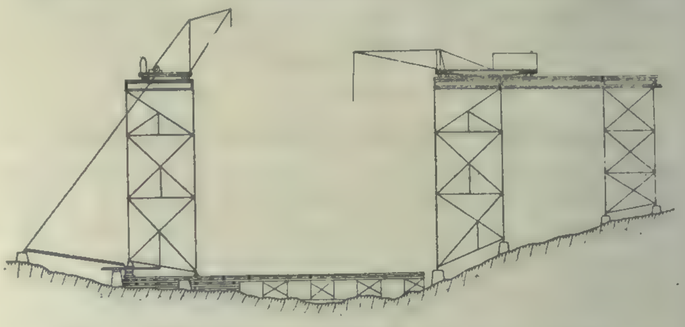


Fig. 5—Sketch showing method of moving tower.

The rivet values permitted are 10,000 lbs. per sq.

inch single shear and 20,000 lbs. per square inch bearing. These figures are for shop-driven rivets, whilst for those driven by power in the field a reduction in value of 10 per cent. is insisted on, and for hand-drivend rivets a decrease of 25 per cent. in value is prescribed. The gusset plates in the main truss were principally ⅝ in. and the minimum thickness of material allowed was ⅜ in. throughout the bridge.

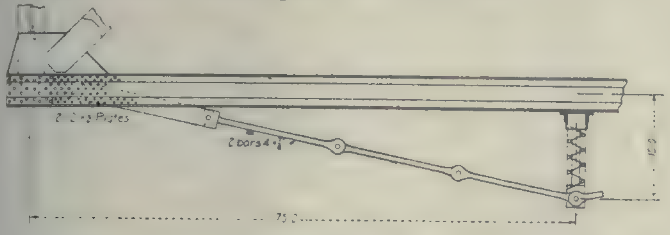


Fig. 6—Method of trussing bottom chord for erection in one piece.

The towers are of the usual viaduct construction, and consist of two "bents" braced longitudinally together. Each "bent" is made up of two battered posts with sway bracing between them. The sway bracing as indicated on Fig. 3 is composed of panels of crossed diagonals and horizontal struts. This is the most usually adopted type, although occasionally the struts are omitted except at the extreme top and bottom, and the diagonals made rigid enough to effectively resist compression. In the usual layout as typified by the Boucanne River Viaduct, the diagonals although made of stiff shapes are proportioned for tension with a limit of slenderness determined by making the maximum permissible ratio of unsupported length to radius of gyration equal to 200.

The horizontal struts are then figured as compression members and their stiffness is governed in turn by a clause limiting $\frac{l}{r}$ to 120. Under these conditions the stiffness more generally than the figured stress governs the choice of sections.

The longitudinal bracing between the bents is calculated to take any stress that might occur from suddenly applying or releasing the brakes on the train. Here, again, however, with the National Transcontinental Railway the same stiffness clauses come in and in the smaller towers determine the dimensions of the diagonals and struts, whilst in the larger towers carrying the ends of long spans the figured stresses often call for increased thickness of metal. A typical diagram Fig. 3 is appended showing computed stresses and supplied material for the particular tower to be considered in this paper.

The posts are made up of three I-beams rivetted together to form an H-section, reinforced by side plates where necessary. This form of post section provides the minimum of shop work and secures reasonable connections for all bracing. When the two I's are deep they may be connected at suitable intervals between bracing points by batten plates, or may be continuously latticed. In the case of the Boucanne Viaduct the bottom plate system was employed and 9 x ⅜-in. plates 1 ft. 3 ins. long were provided on each face at about 5 ft. intervals. In the tower 7-8 under consideration the lowest storey was built up of two 20-in. I-beams weighing 90 lbs. per foot each, with the diaphragm I-beam 15 ins. deep and weighing 60 lbs. per foot. In addition, there were two 16 x ½-in. side plates, one on the outside of the web of each 20-in beam, giving a total gross section of 86.6 sq. ins. The beams are heavy American standards and were rolled by the Carnegie Steel Company. The loads on this post, No. 8, are computed to be as follows:

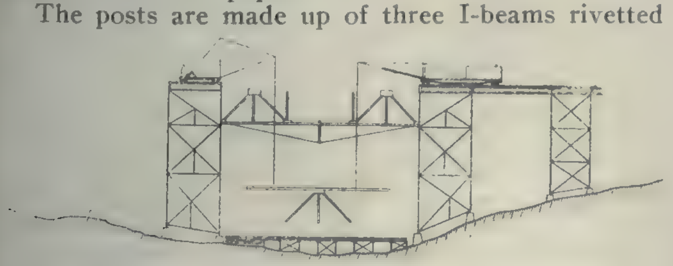


Fig. 7—Sketch showing method of erecting trusses.

Dead load	149,500
Live load	276,900
Impact	179,800
	606,200
Wind load	264,000
Brake load	231,200
Total	1,101,400

These loads are the maximum that can co-exist according to the specification and not necessarily the maximum amount of each and every class of load. Now the unit compressive stress allowed by the specification is that given by the formula $16,000 \div \left(1+\frac{l^2}{9,000\, r^2}\right)$ This applies, however, to the combination of dead, live and impact loads which, as above detailed, amount to 606,200 lbs. In the storey under inspection $\frac{l}{r} = 72$ and consequently f = 10,150 lbs. per square inch. But in consideration of the remoteness of the possibility of all the wind load and all the brake load occurring together and at the same time as such a large impact load, which the braking load either removes or replaces, the allowed unit for the full combination of live, dead, impact, wind and brake loads is increased above that already determined by 25 per cent. There are thus two cases to be considered in every post—first, the ordinary combination at the ordinary unit; and, second, the extraordinary combination at the increased unit. In the present case, as with most cases of high towers and long spans, the second case governs and so the unit of 12,688 is used, necessitating 87 sq. ins. of section,

The feet of the posts are shod with a steel shoe plate 2 ins. thick which rests upon a steel bed plate 2 ins. thick, the latter being anchored to the pedestals. The anchor bolts for bent 8 were 1¾ ins. diameter and 6 ft. long, two to each post, whilst to bent 7 were given 2½-in. diameter bolts 13 ft. 3 ins. long, two to each post. A few inches of each bolt project above masonry to receive nuts and washers above shoe plates, and the rest is built into the pedestals. A space is left around the bolt to allow of slight adjustment and then after the towers are completed this space is filled with cement grout.

One post of each tower was rigidly fixed to its bed plate, but the other three were allowed freedom to move under expansion or contraction from temperature or loading. Each of the posts adjacent to the fixed one is permitted to move in the direction of the line adjoining to the fixed one; that is, the one transversely to the viaduct axis and the other longitudinally with the viaduct axis, while the diagonally opposite post can move in any direction. In other words, one shoe being fixed two had one degree of freedom and the other two degrees. Tongue and grooves in the bed and shoe plates, respectively, were used to accomplish this, and in the particular tower under notice the S. E. post was the fixed one. The tongues were 2½ x 5/16-in. flats and the grooves were planed out 7/16-in. depth.

Erection Methods

The viaduct was erected from the east end, and as the line itself was the only approach, the steel had to be forwarded from Montreal to the station on one of the existing railways nearest to the constructed track. This meant the carrying of all steel by the derrick cars from the east end storage to the actual site and over the erected portions. The process, therefore, was to erect bent 14 and place the 60-ft. girders from the east embankment. The derrick then moving into the 60-ft. girders erected bent 13 and the longitudinal bracing and the 30-ft. girders. This method, obvious and ordinary, was followed to bent 9. For the higher bents a horizontal temporary strut is employed to steady and support the first bent of a tower, being erected between it and the last completed tower. These temporary struts serve to stiffen the bent while the 60-ft. girders are placed and the derrick advanced to erect the rest of the tower. They were wooden in the case of the Boucanne River Viaduct, but are of steel for larger and higher towers.

When the tower 9-10 was completed, the next necessary undertaking was bent 8, which in its final position was to be 150 ft. west of bent 9. As this could not be erected from the west end, there being no line, it was essential to scheme out some method of building the complete tower 7-8 before the truss span which it was destined to carry. Although the river was but a foot or two in depth, falsework for the truss was considered too expensive and troublesome, and the plan now to be presented was selected as the most feasible and desirable means of erecting both the trusses and the tower. The outline of the scheme was the building of tower 7-8 on low staging close to 9-10 within reach of the derrick booms and approximately at its final level, and then rolling or sliding it westward into place. The company had before had experience with the moving of towers by this means and were satisfied from past successes that this was a possible and practicable scheme. Temporary wooden staging was built across the river upon which were laid the skidding or rolling track rails. These were laid at such a height that between their bases and the top of the pedestals of 8 there was just room for an ordinary railroad tie and an inch or two of blocking, Fig. 4. On top of these rails were then built the posts of bent 8. This base of bent 7 being 6 ft. higher than bent 8, this amount of timber blocking was built upon the rails 40 ft. west of bent 8 and upon this small timber tower bent 7 was erected. When the bracing and 40-ft. girders of this tower had been completed a stiff-leg derrick was built on top of the tower by the erection derrick on tower 9-10, Fig. 5.

Between the shoe plates of bent 7 and the blocking upon which they rested was placed another set of rails, so that when the tower had been rolled west ward until the blocking under bent 7, having passed pedestal 8, was about 8 ft. from pedestal 7 they would project over pedestal 7 and when staged or blocked, would form a track upon which the shoes of bent 7 could slide the last few feet of their travel, the shoes of bent 8, of course, still rolling. Thus for the first 135 ft. or so the two bents of the tower rolled on the lower tiers of rails and afterwards the higher shoes slid on the upper tiers. The rollers were 2 ins, in diameter and about 4 ft. in length. In this manner the towers was rolled to position and then jacked down onto its anchor bolts which were already in place on the pedestals. The rolling was effected by the winding engine of the stiff-legged derrick on top of the tower rolled. Lines from its spools to a hitch west of pedestal 7 passed back to the tackles, which were placed around posts at gussets and around the blocking under 7. The derrick up above thus pulled the tower carrying it into place. The movement was very easily accomplished and without any trouble or hindrance.

The next problem was the erecting of the truss span. The two bottom chords were lowered piece by piece to the staging already referred to, a few feet only from the ground, and there they were bolted up and trussed as shown in Fig. 6, by temporary eye bars and short struts. By this means they were made strong enough to carry themselves and a part of their respective trusses as spans of 145 ft. 6 ins. length. The end vertical posts of the trusses had, of course, been already erected as part of the towers and the bottom chord and splices were arranged to permit of the trussed chord being hoisted vertically and immediately bolted to the short end sections, which were shop riveted to the gusset plates at the foot of the vertical posts incorporated into the towers. By this means the two bottom chords were hoisted into place and connected, the stiff-legged derrick on 7-8 taking hold of about 40 ft. out and the main traveller taking hold of about 50 ft. out. The bottom lateral bracing was then put in place and the chords thus stayed horizontally.

The next process, Fig. 7, was the erecting on the low staging of the web members of the two panels at each end of each truss; that is, the main compression diagonal, the first vertical and the main tension diagonal. These were then hoisted into place and immediately braced by the placing of the first floor beam and sway bracing. The second verticals being added, the remaining central portion of each truss was assembled down below with the four panels of top chord and then similarly hoisted up to position and bolted on. The intermediate floor beams, sway bracing and top lateral bracing followed and the addition of end sections of top chords and stringer girders completed the span. When sufficient rivetting had been done the temporary eye bar trussing was removed and everything was ready for the laying of track and the passage of the erection derrick. The stiff-legged derrick was dismantled and the erection of the remaining towers was proceeded with on the same plan as above described for the eastern shore. The photograph of the placing of the last girder is interesting in that it shows the device whereby a brace frame is hoisted above the second girder of a span, so that immediately both girders are correctly placed they can be braced together.

The main erection derrick had an interesting feature in its telescopic booms. They were built of steel sections in two lengths each, and so arranged that the outer half could enter the inner half and the effective boom thus shortened. Holes and pins were provided in the webs of each position of each boom whereby various lengths could be obtained and retained. The capacity of the booms was 15 tons per boom when shortened down to about 40 ft., and 10 tons each when acting at their full extension of 62 feet.

The greatest weight lifted in this viaduct was about 20 tons, divided between the derrick and the stiff-leg erected on tower 7-8. This weight comprised the center portion of the 150-ft. span, was 394,185 lbs., and the total in the viaduct 913 tons.

The steelwork was manufactured and erected by the Dominion Bridge Co., Ltd., of Montreal, under the supervision of R. F. Uniacke, Bridge Engineer of the N. T. C. R.

Mr. F. P. Shearwood is the Designing Engineer of the company, and Mr. J. Finley the Erection Superintendent, while the author as Assistant Designing Engineer was in responsible charge of the designing of the work above described.—Engineering & Contracting.

Permanent Way at Million Dollars a Mile

Three-Mile Fill of Canadian Northern Railway Across Rainy Lake Nearing Completion—Double-Tracked Granite Highway

THE milestones of progress in Canada are bedded deep in the spectacular engineering achievements of its building railways. In this land of distances, trade is transportation, and in every case where the genius of the constructing engineer has triumphed over the obstacles of Nature, commerce has experienced an acceleration marked enough to attract wide attention. Every one is familiar with the great works of the older roads, but, until recently, little has been heard of the conquests of the Canadian Northern in this department of railway building. That virile, progressive road, which is rapidly attaining the status of a transcontinental by the linking together of its separate clusters of line, has many remarkable monuments to the outstanding ability of its builders. Within the next few years it will have added to these its tunnel and terminal in Montreal, its tunnel and terminal in Vancouver, and it will also have succeeded in stretching a great double-tracked causeway of granite across Rainy Lake, about midway between Port Arthur and Winnipeg.

Three and a quarter miles of drilling are involved in the driving of the tunnel through historic old Mount Royal in Montreal. From three to four miles will probably be necessary for the entrance to the terminals in Vancouver. This rockway across Rainy Lake will be almost three miles long and will cost nearly one million dollars a mile.

C. N. R. Unheralded

In this country the railways have developed the habit of proceeding with great constructive projects without initiating the public to the significance of the work. There has been no departure in this case, The Canadian Northern have been engaged upon it continuously for the past two or three years and so quietly has the task been conducted that very few people in Canada to-day are even aware that anything out of the ordinary is occurring there. Yet so much progress has been made that the company looks forward to its early completion. Indeed it is even hinted that the heavy wheat trains from the west this fall will roll smoothly over its solid length on their way to the waiting freighters at the head of Great Lakes navigation. While this is hardly probable, owing to the nature of difficulties still to be met, it is so far advanced as to be an importnt factor in transportation in Canada in the near future.

The Canadian Northern Railway came into existence just when the tide of immigration from other countries began to be deflected Canada-ward. It came into the national life because of the compulsion of the need of additional transportation facilities. If Canada's expanding prosperity continued many new lines had to be built, especially in Western Canada. The nation's need, and calls, were responded to by two men, builders of railways, who secured a dormant charter and laid down two lines of steel across one hundred miles of new, sparsely-settled land in Manitoba. That line was completed about Christmas-time in 1896 and was operated successfully. It connected the village of Gladstone with a settlement which is now the thriving town of Dauphin. Immigration continued to increase rather than diminish, and, in response the lines of the new company began to nose their way out over the new country that has been selected for the founding of homes by the newcomers. That was less than seventeen years ago. To-day the one hundred miles has grown into nearly seven thousand, has spread over six provinces, and will shortly graduate into the transcontinental class with terminals at both Atlantic and Pacific tide-water. In the beginning the road was consecrated to development and the vows have been kept down to this day. The Canadian Northern did not follow the lines of least resistance. It did not parallel existing lines. The policy was to avoid that. The road wanted to give transportation where its blessings had been sadly lacking before:—sought out new territory and then started in to increase that particular district's population and prosperity.

At the beginning of this century the development of the western province demanded a new outlet to lake navigation. The Canadian Northern set itself to the task and in 1901 construction was in progress on a new line to connect Winnipeg and Port Arthur. Conditions compelled rapid construction. Consistent in its policy the company sought a route for its line to the south and finally decided to tap the iron deposits of the Atikoken and Mattawin ranges in the hope that great development would follow the steel. That development is taking place to-day. But the line as located crossed an arm of Rainy Lake. That could not be avoided and the desired object attained. The crossing proved difficult and threatened to hold up the opening of the line. The west was impatient and the company finally decided to throw a series of trestles across the three miles of water and open the road at the earliest possible moment.

Survey Made in 1910

In 1910, with its transcontinental rapidly taking shape, a survey was made to locate a crossing worthy of the project. It was thought first that a series of steel bridges would do. This did not work out. The investigation continued and a little later the news filtered through that the company seriously contemplated the building of a double-tracked permanent way of rugged granite construction. This was to connect a series of little, rocky, pine-clothed islets from mainland to mainland. Work began without fuss. Soundings were taken with rods driven down to the rock and the location determined in similar manner as where hills and valleys have to be contended with. Estimates were compiled of the number of tons of rock required to get down to solid rock. Incidentally these estimates were later completely vindicated.

Early in the summer of 1910 the contracts were let and preparations for the task begun. By July station men were starting short fills out from the shores of some of the islets. On September 16 of the same year the first big "shot" was fired and in October digging by the steam shovels was inaugurated. That winter two shovels were kept at work and in the following summer four were in commission. Until the fall of last year those four shovels attended by eight standard gauge locomotives, two "dinkey" engines, and sixty dump cars, forwarded a steady stream of rock to the dump. The biggest output in one month was 50,000 cubic yards of rock. For one steam shovel in one day the record was 155 cars, or, to translate, about 900 cubic yards. Some single rocks loaded by these 90-ton shovels weighed more than twenty tons. On May 1st, 1911, dumping commenced on the second channel filling, three thousand feet across. Forty train loads of rock, every day for a year, were dropped before this was completed. Repeatedly, for two weeks at a time, this dumping was continued within a car length before the tracks could be extended ahead. Sometimes sudden settlings occurred during the working hours and trains and crews had narrow escapes.

Electric power—a voltage of 6,600—is brought from Fort Frances. That is a distance of seven miles. Two motors of two hundred horse-power each run two compound air-compressors which supply 1,046 cubic feet of free air per minute to one hundred pounds per square inch, at which pressure pipes carry this air to the drills. These put down holes as far as twenty-eight feet tapping, in diameter, from three to two inches. Following the drillers come the "powder" men, who spring the holes repeatedly with dynamite until a pocket large enough to contain the explosive necessary for a giant blast, is made. Then a group of holes are loaded and wired. They are fired by electric current. These are the so-called "big shots." Of this class there have been about 75 averaging from ten to fifteen thousand cubic yards. The largest contained 56,000 pounds of dynamite and broke up 50,000 cubic yards of rock.

The total rock filling will aggregate nearly a million cubic yards measure, solid, in original position. The average haul was one mile. The work is so big that one fails to grasp it until actually following the rock from blast to end of grade. The shovels load a car with broken rock in five minutes.

Remarkable Features

There are some remarkable features about this work. It will bulk large enough to create an impression of awe and astonishment in the mind of the casual visitor. From that standpoint it will appeal to the general public. But to the engineer and the man who knows something of the difficulties always attendant upon colossal construction works, the conditions peculiar to the building of this rockway and the methods resorted to by the contractors "to win out" will comprise its greatest charm. There are always problems to be met in building a permanent way through water. In this case the C. N. R. had to meet difficulties greater than usual owing to the length of the "fill" over all, and, the depth of the water. Besides, Rainy Lake is navigable and the passage of the steamers and also the timber to the mills at Fort Frances and other points in the Rainy Lake country could not be interfered with. To meet the latter exigency the company decided to throw two lift bridges of modern type across two water ways at convenient points. As there is nothing very new about that the accomplishment is only a matter of time. But in the beginning the contractors spent many an anxious hour in evolving a method to successfully do the apparently impossible in dumping rock ahead of the fill in water. The man who finally submitted the adopted plan established a precedent in engineering as far as can be learned.

The dumping apparatus really is a floating bridge. It consists of two plate girders six feet high and 140 feet long. These are placed 30 feet apart and support a pair of tracks as on the ordinary bridge. The forward, or water end, is floated by a barge 34 feet wide and 112 feet long; the embankment end, rests on the permanent way when the dumping is in progress and is upheld by a cross-wise truss between two small barges, one on each side of the grade when floating is effected to a new position ahead. The trains loaded with rock are run out on this floorless bridge and the contents of the cars hurtle down to the lake bottom. About one-third of the grade is added afterward by side dumping as the bridge is moved on.

Hope has been entertained by the Canadian Northern that the big rock fill would be ready for operation this fall. That is possible, but from the nature of the work still to be finished it is likely the opening date will have to be extended into 1914. That means it should be ready for service about the time the C. N. R. connects its eastern and western Canada lines by the completion of the steel between Sudbury and Port Arthur. It is stated positively that the steel will be laid on this line by the end of the year. It will be given its final touches for operation as rapidly as possible. The line through Yellowhead Pass that will join the western provinces with the Pacific coast at Port Mann and Vancouver will not be finished till a little later. But it is being driven through as rapidly as any other piece of Canadian Northern line has ever been driven and through transcontinental trains should be leaving Montreal, Toronto Ottawa and other eastern cities in 1914. That line complete will be a revelation. It will have gradients as low as any cross-continent lines in the world.

No matter how old and hard, paint or varnish can be softened in a few minutes so that it can easily be scraped off, by applying the following mixture: Waterglass, 5 parts; soda lye, 40 degrees Baume (27 per cent.), 1 part; ammonia water, 1 part.

Experiments are being made in France with a roadbed material consisting of an intimate mixture of "iron straw" or iron in the shape of a wiry or fibrous mass such as is commonly used for cleaning and scraping purposes in this country, together with cement mortar and sand. Such material is called "ferro-cement," and it appears that tests are giving good results. But the iron is not the usual kind found in commerce, but is prepared specially for the purpose by suitable machines of appropriate design.

A Practical Method of Following Up Construction Work

By Alden W. Welch

THE purpose of this article is to outline a comprehensive method for following up construction. The system offered herewith is not an accumulation of theories begging trial, but, having been thoroughly tried out by one of the great central-station companies of this country and declared adequate and efficient, is well worth careful consideration. One vital point that should not be overlooked when examining a new system is that one great characteristic of a system is imperfection. It is rarely possible to design a scheme which will work entirely satisfactorily for even similar conditions. The idea or skeleton will fit similar conditions, but the details will probably require readjustment.

Being connected with a large amount of construction, I found it necessary to evolve some good methods for following up the separate jobs, both in the aggregate and as regards their respective parts. The following method is suitable for the use of any concern having a large amount of construction work done, or of any engineering firm whose duty it is to be responsible for the satisfactory progress of such work.

We will assume that a certain central-station company has let the following contracts:—

At Generating Station A

Contract 100—Furnishing and Erecting Structural Steel for New Boiler House to House 20 Boilers.

Contract 101—Furnishing and Erecting Walkways, Stairways, Ladders and Miscellaneous Steelwork for the Coal and Ash-Track Runways, Hoists, and Monitors, over the Coal Bunkers in the Existing Boiler House.

Contract 102—Furnishing and Erecting Structural Steel for Roof over Yard between Old Boiler House and Machine Shop.

At Sub-Station No. 13

Contract 103—Construction of a Modern Sub-Station for the Distribution of Electric Energy at 2,400 Volts, Two-Phase.

At Sub-Station No. 14

Contract 104—Excavating for and Laying Foundations, for New Sub-Station No. 14.

Miscellaneous Building Jobs

Contract 105—Construction of a High-Tension Switch and Bus House.

Contract 106—Construction of a Stable and a Storeroom for Transmission and Distribution Material.

The foregoing are not hypothetical jobs, but represent actual work which at the present time has been completed and can, therefore, be analyzed with accuracy.

The first job to be considered will be that covering the steel work for the boiler house at Generating Station A. For the purpose of keeping track of the important details a form should be prepared. It is not the intention of this article to explain at length the various features connected with these jobs as they are not the points to be emphasized. Instead, I wish to show how my method may be applied, not only to these specific jobs, but to any work of a similar character. An idea of the scope of this boiler-house contract may be gathered from the following tabulation:—

Examination of this table will show that the important details have been laid out in logical sequence. First, the grillages, columns, floor beams and girders to the main floor, to the bunker floor, and to the track floor are considered. Lastly, the roof details are given. This form is primarily for the purpose of getting the material upon the job in ample time. The form is to be filled in with dates corresponding to the times when the various parts of the work were ordered, shipped, on the job, erection begun, and job completed. The first dates to be inserted will be the various promises on the above. These may be written in pencil. Should it prove impossible to meet these promises, the new ones should be inserted after crossing out the first. The old ones should not be erased as they are often of value in showing what was expected of the contractor, and what was actually accomplished. When the work has been completed this date should be inserted in ink.

CONTRACT 100
ERECTION OF ALL STRUCTURAL STEEL FOR BOILER HOUSE.

	MAIN FLOOR				BUNKER FLOOR		
	Grillage	Columns to	Floor Beams	Girders Bracing	Columns to	Floor Beams	Girders Bracing
Ordered							
Shipped							
On Job							
Start Erection							
Complete							

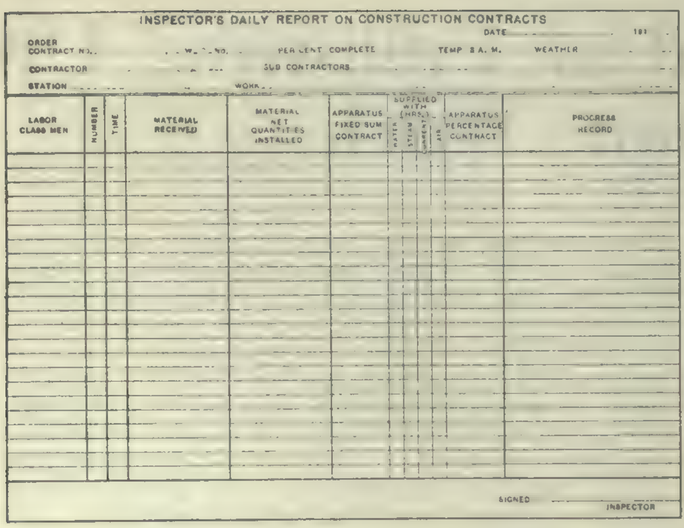
	TRACK FLOOR			ROOF		
	Columns to	Floor Beams	Girders Bracings	Columns to	Stack	Roof Trusses Purlins
Ordered						
Shipped						
On Job						
Start Erection						
Complete						

Table 1.—Outline of boiler house contract.

The form just considered will take care of the more important features of the work. The whole job is followed in detail by the inspector. It is the duty of this man to watch carefully the course of construction of the job for which he is responsible. He reports to the engineer of the company. He must check up the workmen of the contractor to make sure that they begin every part of the work correctly and that they continue without error to the end. He reports daily to the engineers by means of a written form as follows:—

The table is self-explanatory and well worth considering carefully. It was adopted after the abandonment of many other forms. It contains all the points of vital interest, and will prove of immense advantage in the checking of bills when the contract happens to be on the "time and material plus 10 per cent." plan.

In order to follow the progress of the work graphically a curve should be plotted, using the number of men at work per day multiplied by the average working hours per day as the ordinates, and the duration of the particular job, in days, as abscissae. The



INSPECTOR'S DAILY REPORT ON CONSTRUCTION CONTRACTS

DATE .... 191 ..

ORDER CONTRACT NO. .... W. O. NO. .... PER CENT COMPLETE .... TEMP 8 A. M. .... WEATHER ....

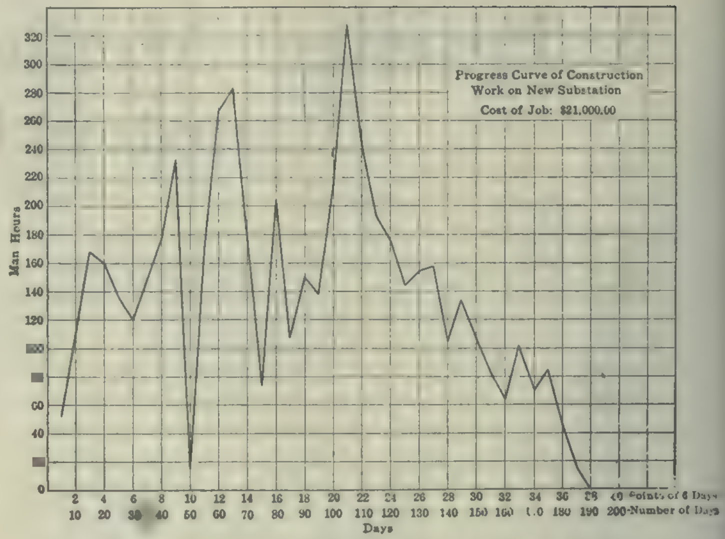
CONTRACTOR .... SUB CONTRACTORS ....

STATION .... WORK ....

LABOR CLASS MEN	NUMBER	TIME	MATERIAL RECEIVED	MATERIAL NET QUANTITIES INSTALLED	APPARATUS FIXED SUM CONTRACT	SUPPLIED WITH (HRS.) WATER	STEAM	CURRENT	AIR	APPARATUS PERCENTAGE CONTRACT	PROGRESS RECORD

SIGNED .... INSPECTOR

Table 2—Inspector's report to engineer.



Curve Sheet 2—Poor handling of work on a power house contract.

man-hours represents a very good, though of course approximate measure of work performed. The completed curve shows where the work slacked and where it was pushed with vigor.

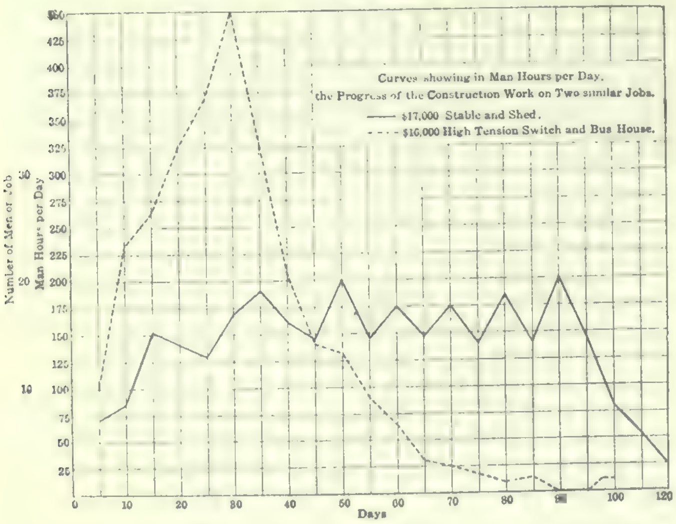
Curve sheet No. 1 is for the purpose of showing how two different contractors handle work of a similar character. The two jobs are contracts 105 and 106, mentioned under "Miscellaneous Building Jobs." The dashed curve with the high peak shows that this contractor pushed the job hard for the first thirty days, at which point he saw that he could complete the job with ease within the allotted time. Hence, he decreased his force, rapidly at first, but continually. From the sixty-fifth to the ninetieth day, the work was carried on in a desultory manner as the details were being cleaned up. The succeeding seven days were devoid of activity as the contractor believed the work to be completed. During this period the engineer made a thorough examination of the job and when he had finished, the unfinished items which he discovered required the attention of one man for two days.

The other curve shows that the contractor on the Stable and Shed contract had a different method of prosecuting his work. The amount of work performed increases during the first thirty days and then continues at a comparatively constant rate for the following sixty days, when it decreases uniformly to the completion of the work twenty days thereafter.

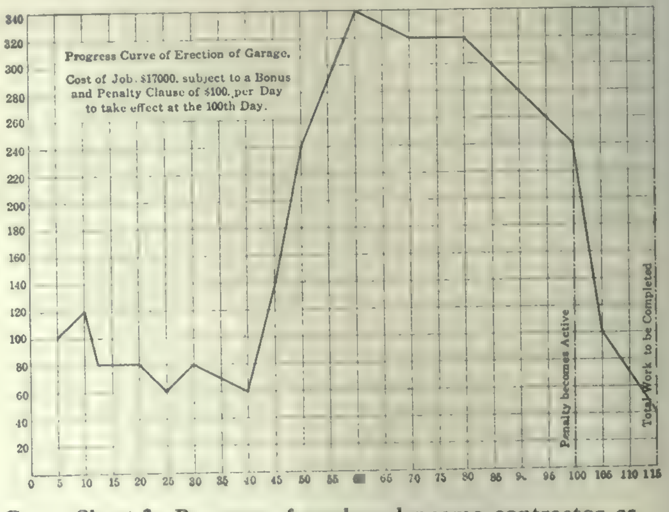
I have had a number of curves plotted for both of these contractors and find that the two just considered are their characteristic curves. The first begins his work with a dash, but soon cools down, when it becomes extremely difficult to push him. When this sort of man is performing work which it is desirable to complete at an early, or at least, on a certain date, it is well to provide a spur within the contract, such as a bonus and penalty clause. The other contractor comes up to speed more slowly, but holds it with greater constancy to the end.

The ideal curve for jobs of this character lasting approximately one hundred and ten days would rise with a gentle sweep to maximum at about the fortieth day, continue constant for twenty days, and then decline smoothly and constantly to completion. There are many factors which tend to make this impracticable, e.g., the non-arrival of certain material, unpropitious weather conditions, strikes, difficulty in obtaining labor, etc.

We will now examine the progress curve, Curve Sheet No. 2 of Contract No. 103 for the construction of a modern sub-station. It shows that the work was poorly handled. There are too many peaks and valleys to indicate connected and well directed effort.



Curve Sheet 1—Comparative performance of two contractors.



Curve Sheet 3—Progress of work under same contractor as Curve 3, but now working under a bonus and penalty clause.

This job required the expenditure of a large amount of nervous energy upon the part of the engineer in order to get it completed within a reasonable time.

The next curve shows this same contractor working under a bonus and penalty clause. The job is the erection of a garage to contain the electric automobile trucks of the company. The contract price was $17,000. The work was to be finished except for certain specified details representing about 8 per cent. of the total work, one hundred days from date of contract, the remaining work to be completed within fourteen days thereafter. The bonus and penalty clause stated that if this approximate 92 per cent. of the work should remain unfinished one hundred days from date of contract, a penalty of $100 per day would be required for each and every day thereafter until the terms of the contract were met, but a bonus of the same amount would be allowed for each and every day that the work required was satisfactorily finished prior to the specified time.

From Curve No. 3 it will be seen that the contractor did not appreciate the necessity of prosecuting the work with energy from the commencement. He dawdled along for the first forty days as he had been accustomed to do in the past. At the end of this period he suddenly realized that he had sixty days left in which to make good. The penalty became a reality that stared him in the face. This job had been let at a time when the contracting business was rather quiet, so that it had been bid pretty close. Every $100 counted, and he had no desire to pay a penalty if it could be prevented. He, therefore, increased his force rapidly and kept them up to speed and just managed to satisfy the engineer. He escaped the penalty, but received a valuable lesson, and it has been noticed that his characteristic curve has been somewhat improved by subsequent management.

The value of these curves will be evident to engineers or superintendents in charge of construction work. They not only serve as a mental picture of the progress of a certain job, but are also of value as a means of impressing the contractor with the way in which his work is managed.

Another curve may be plotted on the same sheet, if desired, showing the percentage of the job completed at the close of each day. These values are estimated by the inspectors on the job. Of course these percentages, being estimated, will be only approximate, but an experienced inspector can estimate the status of the work with reasonable accuracy.

The six contracts assumed in the early part of this article to be active in a certain company should all be followed up as suggested herein. If this be done, each job will be kept separate and distinct and the features of each may be examined on demand. As before stated, this system has been thoroughly tried out and found efficient and valuable under the conditions of practical construction. **Engineering Magazine.**

Brick An Ideal Architectural Material

CONSIDERED from the view-point of beauty, brick would seem to occupy a unique position among the structural materials available for the creation of beautiful buildings.

Brick is made in reasonable small units, so that in the case of many modern buildings, at least 100,000 of them show on the exterior. This, together with the varying shapes and sizes obtainable, make possible an almost infinite variety of form and pattern, thus giving full scope to the imagination, ingenuity and skill both of the designer and the workman.

Brick, moreover, is now made in almost every conceivable color and shade, the permanency of which is unequalled by hardly any other building material; with such a "palette," therefore, at one's command, and by a skilful use of color, the brick builder of to-day can readily add to his design that living touch which the painter gives us in his painting.

Brick may also be counted unique in the fact that it requires for its structural efficiency the use of a very considerable amount of material of quite another kind and color, namely, mortar; and, further, that this material must of necessity show in the form of a joint to a more or less degree in the face of the finished wall. A mistaken idea has prevailed that the mortar joint is a blemish that should be suppressed as far as possible, or be colored to match the brick. We find, however, that the designer of to-day seizes the very opportunity afforded by a mortar joint to introduce into his wall another element of color and pattern.

The word "texture" has lately come into use in connection with brickwork, and, strange to say, this word has a very pausible application, for the builder of interesting brick work has much in common with the weaver at the loom as far as resulting color effect goes. Just as the weaver, with his threads of varying sizes and colors produces a never-ending variety of useful and beautiful fabrics, just so it is possible for the brick builder, with his bricks and joints of many colors and sizes, to weave new ideas and combinations in his work, all in beautiful and imperishable patterns; and this applies to all brick.

Just as the fabric charms and delights the eye, and at the same time protects men from heat and cold, and performs a thousand other useful functions, so the beautiful way of brick, exemplifying man's ingenuity and his artistic skill, forms also the protective structure of the buildings erected for his use. Brick, therefore, would seem to fulfill to a very high degree the requirements of an ideal architectural material.

The Harrisburg filter plant made a new high record for bacterial removal during 1912; the average efficiency for the year was 99.97 per cent. The Susquehanna River water contained, on the average, 5,300 bacteria per cubic centimeter, while the treated water showed average counts of only 2. The operating expenses, at the plant, which includes coagulating basins, rapid filters and hypochlorite apparatus, were as follows, per million gallons of water treated: Coagulant, $1.35; coal, 36 cents; supplies, 42 cents; repairs, 52 cents; oil and waste, .05 cents; chemist and laboratory, 37 cents; salaries, $2.46; total, $5.53. The fixed charges for interest and sinking fund and state tax on the filtration loan was $6.94 per million gallons. The operation of the filtration plant is in charge of Mr. George G. Kennedy, Mr. James M. Caird has served as chemist and bacteriologist.

Magnificent New Hotel for Edmonton

Nine-Storey Building Designed in the Old French Chateau Style for the G. T. P. Development Company — Steel and Concrete Construction

THE MacDonald Hotel, at Edmonton, Alta., is to be located on a beautiful site overlooking the river and at the same time only a few steps from the business and shopping centres and convenient to the railway stations.

The hotel will be built of Canadian granite and buff limestone in the style of the old French chateaux of Normandy and Touraine—a style particularly appropriate to its location on the bluff above the river. Its height of nine storeys, surmounted by a steep, picturesque roof, will make it a landmark to be seen for miles along the river valley, as well as from all parts of the city itself.

There will be more than two hundred sleeping chambers provided, with separate private bath-rooms and telephones, and the building will be equipped with every approved modern appointment.

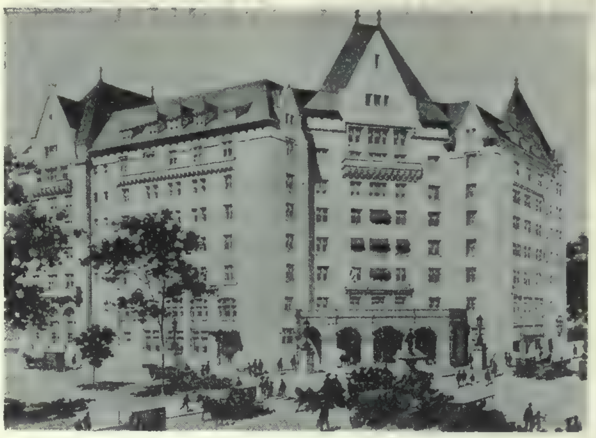
The hotel has its main entrance on McDougall Street, just a step away from the busy corner of Jasper Avenue, so located as to be most convenient of access, yet just away from the noise of the crowded corner.

One enters off the street into a little open courtyard and the entrance loggia and through the revolving doors into the spacious rotunda. From the rotunda one catches enticing glimpses of the lounge and the palm room and of the corridors leading to the dining room, cafe and bar, while the office, telephone and telegraph rooms and the elevators are easy of access and can be found at once. A separate entrance provided for ladies, leads first to the ladies' reception room and then to the corridor directly in front of the ladies' elevator and adjacent to the palm room, without passing through the rotunda.

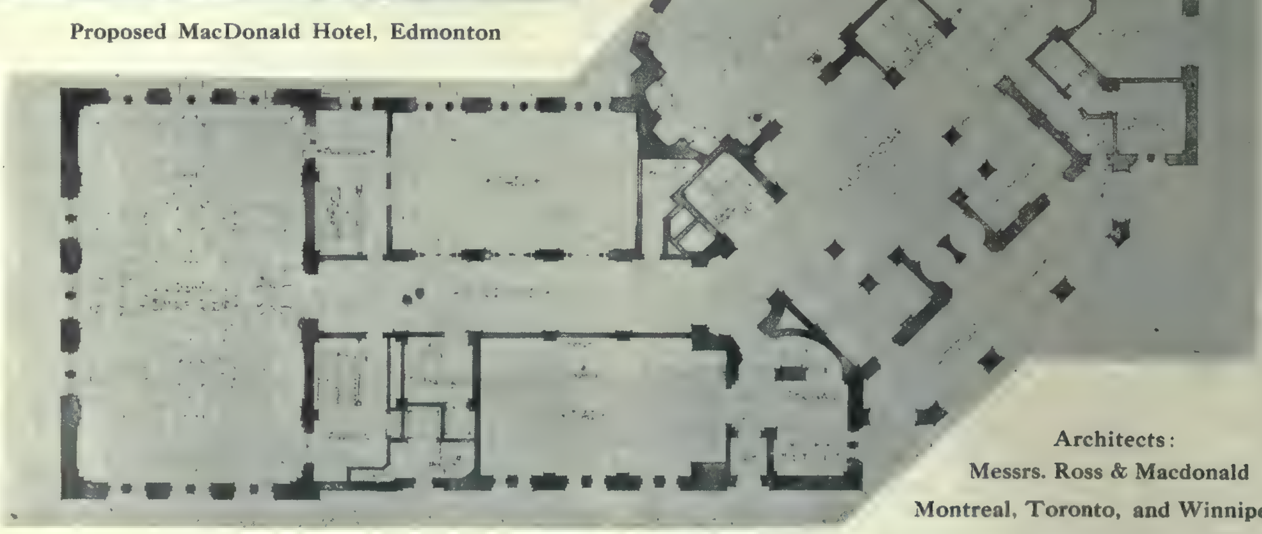
A feature of this floor is the octagonal palm room, free from all columns, with richly decorated ceilings and lighted on all sides by great windows.

Another interesting feature is the large comfortable lounge room immediately off the rotunda, with its great fireplace and its broad elliptical bay window, affording a magnificent view of the river and surrounding country.

From the rotunda the grand staircase of marble and bronze conducts to the mezzanine gallery and foyer, from which one can watch the busy life of the rotunda without participating in it, and from which



Proposed MacDonald Hotel, Edmonton



Architects:
Messrs. Ross & Macdonald
Montreal, Toronto, and Winnipeg

Ground Floor Plan

lead the drawing rooms, ladies' gallery and banquet rooms.

Above the mezzanine floor rise tiers of sleeping rooms and private parlors, reached by means of wide, spacious staircases and elevators, each one with a magnificent outlook over the city and the river. There is not a dark or uninviting chamber in the entire building, and comfort and spaciousness have not been sacrificed to secure a maximum of accommodation. Large closets have been provided in every room.

Not the least desirable feature about this hotel is the fact that it is to be absolutely fireproof, every precaution having been taken to attain this, regardless of cost. All the structural parts are steel and concrete, and the partitions of terra cotta. The floors are of cement and marble and the staircases marble and iron.

With all these precautions fire escapes would seem to be unnecessary, yet these have not been neglected, ample provision having been made for them in several parts of the building, so as to be easily and quickly reached from every room.

The same careful attention has been given to the sanitation of the hotel. All of the bath rooms are models of cleanliness and healthfulness, with porcelain fixtures and tile floors and walls of exquisite design. The bath rooms are all well ventilated, eighty per cent. being outside rooms lighted by actual windows.

The architects are Messrs. Ross & Macdonald, of Montreal, Toronto and Winnipeg.

The Design and Supervision of Construction of Low-Truss Steel Highway Bridges[†]

By G. M. Braune[*]

THE plans for small country highway bridges are usually made by bridge company agents, and experience proves that the majority of county commissioners will accept most any plan so long as the price is low enough. A great number of these bridges are indeed doing service to-day for ordinary light traffic, but should the members be stressed up to the amount for which they were "designed" the chances are that they will refuse to carry the loads. The peculiar thing about the situation is, moreover, that the collapse of such structures, and even the publication of these occurrences, seems to have small effect upon the future construction of similar structures.

The writer has knowledge of the collapse of a bridge built in one of the Southern States some years ago. The top chord was made of two angles and a web plate, in the form of a T-section. In this case, however, the bridge had been accepted by the county commissioners, and it was not until a few days after the acceptance that it collapsed under a drove of horses.

Precautions When Using a Heavy Concrete Floor

Concrete floors are rapidly replacing the former light wooden floors; therefore the actual dead-load stresses occurring in the bridge members are a large percentage of the maximum computed stresses, and the details are seldom designed to properly take care of these large actually occurring stresses. The design of the details is too often turned over to a young, inexperienced draftsman, whose knowledge about the distribution of stresses is generally somewhat meager.

Not very long ago the writer was shown the shop drawings for a 75-ft. pony truss "designed" to carry a heavy concrete floor. A splice of the bottom chord (made of ⅝-in. material) was attempted at one of the lower panel points, and the draftsman had intentionally, although ignorantly, neglected to provide sufficient splice material to equal the area of the cut chord. The correct number of rivets had, however, been provided to take care of the stresses in the different members that were attached to the ⅜-in. gusset plates. When the error was called to the draftsman's attention, he was much surprised, and informed the writer, "that was their usual method of designing splices." Luckily the bridge had not been shipped, and the corrections were made in the shop.

Since heavy concrete floors have come into fashion, resulting in large dead-loads and large reactions, it is very essential that the ends of the trusses should be provided with pin bearings, although this detail is to a great extent ignored, not only by a number of bridge companies, but also in some of the recent textbooks. Owing to the uneven distribution of the reaction over the bearing plate, large secondary stresses will occur in the members designed to take only direct stress.

The writer is personally acquainted with an accident which happened some years ago to a heavy low-truss bridge in which this detail was omitted. As the bridge was not provided with end-pin bearings, large bending moments occurred in the bottom chord, and also, of course, in other members of the truss. One day, when a heavy electric car was crossing the bridge, the bottom chord parted near the end-panel point. Computations showed that the member was carrying a conservative direct working stress; and faulty material was not the cause of the failure as was shown by subsequent tests.

Low-truss bridges, 100 ft. long and over, have been constructed in Europe and in this country, which, from a standpoint of strength, stiffness and aesthetics are all that could be desired. The computations of the stresses, makeup of the sections, and the design of the equally important details, require, and always will require, however, a certain amount of intelligence and experience.

Points About Some of the Details

The lateral forces acting upon the top chord of a low-truss bridge, whether from external causes, or resulting from column action, can be cared for without the addition of unsightly floor-beam knee-braces by designing the vertical posts or diagonals of a form (say, two angles and a web plate, or if the design requires it, four angles and a plate) capable of resisting bending and shear. The overturning effect of the lateral forces can then be transferred into the floor-beams by riveting the vertical posts to the floor-beam web, or through the diagonals into the gusset plates, and thence by means of a diaphragm, into the floorbeams.

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[*] Assistant Professor of Civil Engineering, University of Cincinnati.

[†] Abstracted from an article in The Engineering News

The bending moment in the verticals and diagonals, and hence the resulting indirect shearing action on the rivet connections, would be obtained by multiplying the assumed lateral force by the distance between the center line of the top chord (position of application of lateral forces) and the center of the group of rivets connecting the floor-beam to the vertical posts. The rivet connections should be sufficiently strong to take care of direct shear and also the shearing action resulting from the bending in the posts and diagonals.

The top chord should be of an inverted trough section, sufficiently wide to allow the vertical posts and diagonals to be inserted between the gusset plates. Pin-connected pony trusses should not be tolerated.

Supervision of Construction

As long as intelligent supervision is not had over the design and construction of highway bridges, we will hear of occasional collapses; and there will also occur numerous failures which will not be brought to the notice of the engineering profession.

The question before us is, how can an improvement of this state of affairs be brought about? Some engineers honestly believe that by licensing the practice of engineering good results could be secured in this direction; others hold, however, that this would not overcome the evil, on the other hand, it might make matters worse; for an engineer holding a license would be per se in the eyes of a great many county commissioners a competent bridge engineer, whereas we all know that this would not be the case.

Mackenzie and Mann—Builders of a Transcontinental Railway

By Robson Black

THE obvious suggestion in the mention of "Mackenzie and Mann" is that Scotland is in the offing. In Canada, where forty of their years have focussed on the building of a transcontinental railway, coaxing away franchise, and piping power from Niagara Falls for the biggest kilowatt combine in the British Empire, most of the pioneer jobs have been done by transplanted Covenanters.

In the United States, it is not unusual to find half-a-dozen contesting for the credit of the nation's growth—but in Canada the annual reunions of Lowlander and Highlander settle that point.

The story of Sir William Mackenzie and Sir Donald Mann, and how they have epitomized the strongest characteristics of their race in a two-person alliance, has not hitherto been segregated from the other and more matter-of-fact story of geographical victories through railway building.

While other men have written their isolated chapters in the serial of a national railway system, Mackenzie and Mann in their own unaided strength carried their lines from handicapped birth through troublesome childhood to truly stupendous maturity.

From the day they stood together on a Manitoba hillock and glanced over the infinite monotony of half-bleached prairie-grass, on through forty years of planning and perfecting, they have interlaced the Dominion with speeding trains that bind the grainfields to the seaboard and criss-cross from north to south with more than six thousand miles of steel.

The past contains no such picturesque proof of the possibilities of one span of life, a single brain, one pair of hands, as the building of the great railways of the American continent. For gigantic daring, quixotic faith and uncanny resourcefulness, the tale of the construction of a transcontinental railway system over a vacant wilderness of brown lands and swollen rivers constitutes a sort of Robinson Crusoe in commercial fiction.

The partnership of Sir William Mackenzie and Sir Donald Mann, who only a while back passed beneath the gilding-machine of knighthood, has won distinction for a reason rather unique. Not only have a schoolmaster and lumber-jack built and equipped the Canadian Northern Railway in the face of the bitterest adversity, but they still own it.

Usually, the story of big American railways has contained two chapters: one written by the pioneer, the builder, the man with the idea; the other penned more delicately by the financial diplomatist who reaped where his brother had planted.

Who of the human stream passing into the great railway depots of New York City or San Francisco could tell you the builder of the Southern Pacific or the New York Central? But wherever there is a tongue to speak in East or West Canada, the names of "Mackenzie and Mann" are the ready answer to the question of who created the Canadian Northern.

It is a pleasing equation: two Scots, "Bill" and his comrade, "Dan;" the one weary of birching schoolboys; the other sick of a timber limit and dreaming of a continent; unknown to either, they struck for the heart of the prairies, took up small contracting, then pushed onward, still in their isolated trails, until "big business" cast both men near Kicking Horse Lake, an effervescent construction camp at the foothills of the Rockies.

Donald Daniel Mann, seeking a new load of grub for his navvies five miles back country, went townward.

Along the same trail he spied a lean and sinewy figure in a coarse suit and prospectors' fatigue boots that harmonized with the rough duties of William Mackenzie. Mann sharpened his pace. The sound of his mighty steps made the first traveller glance backward; his gait slackened. When the big fellow caught up with him he turned and nodded. The other nodded too.

"Going for grub," admitted Bill.

"Same here," sympathized Dan.

That was the first meeting of Mackenzie and Mann. It was some years afterward that an actual partnership came about with a contract for a small Western railway as their first giants' menu; but there is little doubt that in the stroll to Kicking Horse town some keen and stealthy analysis of each other's strength was paving the way for one of the finest business coalitions ever known.

Mackenzie is commonly spoken of in exaggerated terms; but he is neither wizard, alchemist nor goblin. He attains his marvellous ends after the manner of men and the works of men. He is perfectly normal flesh and blood—not much more than five feet of it, either.

His journeyings here and there, his positive delight in brewing a mystery, his cautious radicalism, his calculating method in transactions, are those, perhaps, of a hundred other heads of great organizations across the face of the financial world. He is in every detail a business scientist. His lieutenants are usually treated with large salaries and scant sentiment.

He does not assume to be his brother's keeper, but on no account must that attitude be presumed by others. He has all the crisp, curt ruthlessness of a Napoleon applied to the warfare of elevated finance; nor had the Little Corporal a finer fund of persistence, economy of effort, swift perception, self-control, or more absolute judgment of his fellow-men as productive or non-productive units in some high-efficiency grist-mill.

Sir Wm. Mackenzie.

Sir Donald Mann.

A short while ago his solicitor appeared before a commission of the Federal Government at Ottawa. Finding it necessary to explain to the members of Parliament his personal anxiety to obtain a charter from one place to another in the west of Canada, the lawyer remarked frankly: "Gentlemen, this is no picnic for me, I assure you. One day Sir William drops into my office. 'We are going to run a line between these two towns,' says he, throwing down a map. Then I try to tell him I have no charter. 'Well, why in blazes haven't you?" That's all. So I pack my grip and come down here," ended the lawyer.

That is Mackenzie through and through. He demands precisely as much thought, care, courage, cunning and patience as he in his own person would give. When it is not forthcoming there is usually a row, and the office boy salutes a new boss o' mornings.

If the writer were called upon to denote one outstanding distinction in Mackenzie it would be a healthy Celtic-Saxon propensity for a personal conflict, an inborn appetite for "fight." Not that he is stubborn; his nature is intensely virile but refined; his expression has an attractive calmness, dignity, and an air of kindliness. Yet hidden in a pair of eyes totally inscrutable through a veil of shadows of deceiving texture is the impatient spirit of a consistent victor who refuses to scent defeat.

Mackenzie is not of the opulent, supervain or covetous sort either, for his threescore years have been a very real contribution to the book of Canadian and British progress. By convenience a citizen of Toronto, he is by choice and in the natural channels of his genius an international trader in capital and dividends and a much more productive Empire-builder—if less picturesque and poetic—than his elder brother, the African Rhodes.

The ascent of a pair of Canadian youths into the orbit of the world's mightiest was no combination of lucky accidents. They have done what they have done as regularly as (if more radically than) the system of British banks from which they draw their bags of millions—and, so far from being assisted or propelled by the money or the goodwill of other Canadian railway interests, their London flotations have been forced through often in the teeth of atrocious rumors and other malignant bearish influences.

A little while back, out of the scrapheap of vague newspaper gossip and street-corner speculation about the city of Montreal burst a dazzling story bearing the official stamp of Mackenzie and Mann.

The whole city stood in amazement; the Grand Trunk and Canadian Pacific Railway companies tried to smother their disappointment in a show of incredulity.

By this time the deed of that day has passed across the tongue of Canada—how the Canadian Pacific and the Grand Trunk held the metropolis of Canada as a jealous monopoly, scorning the efforts of the Canadian Northern to enter the city by any known route. To purchase an entry to Montreal would have required more cash than could have paid a return. And that was flawless logic—in so far as conservative vision could embrace the situation.

At the back of the city loomed a high and thickly-wooded hill called Mount Royal, which effectually confined the flow of traffic and the spread of population to the comparatively narrow strip between its base and the curve of the St. Lawrence River. To the farther side of the barrier lay an area of cheap land, rendered so through the indirectness of its street railway facilities.

I believe the idea struck "Dan" first. "Bill' went down to look it over. Then silence—long, exasperating lull, during which only the drip, drip, of a brimful newspaper story coursed through the daily columns. But it spilled at last, right to the dregs.

And the country read that day how Mackenzie and Mann had secretly purchased seven miles of dirt-cheap land back of the mountain—how they were to drive their railway into the heart of Montreal by tunnelling the base of the hill; how the direct route thereby effected would send the value of the land-purchase into thirty millions of profit by creating a new residential district within a few minutes' trolley ride of the heart of the metropolis; how the brilliant engineering coup would take away the back-breaking burden of the tunnel's cost, pay for the terminals, and leave a long line of money-bags as a surplus for the company's treasury.

Sir Donald Mann is the unsung genius of the Canadian Northern combination. He receives few deputations; he seldom makes comments to the Press; he is not the social ambassador of the system by any action or pretence; only recently has he bothered much with the political life of the western provinces or the Federal government.

When people call round who talk too long or too circuitously, "Dan" blows a bombshell of cigar smoke half way across his room, and on occasions has been known to mutter big declamatory things that roll and rumble like a fretful tempest in the foothills.

"Dan" Mann is deep-chested, solemn-eyed and reflective. A closely-trimmed beard does its best to soften the lines of a Samson's face, and in these latter days, with the increasing strokes of grey, the shadows are meeting the high-lights upon a more amicable understanding. The head is set solid; its lines are not in the least degree apologetic; the eye is the master's eye; the voice is the channel of muscular words—some little flash of sunshine once in a long time—but usually his contact with his fellowmen brings up the more austere reflections of the Nature he has known with an imperial intimacy.

His physical strength has been titanic. Once, while still a boy on his father's humble farm near Acton, Ont., he set off for town with a wagonload of garden truck. He had little difficulty in disposing of his stock, and found himself with several hours of idleness before the time of his return.

His stroll brought him to the town commons, where the athletes of several counties were testing their skill at an annual tournament of sports. Young Daniel hung about the crowd for a while, then, unable to restrain his spirits, threw off his coat and entered his name in practically every event, from throwing the discus to wrestling, boxing and running.

When he hitched up the team for home that night he was richer by forty dollars of cash and a china tea-set.

That physical dominance was in his case the complement of a massively-formed intelligence. And it struck it roots with as much dissimilarity from his comrade Mackenzie as Cromwell showed from Cardinal Mazarin.

Beauty and Utility in the Skyscraper

IN St. Louis what is styled "the world's largest business building" is about to be opened. It has twenty-one storeys, with an area of 65,000 square feet for each floor. It is light and airy, and evidently well constructed, and no doubt it is in all particulars adequate to the commercial uses to which it will be put. But it is abominably ugly, comments the Philadelphia Ledger. Its plan is uncompromisingly, pitilessly rectangular and rigid. Each facade presents the appearance of an enormous vertical cucumber frame of multitudinous windows. There is not a single visible attempt at adornment, not a curvilinear effect of any sort to relieve the rows and rows of squares and oblongs and gaunt upright parallels.

By way of striking contrast, take the new Woolworth building, which dominates Manhattan Island with an upsoaring shaft of stone that answers to Mme. de Stael's famous definition of architecture as frozen music. This is a building at once useful and beautiful. It nobly asserts above Broadway its spiritual inspiration, just as Trinity church stands at the head of the rush and roar of Wall street like a perpetual minaret and muezzin call. When such results are feasible, what is the excuse for uglifying a downtown city block with the hideous angularity of such a structure as that upreared in the metropolis of the Mississippi valley?

In every American city to-day there are increasingly abundant examples of the way to build great houses of business that blend the practical and the inspirational values. Philadelphia has a goodly proportion of such ornamental edifices, in which thought was altruistically taken for the improvement of an entire neighborhood. In time, with the contagion of taste and esthetic education, the "cloud-scratching" monstrosity will be an abomination of the past.

Organization, co-ordination, co-operation, are the right of every body of men whose aims are worthy and equitable and must needs be the resource of those who individually are unable to persuade their fellowmen to recognize the justice of their claims and principles. If employed within lawful and peaceful limits it may rightly hope to be a means of educating society in a spirit of fairness and the practical brotherhood.—Bishop Potter.

Canada is the world's chief source of supply of asbestos. According to the preliminary returns, Canada's output of asbestos in 1912 exceeded that of 1911 by at least five per cent. The output was 97,816 tons, the sales 106,520 tons, valued at $2,959,677, or an average of $27.79 per ton, and the stock on hand at the end of the year 21,686 tons, valued at $1,021,066. The record indicates an increase in sales and reduction of stocks on hand. The exports during the year 1912 were 88,008 tons, valued at $2,349,353, as against 75,120 tons, valued at $2,067,259, in 1911.

Methods of Purifying Water in the Household, with Some Costs

THE methods available for the purification of water in residences are of interest to water works men and engineers who are frequently asked to recommend a type of water purification plant for residences not served by a pure public supply of water. Experiments, which have been conducted in the laboratories of some of the engineering colleges, indicate that certain forms of household water purification plants now on the market are of no value. Some of these devices are worse than useless since they give a feeling of security to the water user, yet do not remove bacteria. In a recent paper before the Iowa Engineering Society on the Purification of Water for Residences, Mr. J. H. Dunlap, Assistant Professor of Hydraulics and Sanitary Engineering at the State University of Iowa, discussed the various types of household filters now on the market in a very frank manner. Portions of the paper abstracted and quoted by Engineering and Contracting are given below.

The following methods of purifying water in the residence will be discussed: (1) by chemicals; (2) by electricity; (3) by heat; (4) by filtration.

Purification by Chemicals.—Hypochlorite of lime has proven itself a valuable germicide. Experiments with chlorine itself seem to point to a new process that will do away with the difficulties of using the customary bleaching powder and with the consequent formation of sludge. For comparatively large amounts in institutions, engineering camps, etc., hypochlorite of lime has a field. For the ordinary householder, however, it is out of the question.

Purification by Electricity.—Electric current may be used in household water purification, either in the ozone process or in the ultra violet ray process. Ozonizers have been greatly improved in the past ten years. In 1890 the Berthelot ozonizer produced one gram of ozone per kilowatt hour, as against 215 grams from the Meeker ozonizer in 1911. In this country household air ozonizers are on the market. Abroad household water ozonizers are coming into use. The first cost of one good type is about $40. Wherever electric current is available it is a convenient method, for the full output of the tap may be depended upon to be sterilized and well aerated. In Europe last year about $7,000,000 worth of business was transacted in ozone apparatus. Future development in this country is bound to be rapid. As for the ultra violet ray process it is already used considerably abroad. In this country it is likely to be used more in the near future. In France small household apparatus is available. The North Railway Company of France is reported to have adopted this process for sterilizing the water supplied in its stations. The common method of producing the rays is by a Cooper-Hewitt mercury vapor lamp, using a quartz tube.

The process thus far described, while not in actual use to any great extent in this country, are mentioned in order to indicate what direction the future course of events is likely to follow.

Purification by Heat.—Boiling impure water is of course the most common way to kill the bacterial content. Many people erroneously suppose that it is necessary to boil the water for 15 minutes or even half an hour. As a matter of fact the heat will have done its work as soon as all the water has reached 212 degrees F. Since individuals differ in the standard used for determining when the water is boiling, it is customary to advise boiling for five minutes. This is an extremely expensive and laborious method as ordinarily done. The Forbes Water Sterilizer solves the problem.

This sterilizer is so made, that although it boils every particle of water for a few seconds, it does not render the water unpalatable. Water is discharged continuously at nearly its original temperature, having given up its heat to the incoming supply. It costs in the household size, about $25. The capacity of this size is 2 gals. per hour. Capacities up to 500,000 gals. per hour are advertised. Any heat source may be used, steam, electricity, gas, kerosene, or alcohol. One foot of gas is said to sterilize one gallon of water, which shows it to be very economical in operation.

The two sanitary drawbacks to such an apparatus, or to boiling in general, are first: that a turbid water is not clarified; second, that the vegetative forms of bacteria are not destroyed. The spores remain. Now abroad several types of apparatus are in use for boiling water under pressure at a temperature of 115 deg. to 120 deg. C., which will destroy the spores. Until it is more clearly proven than at present, that the usual spore forming bacteria are harmful, such apparatus will not come into general use in this country. Some recent studies of the spore forming bacteria found in water have been made, but further investigation along this line is needed.

Purification by Filtration.—The other draw-back of boiling, the lack of removal of turbidity and suspended organic matter, can be overcome only by filtration. If all the water for the house is to be filtered, and the water is under the pressure of a town supply, rapid filtration may be used. Many companies are manufacturing pressure rapid filters in household sizes ready for installation by any plumber. Whenever the water needs preliminary coagulation, an automatic alum feed is provided.

The New York Continental Jewell Filtration Company charges $100 for its 12-in. New York House Pressure Filter. The capacity of this filter is 2 gals. per minute. Hence no householder need use turbid or highly-colored water, even though the community in which he lives cannot provide better. The bacterial efficiency of this type of filter, considering the conditions under which it is run, is probably not over 75 per cent. Hence subsequent sterilization is necessary for water used in drinking and in cooking, and may be accomplished either by heat or by certain kinds of filters to be described later. The filtering medium of the New York type is ordinarily sand. The water passes downward through the sand, through the strainers at the bottom, and then to the tap. Once a day the flow is reversed and the rakes are revolved by turning the handle at the top. The water and the revolving rakes thoroughly churn up the sand, and the dirt and many of the bacteria are flushed out. If two filters are used, water filtered by one may be used for washing the other. Alum in solution is held in a coagulant tank.

A few pounds of alum will last for days, 1 lb. being said to be sufficient for 7,000 gals. of water.

One way of purifying small amounts of water is by means of a home made slow sand filter. One of these little filters was in successful use at Dartmouth College for 15 years. It consisted of two vitrified tile pipes, 10 ins. in diameter, the upper one filled with sand of the proper size, with a few pebbles directly above the cement slab bottom. Through a small hole in the center of this slab the filtered water dripped into the lower tile, which thus served as a reservoir. Such a filter will cost about $8.

Sterilizing either turbid or clear water for drinking and cooking purposes may be done by a Pasteur-Chamberland household filter, manufactured by the Pasteur-Chamberland Filter Company, Dayton, Ohio, or by a Berkefeld household filter, manufactured by the Berkefeld Filter Company, New York City. Either type will cost about $6 in the smallest size convenient for an average household. The Pasteur-Chamberland filtering medium is unglazed porcelain. It was developed by the eminent French scientist, Louis Pasteur, and his assistant, Chamberland. The hollow filtering tubes are commonly called candles, because of their shape. They are made in France and are all of one size. The capacity of a single candle, with average water, is about one quart per hour when under 40 lbs. pressure. Any number of candles may be placed inside of one case when larger capacities are needed. They may be used anywhere by anyone, both gravity and pressure types being manufactured. Due to the slow rate of filtration a storage reservoir is convenient. The raw water surrounds the outside of the candle and slowly passes through its walls into the interior, leaving the bacteria and the dirt in the pores of the candle.

The Berkefeld candle is made of diatomaceous earth. The candles are made in different sizes. For large capacities any desired number may be placed inside the same case. In the smallest size the rate of filtration, under 40 lbs. pressure, is about 40 quarts per hour, as against the one quart per hour from the Pasteur. The Berkefeld, like the Pasteur, is made in many forms for water under both pressure and gravity conditions. The higher rate of filtration of the Berkefeld obviates the necessity for a storage reservoir, though this may add to its convenience at times

Another filter that will sterilize water is the Woolworth, manufactured by James G. Woolworth, Providence, R. I. During a period of 1 year and 46 days Professor Frederick P. Gorham of Brown University made 40 tests of the effluent from this filter and found it unfailingly sterile. The filter candle differs from all others in use of a mantle of aluminium hydroxide, bound together by mineral wool, supported on a porous earthenware tube. At present it is not upon the general market. In Providence and New York it is finding considerable use. To prevent neglect of the filters by the householder, it is the custom to lease them at $1 per month. With the lease goes a system of regular inspection and renewal of the candles, the average life of which is five months. Although Providence began filtration of its water supply several years ago, the demand for the Woolworth pure water service is said not to have lessened.

Of course there are many other kinds of household filters. Since most, if not all, of them are worthless, certain principles should be observed in making a selection. First, the value of a filter in general is in inverse ratio to its rate of filtration. Any filter that is to yield a sterile effluent, and that filters more rapidly than the Berkefeld, is to be looked upon with suspicion. This rules out the common cheap types. Second, natural stone filters of all classes and descriptions are to be avoided. A filter of this type costs nearly as much as the ones recommended, and can never be depended upon.

In order to test the natural stone type against the Berkefeld and the Pasteur, some experiments were recently made by the author, assisted by Dr. Arthur C. Grover of the Department of Pathology and Bacteriology of the State University of Iowa. Now according to the manufacturers, these stone filters do not need sterilizing, all of the impurities being said to be caught upon the surface, whence they may be easily brushed off to prevent clogging. Experiments, however, prove, as might be anticipated, that bacteria readily grow through the pores of the stone. Two types of bacteria were applied at different times, the Bacillus ruber de Kiel and the Bacillus coli communis. The effluents were plated on the usual media. The stone filters tested were of three different makes. After a run of 24 hours the effluents from all of the stone filters tested were of three different makes. After a run of 24 hours the effluents from all of the stone filters showed considerable contamination. After a run of one to five days the effluents ranged from about 1,000 to 10,000 bacteria per c. c. Of coures, the fact that certain types of bacteria, when applied in a solution containing millions per cubic centimeter, are able to pass through these stone filters in so short a time, does not prove that the typhoid germ, when present in the raw water in the usual numbers, would do so as easily. But the uncertainty renders stone filters worthless, if a sterile effluent is desired. They are very successful in removing turbidity, but not bacteria.

The tests on the Berkefeld and Pasteur filters lead to the belief that these filters will yield a safe effluent if sterilized daily. This should be done at a regular time each day, so that it will not be forgotten. Boiling the candles for about five minutes will suffice, together with all the surfaces that come into contact with the filtered water. For this requirement the construction of the Berkefeld is admirable. It will be convenient to have two candles, one to be in use while the other is being sterilized. Too much emphasis cannot be placed upon the necessity for frequent, regular sterilization of these types of filters. Unless the householder can attend to this himself, or has someone who can be trusted to attend to it, the filters should not be used. Boiling the water is in such a case the only resort. The question of how frequently the filters should be sterilized is one upon which difference of opinion exists. Some authorities advise boiling once a week. Others agree with the recommendation above, that daily boiling is necessary for absolute safety. It seems to be true that the bacteria grow through these filters. They do not pass through at once. But in the course of two or three days may succeed in developing in the pores of the filter walls, and in this way appear finally in the effluent. The rate of growth increases with increase in the temperature of the water, and is independent of the pressure of the water at the tap.

From the foregoing considerations the following summary must be given of household apparatus available for water purification. The Forbes Sterilizer is a most practical device for boiling. For water containing an objectionable amount of suspended matter, rapid or slow filtration with the household types is necessary. For subsequent sterilization either boiling or filtration by the Pasteur-Chamberland or the Berkefeld filters is possible, remembering to sterilize these filters daily.

The Bacterial Clarification of Sewage

IT will hardly be disputed that the most costly part of a modern sewage works, certainly in capital expenditure and often in revenue charges, is the filtration area. Just as the difficulty of land treatment of the sewage of large cities forced on the consideration of more compact processes, so these in their turn are becoming impracticable when great centres of population have to be considered. This conclusion was impressed upon the senior author of this paper when called upon recently to report on the proposals of the Metropolitan Sewerage Commission of New York for the disposal of the sewage of that city. This conclusion was shared by his colleague, Mr. J. D. Watson, who reported simultaneously from an engineering point of view.

The area and cost of filter-beds depends mainly, it will be found, on the amount of colloidal matter present in the sewage, and much confusion of ideas is probably due to the fact that the ordinary sewage filter, be it contact or trickling, is called upon to do two entirely different things at the same time—viz., on the one hand to oxidise, granulate, and finally discharge as humus the colloidal matters present, and on the other to oxidise and nitrify substances in true solution.

A very open grade deep filter is best suited for the first purpose, a shallow fine-grained filter is the most economical for the second. It is true, as Dr. Reid has shown in the Potteries, that a tank effluent well clarified by sedimentation can, by accurate distribution, be very efficiently purified on filters of fine material, but even then the area and cost involved when exceptionally large works are under consideration make the problem a very serious one. For these and other reasons the thoughts of many workers in sewage treatment have been turned to the possibility of more efficient removal of colloidal matter before the filtration process.

Hitherto almost the only practical method has been heavy chemical precipitation. The cost and difficulty of this process when really efficiently carried out (and it should be emphasised that a mere prefunctory addition of a few grains per gallon of precipitant is money thrown away) become very great as the volume of sewage increases. Not only are enormous quantities of chemicals necessary, but the disposal of the vast volume of resultant sludge, without menace in some way to the community, becomes increasingly difficult and costly.

Method of Obtaining Clarified Effluent

The thought which has been in the minds of the authors of the present paper has been to find a method of obtaining a thoroughly clarified effluent without the use of large quantities of chemicals and with the minimum production of sludge. By a thoroughly clarified effluent is meant one which will not eventually deposit solid matter either on the bottom of a stream into which it flows or in the interstices of a bacterial filter. It is clear that in a sewage filter a combined oxidation and coagulation of the colloidal matter must go on, resulting in the production of the so-called residual humus, which either is collected in humus tanks or is periodically washed out of the medium. If this oxidising and coagulating process could be brought about by suitable open tank treatment before the filtration process, it is obvious that the latter could be enormously accelerated, if not dispensed with altogether, and the whole operation of sewage treatment could be conducted on a much smaller area.

In the course of a research on another matter, one of the authors had occasion to study the reactions of an organism occurring in Nature in pit water impregnated with iron. This organism, which for convenience has been designated B7, is a true facultative organism, preferably an aerobe, and exercises a specific action on iron solutions.

The action of the bacillus on iron solutions proceeds in two stages, in which the aerobic and anaerobic actions appear to be symbiotic, at any rate under the conditions occurring in Nature. The aerobic action is to precipitate ferric hydroxide from iron solutions, while the anaerobic action is to transform the hydroxide thus precipitated into bog ore, with partial reduction of the iron to a ferrous state. It was found that in order to precipitate the iron sufficiently the organism required a certain proportion of albuminoid organic matter. It was therefore natural to expect that ordinary sewage matter could be utilised in this way. Experiment, in fact, showed that a sewage effluent could be effectively clarified in this way when acted upon by this organism in presence of small quantities of ferric salts, aerobic salts, aerobic conditions being maintained in the liquid by means of a current of air.

The process therefore by which it is proposed to clarify sewage is, in the first place, to remove the grosser solids, either in a plain sedimentation tank, an Emscher tank, or a Dibdin slate bed, in such a manner, i.e., as shall give rise to the least amount of putrefactive change in the liquid portion of the sewage. The effluent from this preliminary process would be led into a second tank, where it is inoculated with the organism, a small dose of ferric salt is added, and air blown through till clarification sets in. A period of settlement is then allowed for precipitation of the coagulated matter, and eventually the clear liquid is run off, either for rapid final filtration or for direct discharge into the stream. The precise mode of action of the organism is not yet fully worked out, but it seems likely that simultaneous precipitation and solution takes place, some of the organic matter being converted into amido derivatives, and some being coagulated and thrown down with the ferric hydroxide.

The ordinary methods of sewage analysis fail to reveal the change which has really taken place during this process, as they do not differentiate between organic and nitrogenous material in the colloidal and crystalloidal states respectively. It should be pointed out that a fairly strong solution of amido acids, which are the end products of protein degradation, is not necessarily putrefactive, though they require oxygen for their final conversion into nitrate. A recent unpublished research by Mr. R. M. Beesley, a co-worker of the authors, has shown that there is no great difference between the rate of oxidation of substances such as uric acid and glycin, and simpler bodies such as urea. It may be anticipated, therefore, on all grounds, that the clarified liquid resulting from the process as above described can be oxidised at a very rapid rate.

As the conditions during the process are maintained, as far as possible, aerobic throughout, and there is always a certain amount of ferric hydrate present to oxidise offensive sulphur compounds, it is not anticipated that the aeration can give rise to nuisance, and none has been observed in laboratory trials where these conditions have been fulfilled. Experiments in the laboratory with quantities up to four litres have shown that it is possible to clarify a strong faecal emulsion in this way.

A limpid, sparkling and non-putrefactive effluent was obtained from domestic sewage drawn from a sewer near the laboratory. Ordinary tank effluent from the Manchester Corporation sewage works at Davyhulme has been rendered non-putrefactive on incubation. So far only approximate estimates can be given of the amount of iron salt required and the duration of the blowing process. Experiments would indicate that 1 grain of iron-salt per gallon is the maximum need, and that a total of twelve hours' tankage—i,e.. six hours' aeration and six hours' settlement—will be sufficient.

As regards the inoculation of the organism, once the growth has been established in a tank there appears to be no difficulty in maintaining it. The fact that large bodies of water in the old colliery workings at Worsley, near Manchester, are teeming with the organism, is sufficient evidence of its vitality. An experimental plant has been erected at the University of Manchester which will permit of accurate observations of this process to be made, and sufficient data to be collected to serve as a basis for work on the larger scale. It is already evident that the conditioning factor is the cost of an air blast; the pressure of air will, of course, depend simply on the depth of water to be blown through, and a number of engineering conditions will naturally affect this part of the problem.

It is reasonable to suggest that much of the power required could be obtained on the one hand from gas collected from the fermentation of the main bulk of the sewage solids, either in Emscher tanks or by some kindred process, or the fall available from the aerating tank might often admit of the water-head being turned into power. In any event the authors believe that they are justified in bringing the idea forward at this congress in order that it may be discussed from different points of view.

Aeration of Sewage

Experiments on the aeration of sewage in different ways have, of course, been made by different observers. Dr. Dupre and Mr. Dibdin, in Vol. 2 of the Report to the Royal Commisison on Metropolitan Sewage Discharge, in 1884, describe a large number of experiments on the aeration of London sewage. In 1888, Mr. Hartland, in conjunction with Mr. Kaye-Parry, patented an aeration chamber for purification of tank effluent. In 1892, Mr. Sydney R. Lowcock conducted experiments on the aeration of filter-beds by a forced air supply. Dr. Adeney's long series of careful researches have thrown great light on the chemical changes occurring when sewage is completely oxidised by prolonged aeration. In 1897 one of the present authors carried out extensive experiments on the aeration of tank effluent under various conditions, and recently Messrs. Black and Phelps have carried out a number of experiments on the aeration of New York sewage, while the subject is also being studied by the chemists of the Massachusetts State Board of Health.

The advance claimed in the present communication is the use of a specific organism found in Nature, together with iron salts, to effect the clarification of the effluent—that is, the coagulation of the colloidal matter as distinct from the purification of the effluent taken as a whole. To use a simple illustration, the addition of a little rennet does not appreciably alter the composition of milk as a whole, but separates it into a solid and liquid portion. The endeavour of the authors has been to obtain a similar result in the case of a sewage tank effluent; to collect the precipitated colloids, and purify the liquid portions by high speed filters, or it may be in large tanks stocked with suitable aquatic plants.

One of the most remarkable feats in railway construction and railway development ever recorded has been the creation of the Canadian Northern Railway system, says Engineering News. A dozen years ago the Grand Trunk and Canadian Pacific controlled nearly the entire railway system of Canada. There seemed no possibility that a new enterprise could arise to compete with these great and powerful companies. From comparatively small beginnings, however, the Canadian Northern system has grown at such a phenomenal rate that it now has nearly 5,000 miles of railway in operation and 2,500 miles additional under construction. At present, the system comprises two widely separated groups of lines in the eastern and western provinces, but construction is well advanced upon the connecting line which will link these up into one homogeneous system. In view of this development the railway will require extensive terminal facilities at Montreal, and in order to secure a direct and convenient entrance to that city a three-mile tunnel is being driven through Mount Royal, the mountain which dominates Montreal Island and gives its name to the city. This tunnel is of special interest from its section and its length, and especially for the great speed with which it has been driven.

A novel cement for concealing the flaws in wood may be prepared as follows: Put any quantity of fine sawdust of the same wood your work is made with into an earthen pan, and pour boiling water on it; stir it well, and let it remain for a week or ten days, occasionally stirring it. Then boil it for some time, and it will be of the consistency of pulp or paste. Put it into a coarse cloth and squeeze all the moisture from it. Keep for use, and, when wanted, mix a sufficient quantity of thin glue to make a paste; rub it well into the cracks or fill up the holes in your work with it. When quite hard and dry, clean the work off, and, if carefully done, you will scarcely discern the imperfection.

Loans on reinforced concrete structures and the periods granted for their repayment have been investigated by a committee of the Concrete Institute, according to the "Surveyor." It was determined that the government board had not fixed any definite period, but dealt with each case on its merits. However, the following periods are taken as a basis of comparison for the more common types of construction: Bridges with flat superstructure properly protected by a layer of asphalt or other suitable material, reservoirs and tanks containing liquid, 10 years; arched bridges protected from moisture by a layer of asphalt or other suitable material, 15 years.

Many Fine Exhibits Seen at Toronto

Higher Standards Generally in Evidence at the Canadian National Exhibition—Creditable Displays by the Constructional Interests

THE 35th Annual Canadian National Exhibition of 1913 established a general high-water mark. Not only was the attendance greater, as we were reminded constantly by the Exhibition directors—who in their enthusiasm waxed over-strong on this point, perhaps—but also greater care was shown in the manner of exhibiting the various lines of manufacture—at least this applied to those products which entered into the immediate constructional domain and which, after all, formed a fair proportion of the total number and represented a substantial part of the value of the exhibits shown.

We are quite in accord with the Hon. G. E. Foster, who complimented the Directors of the Exhibition on the perennial freshness of the show and paid tribute to the value of the great national event as a medium for bringing people from all parts of the country into close personal contact with each other.

Undoubtedly the Exhibition plays a great part in the development of the country in that it improves trade relations and provides an incentive for higher attainment. Few complaints were heard this year, except perhaps on the score of transportation—and this problem, we suppose, like the poor, we shall always have with us.

Below we give brief mention of a number of the more interesting exhibits identified with the field of this journal. Pressure of space prohibits our devoting more attention to the many interesting lines, but we shall be glad to learn of any notable omissions and to receive supplementary particulars.

Galt Stove and Furnace Company, Limited, Galt, Ont.—Exhibiting a line of their "Majestic" coal chutes. These chutes can be installed in either new or old buildings. The ready operation of the chute under all conditions is a meritorious feature.

Buffalo Pitts Company, Buffalo, N.Y.—This company demonstrated their haulage train on the grounds. This train is used very extensively by municipalities and contractors in Canada and the United States. The train consists of a road locomotive and half a dozen patent reversible type of road cars which can be steered either way by simply throwing a lever.

Tuec Company, Toronto—Demonstrating the Tuec stationary air cleaners which have already been described in detail in this journal and the efficiency of which is too widely recognized to call for comment. Mr. J. J. Martindale, who was in charge of the exhibit, reported excellent business.

The John Deere Plow Company, Toronto.—Exhibiting a number of road plows and also demonstrating the Watson dump wagon.

W. D. Beath & Son, Toronto.—An extensive line of switches and cross tracks, as well as a variety of derricks, both hand power operated.

The Ontario Wind Engine & Pump Company, Limited, Toronto.—Demonstrating the efficiency in the operation of their pumps and other lines. Also showing the Chapman gas engine.

The Geo. B. Meadows Toronto Wire, Iron & Brass Works Company, Limited.—This company were exhibiting a number of samples of their ornamental iron, bronze and brass work and metal lockers. As a new feature they had a sample of their latest line of stairways which was attracting considerable attention.

The Luxfer Prism Company, Limited, Toronto, Ont.—Some very handsome examples of memorial windows were to be found at this company's exhibit. They also had on view a full range of their prism lines.

Abram Cement Tool Company, Windsor, Ont., were exhibiting a full line of the "Abram" wrist motion tools. Mr. Abram doing the demonstrating work in the space occupied by Wettlaufer Bros., Toronto, who are agents for this line.

F. W. Bird & Son, Hamilton, Ont.—This company had some attractive samples of their well-know Neponset wall board, Neponset flooring sound-deadening felt and a full line of their Neponset products.

The Cockburn Lumber & Concrete Company, Dundas, Ont., have recently started the manufacture of a product which is composed of crushed rock and Portland cement. This material, they claim, will greatly improve with age.

Dominion Belting Company, Limited, Hamilton, Ont.—A full line of "Maple Leaf" products was on view in this booth, an attractive display of "Maple Leaf" brand stitched cotton duck belting being shown. The "Crescent" belt fastener was also demonstrated.

The Dennis Wire & Iron Works Limited, London, Ont.—Various types of metal and steel doors and lockers formed the chief items of interest in this exhibit. There were also on view some ornamental designs in lamps and lamp stands.

Black Building Supply Company, Limited, Toronto, Ont.—Some very handsome terra cotta work manufactured by the Northwestern Terra Cotta Company, Chicago, decorated the walls of this exhibit. The company also had a good example of an old-fashioned fireplace, which was equipped with the "Covert Improved" fireplace damper.

William Hamilton Company, Limited, Peterboro, Ont.—This company were making a feature of their centrifugal pumps and an improved Samson water turbine. The pumps have been especially designed for contractors' work. The exhibit was in charge of Mr. R. C. Cameron, sales manager.

The Pedlar People of Oshawa, Ont.—Showing their lines of "Toncan" metal and corrugated pipe. One of their garages was exhibited in use as an office. The portable, galvanized metal structures made in unit sections by this company were of special interest. The metal lath known as "Perfect" came in for considerable attention. Corrugated culverts were a feature of interest.

The Metal Shingle and Siding Company, Ltd., Preston, Ont.—Associated with the A. B. Ormsby Company, Limited, Toronto. Had an interesting exhibit in the shape of a model barn, constructed of steel trusses covered with wood sheeting and having a galvanized roof and sides.

M. Hutchinson, Toronto.—Demonstrating the Hutchinson combination woodworker, a machine which is a labor and money saver for builders, contractors, etc. This machine attracted considerable attention.

R. A. Lister & Company, Limited.—Demonstrating the Lister-Bruston automatic electric generating plant which is especially suitable for small towns, hotels, clubs, churches, etc, requiring no skilled engineer in its operation. This company have lately installed a plant for town lighting for the municipality of Shawville, Que.

The Brantford Roofing Company, Limited, Brantford, Ont.—Occupied a house in the grounds which was covered with their roofing. Their principal exhibits were "Climax" insulating building paper, "Oneida" sheathing paper and their various makes of paint.

Canadian Bitumastic Enamel Company, Toronto.—Showing Bitumastic solution, which is applied in the same manner as paint and is not affected by extreme temperatures. Bitumastic enamel, which is applied on iron, steel and concrete surfaces, hardens immediately after it is applied.

The Bateman-Wilkinson Company, Limited, Toronto.—Among their general line of contractors' supplies were their well-known drag and wheel scrapers, which were especially noteworthy.

General Machinery Company, Limited, Toronto, Ont.—The Luitweiler system of water supply, especially adapted for firms, hotels, municipalities, etc., was one of the chief features of this exhibit. They were also showing the Muncie oil engine, which is run with crude oil.

Wettlaufer Bros., Toronto, Ont.—One of the most comprehensive and interesting exhibits on the grounds. As usual the firm's concrete mixers, which are too well known to the trade to require describing here, were the centre of attraction. A noteworthy feature of the exhibit was a cement brick machine shown for the first time. Other extensive lines, for which the company are agents, were also shown.

London Concrete Machinery Company, London, Ont.—The principal lines shown by this company were brick machinery, wheelbarrows, batch and continuous mixers, tile moulders, sidewalk tools and the "Standard" gas engine. This well known firm manufacture a complete line of contractors' machinery. Their exhibit was one of the most interesting in the line of heavier equipment.

Asbestos Manufacturing Company, Limited, Montreal.—The principal features of this exhibit were Asbesto-cement, Asbesto-slate and asbestos shingles, together with their other well-known lines.

Batts Limited, Toronto.—Exhibiting an extensive line of doors and columns in the Process Building. Also had an outside exhibit in the form of a pergola which was perhaps the most attractive of its kind in the grounds.

Alabastine Hard Mortar, Limited, Toronto.—The well-known Anchor Brand products were made a special feature by this company and the literature displayed described very fully many advantages of their products.

Alabastine Company, Limited, Paris, Ont.—The Paristone wall plaster, Pulpstone and special exterior plaster were the chief specialties shown by this company at their very attractive display. Special mention may be made of the new popular marble white plaster of paris.

Waterous Engine Works Company, Limited, Brantford, Ont.—Making a special feature of steam rollers at their exhibit. Also demonstrating a line of their trouble-proof pumps.

Goodyear Tire & Rubber Company of Canada, Limited, Toronto.—A very pleasing exhibit of their automobile tires in the Transportation Building. The firm have recently received an order for their special belting from the Saskatchewan Government.

W. A. Martin & Company, who have recently moved into new premises at 70 Lombard Street, Toronto, had a very extensive exhibit. They were showing the full line of the Graton & Knight Mfg. Company's belting, specializing particularly on waterproof leather belting. They also showed A. B. C. foolproof steel, manufactured by Messrs. Darwin & Milner, of Sheffield, England; Gripoly belting; Callender's alloys, babbits and bronzes, and the Crescent belt fastener. They are agents for, and were demonstrating, the E. C. C. motors made at Wolverhampton, England, by the Electrical Construction Company. Mr. R. Green, who was in charge of the exhibit, is sales manager for W. A. Martin & Company.

Linde Canadian Refrigeration Company, Limited, Montreal.—Besides the interesting exhibit which was to be found at their own booth, this company called attention to the fact that they had supplied the refrigerating plants both in the dairy and horticultural buildings. These exhibits attracted considerable attention.

Dominion Sewer Pipe Company, Limited, Swansea, Ont.—A well arranged display of sewer pipes was shown by this company. They were also exhibiting their other well-known lines of chimney tops, wall coping, culverts and inverts.

Canadian Fairbanks-Morse Company, Limited, Toronto, Ont.—Two or three specialties exhibited by this company were cradle dump cars and a full line of their oil engines, a number of which they were showing in running order.

Consumers Gas Company, Toronto.—A very handsome line of lighting fixtures was exhibited by this company. The large variety shown attracted a great deal of interest.

Report on Shoal Lake Water System for City of Winnipeg

THE report of the consulting experts on the greater Winnipeg water district scheme to bring water from Shoal Lake was submitted to the city last week. The whole report was read by Mayor Deacon. The formal adoption of the report was deferred for a week to enable the members of the board to become familiar with the details, which are, briefly, as follows:

Estimated cost, $13,045,000.

Total length of aqueduct, 95.35 miles.

Gravity system will bring water through a concrete aqueduct 84.75 miles to a point about one mile east of Transcona.

Shoal Lake water of excellent quality for domestic and manufacturing purposes.

Water is soft, practically free from contamination, without noticeable color, free from odors and of agreeable taste.

Shoal Lake will give ample supply until population reaches 850,000.

Intake to be at head of Indian bay, and Falcon river to be diverted into Snowshoe bay to cut off drainage of muskeg waters.

From Transcona into Winnipeg, 5-foot steel is recommended with crossing into city at Victoria Park under river in 5-foot cast iron pipe.

Four-foot cast iron pipe in tunnel to convey water through city to McPhillips street reservoirs.

Concrete aqueduct to have capacity of 85,000,000 gallons per day.

Storage reservoir at Transcona with capacity of 250,000,000 gallons is recommended when required, but need not be constructed immediately. Estimated cost of reservoir from $300,000 to $400,000.

Main pumping station at Transcona to force water through 5-foot steel pipe into city and districts requiring water.

Annual cost of maintenance and operation estimated at $40,000.

Five years set as time for completion of work.

Experts strongly recommend liberal extensions of present well system as far north as possible to care for needs of city until Shoal Lake scheme is completed.

Forthcoming Road Congress at Detroit

Arrangements Completed for Event of Outstanding Interest to all Identified with Road Improvement— An Attractive Programme

THE third American Road Congress will convene at Detroit, Mich., September 20 to October 4. The regular day sessions will be held at the Wayne Gardens, while the evening and special sessions will meet at the Hotel Pontchartrain.

On September 29 there will be addresses by Federal, state and municipal officials and others, a garden party and a series of banquets at several of the local clubs.

Tuesday, September 30, will be devoted to discussions of legislative matters under the leadership of the American Bar Association.

On Wednesday, October 1, the construction and maintenance session will convene under the auspices of the American Highway Association. Papers will be read by title only and will be followed by discussion. In the evening a boat ride is scheduled.

The American Automobile Association will direct the road users' session on the morning of Thursday, October 2. In the afternoon the American Bankers' Association will preside over the finance session.

Friday, October 3, is to be "Michigan Day," and the proceedings will be directed by the Michigan State Good Roads Association. In the evening there will be the annual meeting and election of officers of the American Highway Association.

The last day of the convention, Saturday, October 4, will be devoted to the report by the committee on resolutions.

There will be an exposition of road materials and machinery.

A partial list of the papers to be presented at the Congress follows:

"The Labor Problem in Road Construction," by Captain P. St. J. Wilson, state highway commissioner of Virginia; discussion to be opened by Mr. W. E. Atkinson, state highway engineer of Louisiana.

"Systematizing the Purchase of Road Materials and Equipment," by Henry G. Shirley, chief engineer, State Roads Commission of Maryland.

"Unsurfaced Roads," by Mr. W. S. Keller, state highway engineer of Alabama; discussion to be opened by Mr. George W. Cooley, state highway engineer of Minnesota.

"Gravel Roads—Their Construction, Maintenance, Cost and Special Treatment," by Hon. S. Percy Hooker, state superintendent of highways of New Hampshire; discussion to be opened by Mr. H. L. Bowlby, state highway engineer of Oregon.

"Treatment of Wornout and Ravelled Macadam Surfaces,' by Colonel E. A. Stevens, state highway commissioner of New Jersey; discussion to be opened by Hon. Robert C. Terrell, state commissioner of public roads of Kentucky.

"Bituminous Macadam Construction and Maintenance," by Mr. S. D. Foster, chief engineer, State Highway Department of Pennsylvania; discussion to be opened by Mr. W. A. McLean, Provincial Engineer of Ontario, Canada.

"Brick Roads," by Mr. James M. McCleary, county engineer of Cuyahoga County, Cleveland, Ohio; discussion to be opened by Mr. R. Keith Compton, chairman, Paving Commission, Baltimore, Md.

"Concrete Roads," by Hon. Frank F. Rogers, State Highway Commissioner of Michigan; discussion to be opened by Mr. Paul D. Sargent, state highway engineer of Maine.

"Selection of Road Materials," by Hon. Logan Waller Page, director U. S. Office of Public Roads.

"Dust Prevention."

"Drainage Structures," by Mr. A. R. Hirst, state highway engineer of Wisconsin; discussion to be opened by Prof. T. H. MacDonald, state highway engineer of Iowa.

"California's $18,000,000 State Highway System," by Mr. A. B. Fletcher, state highway engineer of California.

"Highway Accounting, with Special Reference to Maintenance," by Mr. Halbert P. Gillette, editor-in-chief, "Engineering and Contracting."

"The Organization and Management of Working Forces," by Mr. A. N. Johnson, state highway engineer of Illinois.

"Contract Law," by William Bowman, of New York.

"The Protection and Upkeep of Road Equipment," by Mr. Daniel J. Hauer, of New York.

"The Merit System in Road Management, by Hon. J. A. McIlhenny, president U. S. Civil Service Commission.

"Financing Road Improvement," by Mr. Wm. G. Edens, president, Illinois Highway Improvement Association.

"Bond Issues for Road Improvement," by Mr. S. E. Bradt, vice-president, First National Bank, DeKalb, Ill.

"The International Congress and the Roads of England, France and Germany," by Col. Wm. D. Sohier, chairman, Massachusetts State Highway Commission.

"Economics of Road Improvement," by J. E. Pennypacker, secretary, American Highway Association.

"Dirt Roads and Politics," by Charles P. Light, former state highway commissioner of West Virginia.

Addresses by Hon. James H. MacDonald, Dr. Jos. Hyde Pratt, Mr. Clarence A. Kenyon, and others.

With the completion of the great dam which the Vancouver Island Power Company has been constructing for the past year at its Jordan River power plant, one of the largest works of its kind in Canada is now ready to fill its part in the development of power for the operation of commercial enterprises in the southern end of Vancouver Island. The dam, which is the highest in Canada and has cost nearly three-quarters of a million, will provide storage capacity sufficient to assure an ample supply of water for the operation of the turbines. The necessity of additional storage capacity became imperative when the company undertook to raise the capacity of the power plant from 12,000 to 32,000 horse power. The work of installing the additional units in the power house has been under way for some months. With this increase in power and the Brentwood Bay steam auxiliary plant of 6,000 horse power in reserve, the company will have ample power to operate the lines of the B. C. Electric Company, and meet the remarkable increase in the demand for power for industrial and commercial purposes.

A contract has been awarded to Mr. E. G. M. Cape, Montreal, for the construction of a new factory and offices for the Imperial Wire and Cable Company, Montreal. The building has been commenced on the site at St. Patrick street. The factory and offices will comprise several structures, the principal being one of eight storeys. When completed, the factory will be one of the largest and best equipped in Canada. The machinery will all be run by electric power.

Paving Brick Manufacturers to Convene at Cleveland

The National Paving Brick Manufacturers' Association's tenth annual meeting, September 17 and 18, will be marked by a paving conference which will attract city engineers and other officials and paving contractors from all parts of the country.

At recent meetings of the brick committees of the American Society of Municipal Improvements and the American Society for Standardizing Paving Specifications, incidental to the discussion of matters which came before that committee, it was suggested that if at some time prior to the annual meeting at Wilmington, Deleware, an itinerary of study and investigation at the paving brick plants could be arranged for by the National Paving Brick Manufacturers' Association it would be both acceptable and desirable.

Committees from these societies will therefore meet at the Statler Hotel, Cleveland, at 8.00 a.m., Monday, September 15, to spend that day and the Tuesday following visiting brick plants and to remain in the city as guests of the National Paving Brick Manufacturers' Association during the 17th and 18th, the days of the annual meeting.

Judging from the acceptances which have come from engineers and other city officials at least 150 officials, together with 75 paving contractors, will be present, while representatives of the various engineering, trade, automobile and civic publications, together with the paving brick men themselves, will swell the total attendance to nearly 300.

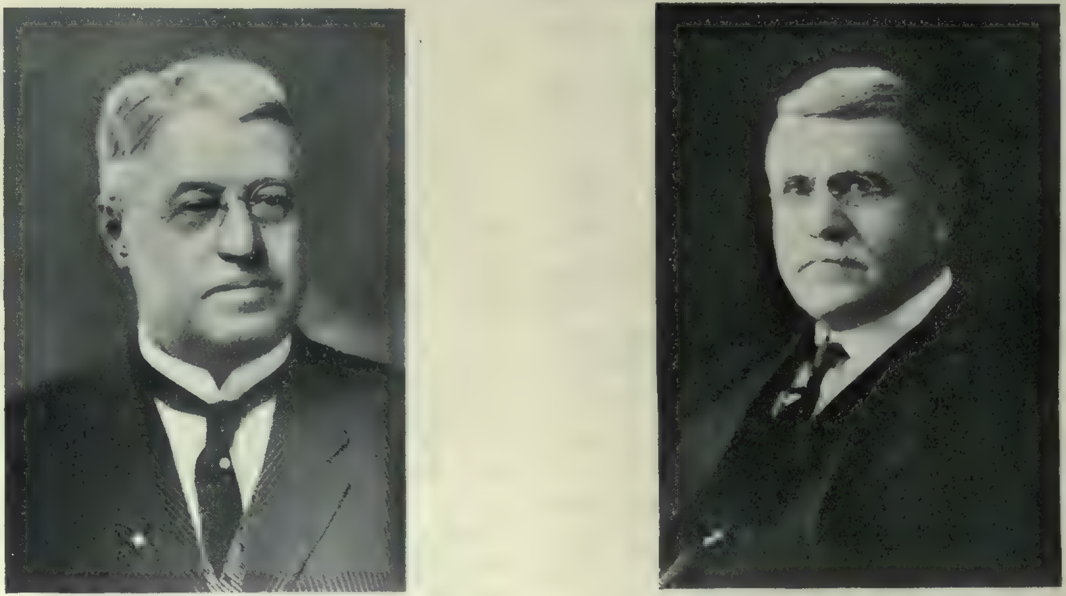
The meeting will be exceedingly important in that it will bring together, for the first time, engineers from the leading cities of the country and almost the entire body of paving brick manufacturers. It will afford engineers and paving brick manufacturers an excellent opportunity to discuss their problems on common ground.

The mornings of the 17th and 18th will be devoted to the business sessions of the Association. The reports which will be read by President Chas. J. Deckman, Secretary Will P. Blair, Treasurer C. C. Barr and Assistant Secretary H. H. Macdonald, will show that the Association has had the most successful year in its history.

Both Cleveland and Cuyahoga County are adding largely to their mileage of brick pavements this year and opportunity will be accorded to witness brick pavement construction in every detail from grading to grouting.

It was at the last annual meeting that the decision was reached to hold future conventions of the association during a season of the year when brick road construction methods could be viewed in actual progress. Many engineers and contractors have written the association that they are looking forward with much interest and pleasure to a personal inspection, for the first time, of the thousand miles of city streets and country roads of Cleveland and Cuyahoga County of which they have read and heard.

About eighty motor cars will be required for the trip over the streets and roads. Every paving brick manufacturer who is the fortunate possessor of an automobile or a stable of automobiles has promised to drive his car to Cleveland for the big event. The itinerary for the inspection of Cleveland's city streets will include visits to brick pavements laid as long as nineteen years ago.



Mr. Chas. J. Deckman, President.

Mr. W. P. Blair, Secretary

Officers of the National Paving Brick Manufacturers' Asssociation.

The inquiry into the design and suitability of the Montreal filtration plant will cost the city $7,500, which includes fees of $100 per day for each of the three engineers appointed.

For August the Montreal building permits totalled $2,318,672, as compared with $1,364,830 in the corresponding month last year. The total for the year is $13,816,622, against $11,179,376 in 1912.

With a view to remedying the dust nuisance caused by motor cars, the Town Council of Outremont, P.Q., have decided to put a new topping of granite screenings on St. Catherine Road and treat it with tarvia.

Messrs. O'Brien & Doheny, contractors, have commenced an action against the Quebec and Saguenay Railway Company for $839,511, balance of money due under contract and for damages for its breach. Another action for $300,006 is still pending.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
Storm sewers for Town Council. Clerk, W H. McFadden. Matter has been passed by Sewers Committee for storm sewers on Queen St., Hosie Lane, Isabella and Railroad streets, and Helstone Ave.

Montreal, Que.
Sewage disposal for Montreal City. Sec.-Treas., L. N. Senecal. R. S. Lea, consulting engineer, New Birks Bldg., Montreal, preparing report for City of Montreal for disposal of sewage in N. D. G. Ward.

Drains and water pipes, cost $8,500, McGregor street, contemplated. Sec.-Treas., L. N. Senecal. Board of Control passed the report.

Sewer, Queen Mary's Park, for City Realty Investing Co., Ltd., 41 Mayor St. Tenders close with owners Sept. 15 for laying 12-in. sewer pipe in this subdivision. Engineer, Thos. Iverson, 10 Cathcart street.

Ottawa, Ont.
Pavements, cost $50,000, for City of Ottawa. Mayor, J. A. Ellis. Controller, Mr. Nelson. Engineer, Archibald Currie, City Hall. Asphalt pavements on O'Conner, Queen to Laurier, James St., Elgin to Bronson, McLaren St., Elgin to Bank St.

City Council contemplate purchasing road roller with scarifier, sprinklers and other road machinery and equipment, estimated cost $25,000. City engineer, Archibald Currie.

Chlorinating buildings, cost $7,000, planned by City Council. Mayor, J. A. Ellis. City engineer, Archibald Currie. Asst. waterworks engineer, A. N. Beer. Solid brick construction, concrete foundation, felt and gravel roofing. To be erected on Lemieux Island in connection with new sedimentation basin. Tenders will be called shortly.

Regina, Sask.
Pavement on Broad St. Subway, planned by City Council. Engineer, F. McArthur. City Commissioner, L. A. Thornton.

City Council plan the construction of approximately 12 miles of plank sidewalk throughout Annexes of City of Regina.

Toronto, Ont.
Street extension, cost $16,000, planned by Board of Control. City Clerk, W. A. Littlejohn. Florence street, westerly to Coxwell; Cairns street, westerly to Coxwell; Orchard Park, northerly to Maughan Road.

Twp. of Brantford, Ont.
Cement sidewalks. Twp. Engineer, A. M. Jackson, Brantford. Plans and specifications at office of engineer. Tenders received by engineer until Sept. 13th, for the construction of 4063 ft. of 4 ft. cement sidewalks. Tenderers are expected to look over site of the work before submitting bids.

Winnipeg, Man.
150 6-in. hydrants recommended by the Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Tenders received by Board of Control till Sept. 19th. Plans, etc., at Engineer's office.

Cast iron pipe required by Board of Control. Sec., M. Peterson. Engineer, H. N. Rutton, 223 James Ave. 3,000 lin. ft. cast iron water pipe 4 in.; 24,000 lin. ft. cast iron water pipe 6 in.; 12,000 lin. ft. cast iron water pipe 8 in.; 8,000 lin. ft. cast iron water pipe 10 in.; 1,500 lin. ft. cast iron water pipe 12 in. Plans and specifications at office of Engineer. Tenders received by Board till Sept. 19th.

Water system, cost $13,000,000, plans approved by City Council. Engineer, H. N. Ruttan, 223 James Ave. Concrete aqueduct 85 miles, steel pipe 10 miles from Shoal Lake. Concrete reservoir at Transcona to have a capacity of 250,000,000 gals. Report furnished by experts has been adopted.

Sewers and granolithic walks planned. Engineer, H. N. Ruttan, 223 James ave. Granolithic walks: S. side MacDonald ave., from Maple street to 350 ft. east. S. side Wardlaw ave. from John street to Wellington cres. Sewers: Dorchester ave. from Lot 16, B1.96 to Rockwood St. Eaton street from Herbert to Talbot ave. Specifications at engineer's office.

CONTRACTS AWARDED

Sudbury, Ont.
Storm sewers, cost $9,944.60, planned by Town Council. Clerk, George Elliott. Engineer-in-charge, A. Tessier. General contractors, Blanchard & Shanahan.

Toronto, Ont.
Sewer, cost $356,000, planned by Board of Control. Commissioner of Works, R. C. Harris. General contractors, Donnelly & Graham, Shaw and Arthur. West Toronto Div. No. 2 Woodville Ave, 63c. per lineal ft. for brick, 62.23c. per lineal ft. for concrete.

Sewer, planned by Board of Control. Mayor, H. C. Hocken. Commissioner of Works, R. C. Harris. General contractors, Moran Construction Co., Ottawa, Ont. Midway sewer system outlet, $89,416. General contractor, Joseph O. Jerow, 90 Curzon St., Earlscourt drainage system, $45,834.

Railroads, Bridges and Wharves

Annapolis Royal, N.S.
Dom. Atlantic Rly. approved plans of company's station to be erected at Annapolis Royal.

Arundel, Que.
C. N. O. Rly. have authorized company to construct a suitable station at Arundel, Que.

Bethany Junction, Ont.
C. P. Rly. have been authorized to construct bridge No. 37.9 Toronto Subdivision, near Bethany Jct.

Blenheim Twp., Ont.
Miller drain planned. Tenders received by Hugh Allan, Drumbo, until Sept. 13th. Specifications at his office.

British Columbia
Esquimalt & Nanaimo Rly. have approved locations of stations to be erected at Union Bay and Courtenay.

Cariboo District, B.C.
G. T. P. Rly. Co. authorized to construct bridge across Dome Creek.

Fort George, B.C.
G. T. P. Rly. have authorized company to construct bridge across Cottonwood Creek District of Fort George.

Frater, Ont.
Algoma Central & Hudson Bay Rly. have approved location and details of station proposed to be erected at Frater District of Algoma.

Guelph, Ont.
Council will shortly vote on by-law to provide for extension of tracks and switching facilities for Robert Stewart & Co., Ltd. City engineer, M. Ferguson.

Bridge and retaining wall, Neeve St., planned by City Council. Clerk, T. J. Moore. Engineer-in-charge, M. Ferguson. Plans have been approved and work will commence as soon as possible.

Limerick, Sask.
C. P. Ry. have approved company's location of proposed station on the Weyburn Westerly Branch.

Moncton, N.B.
Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt., Dept. of Railways and Canals, till Sept. 19th. Plans and specifications at offices of Sec., Station Master, Derby Junction, N.B., Chief Engineer, Moncton, N.B., for Diversion of Line—Nelson to Derby Junction, N.B., for construction of line of railway.

Mulvihill, Man.
C. N. R. have been authorized to construct a standard portable passenger and freight shelter and a 2-car cattle pen.

Prov. of Ontario
C. P. Rly has been authorized to construct bridge No. 88.6.

Osgoode Township, Ont.
Concrete bridges for Township Council. Clerk, Chas. MacNab. Concrete bridge opposite Lot 22, Con. 7. Plans and specifications at office of Engineer, R. W. Farley, Hope Bldg., Ottawa.

Oshawa, Ont.
Dredging for Dom Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders to be called shortly.

Port Burwell, Ont.
C. P. Rly have approved location of station between Wellington and Robinson Sts., Port Burwell, Twp. Bayham, Co. Elgin.

Rochester Twp., Ont.
Eight bridges, cost $10,000, planned. Clerk, M. N. Mousseau, South Woodslee, Ont. Engineer, James Laird, Essex. By-law passed.

St. Catharines, Ont.
Welland canal, section No. 2, planned by Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Joies, Ottawa. Chief engineer, J. L. Weller. Tenders will be called in about a week.

Welland canal, section No. 4, planned by Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Jones, Ottawa. Chief engineer, J. L.Weller. Tenders will be called in about four weeks.

St. John, N.B.
City Council are authorized to construct bridge over C. P. R. at Alexandra St. extension.

Twp. of Tilbury North, Ont.
Four bridges planned. Clerk, J. A. Tremblay, Tilbury, Ont. By-laws passed by Council, 2 bridges over North Town Line Road and 2 over Chauvin Drain. Concrete and steel construction.

Victoria, B.C.
Bridge for C. N. P. Rly. Trestle bridge and embankment across Selkirk River . Plans prepared.

CONTRACTS AWARDED

Sault Ste. Marie, Ont.
Dock, cost $50,000, planned for Standard Oil Co. General contractor, Jno. Boyd, Sault Ste. Marie.

St. Catharines, Ont.
Welland canal, cost $10,000,000, Sec. No. 3. Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Jones, Ottawa. General contractor, M. J. O'Brien and Hugh Doughney, Thorold.

Welland Co., Ont.
Bridge, cost $1,500, Lyons Creek, for County Council. General contractor, A. Goebel, Port Colborne.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
Sunday school and lecture room, cost $7,000, St. Paul Ave., for Baptist Church. Pastor, Rev. Thos. E. Richards, 110 Chestnut Ave. Architect, Lloyd D. Barber. Two storeys, 50 x 47, concrete foundation, pressed brick construction. Plans in progress.

Calgary, Alta.
Parks planned by City Council. Clerk, J. M. Miller. By-law to be voted on Sept. 28 for improvement and equipment for parks, cemeteries, etc.

Coquitlam, B.C.
School, cost $12,000, James Park, contemplated by the Board. Architect, J. Z. Long. Tenders will be called for in a week.

Duck Lake, Sask.
Town hall, cost $11,000, contemplated by Town Council. Mayor, Paul Ashby. Sec.-Treas., J. A. Perret. By-law to be submitted to the ratepayers on Sept. 12th for a town hall which will include a permanent place for the fire apparatus of the town.

Kingston, Ont.
Sunday School Hall planned for St. James Anglican Church congregation, Union street. Rector, Rev. T. W. Savary, 152 Barrie street. Tenders will not be called until next spring.

Macleod, Alta.
School, cost $13,500, for MacLeod Public School Dist. No. 47. Treas., E. Forster Brown. Plans being prepared.

Melville, Sask.
Convent, cost $15,000, contemplated for the Order of Black Veiled Nuns. Plans will be prepared.

Palmerston, Ont.
Barracks, cost $10,000, for Salvation Army. Major, F. Morris, Clarence St., London. Architect, Major Miller, Toronto. Two storeys, white brick construction, stone and concrete foundation. Plans in progress.

Port Alberni, B.C.
School for The Alberni Land Co. A site has been secured and a new High School is contemplated.

Port Arthur, Ont.
Interior fittings, post office. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt., Dept. of Public Works, until Sept. 18th. Plans, etc., at offices of Mr. D. McKenzie, caretaker, Port Arthur; T. A. Hastings, clerk of works, Postal Station "F," Yonge St., Toronto, and Dept., Ottawa.

Prince Rupert, B.C.
Drill hall planned by Dom. Govt., Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa. Deputy Minister, Eugene Fiset. Specifications, etc., at offices of District Officer Commanding Military District No. 11 Victoria, City Clerk, Prince Rupert, and Director-General of Engineer Services, Ottawa. Tenders received by Minister till noon Sept. 23rd.

Quebec, Que.
Mausoleum contemplated by The Quebec Mausoleum Co., Ltd., 136 St. James street, Montreal. Three storeys, 50 x 50, concrete construction throughout. Plans in progress, to be erected here and at Sherbrooke.

Regina, Sask.
School contemplated by Royal North West Mounted Police. Commissioner, Mr. Perry, R. N. W. M. P. Barracks. Plans will be prepared.

Swift Current, Sask.
School contemplated for School District No. 1667. Secretary-treas., J. T. Dodds. Competitive plans called. Information from sec.-treas. Competition closes Sept. 30. 16 rooms.

Tilbury, Ont.
Public library contemplated by the Town Council. Clerk, W. A. Hutton. Matter will be considered shortly.

Toronto, Ont.
Board of Control will build new fruit market. Site not selected. Mayor, H. C. Hocken.

Enlargement of Shirley street School, planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, until Sept. 12th. Specifications, etc., at office of Supt. of Buildings, City Hall.

Addition to School, Parkdale, planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, until Sept. 12th. Specifications, etc., at office of Supt. of Buildings, City Hall.

Vancouver, B.C.
Theatre planned. Architect, C. J. Donnelin, 319 Pender St. W., will receive tenders in a few days, 75 x 120, steel, brick, terra cotta and fireproof construction, heating and ventilating systems.

Drill hall, cost $200,000, Grandview, planned by Dom. Govt., Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa. Deputy Minister, Eugene Fiset. Architects, Perry & Fowler, Pacific Bldg., have been commissioned to prepare plans. Fireproof construction.

Immigration building, cost $300,000, foot of Victoria Drive, planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Four storeys, 212 x 64, reinforced steel beam construction, laundry.

Victoria, B.C.
Armory, cost $250,000, McBride and Bay Sts., planned by Dom. Govt., Dept. of Militia and Defence. Deputy Minister, Eugene Fiset, Ottawa. Architect, W. Ridgeway Wilson, 323 Pemberton Block. Two storeys and basement, 100 x 120. Tenders are to be called soon.

Watt Twp., Ont.
School contemplated for School Sec. No. 5. Twp. Clerk, Edward Hamilton, Raymond, Ont. Plans will be prepared.

CONTRACTS AWARDED

Cobalt, Ont.
Town Hall, cost $37,000. Clerk, R. L. O'Gorgan. Architects, Angus & Angus, North Bay. General contractors, Hill, Clark & Francis, New Liskeard. Heating, plumbing and electrical, F. R. Gibson, Haileybury.

School, cost $10,000, planned by Town Council. Builder, H. McDowell. Heating, F. R. Gibson, Haileybury. 2 stys.

Hamilton, Ont.
Church, cost $17,500, Grosvenor Ave., for Kensington Methodist. Architect, F. W. Warren, Federal Life Bldg. General contractor, Jno. Bryers, 11 Clinton St. Roofing V. Drew, Cannon St. E. Electric, R. E. Allison & Co., King St. W. Painting, A. E. Williams, Emerald St. N. Plumbing, J. Saynor, John St. S. Carpenter, H. Thombs, Whitfield Ave.

Lloydminster, Sask.
Interior fittings for post office for Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, J. T. Schell Co., Kenyon, Alexandria, Ont.

Montreal, Que.
Post Office "L," cost $70,000, Westmount (Greene ave.) planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, brick and masonry, John

Quinlan & Co., 4412 St. Catherine W., will receive tenders as work advances. Two storeys and basement, 102 x 85. Excavating done.

Boiler house planned by Board of Commissioners, Point St. Charles, Sec., L. N. Senecal. General contractor, J. L. Simmons, 528a Lasalle Road, $6,225.

Ottawa, Ont.
Home, cost $27,000, Turner St., for Friendless Women. Sec., Mrs. Geo. Greene, 320 Waverly St. Architect, C. J. Burritt, 193 Sparks St. General contractors, Taylor & Lackey, 21 1st Ave.

Regina, Sask.
Isolation hospital, cost $77,600. City Council Hospital Board. Clerk, A. W. Pool. Architect, N. R. Darrach, Western Trust Bldg. General contractors, Minkley & Traub. Two storeys, 130 x 40, brick construction, concrete and stone foundation.

Selkirk, Man.
Addition to hospital, cost $65,000, planned by Prov. Govt., Dept. of Public Works. Acting Minister, Hon. G. R. Coldwell, Winnipeg. Prov. Architect, V. W. Horwood, 261 Fort St., Winnipeg. General contractors, Carter-Halls-Aldinger Co., Union Bank Bldg., Winnipeg. Foundations in.

Ste. Croix, Que.
Completing interior of Church, cost $35,000, for R. C. Church congregation. Architects, Talbot & Dionne, 14 St. Joseph street, Quebec. General contractors, Messrs. Paquet & Godbout, St. Hyacinthe, Que. Interior finish in white and gold and pews painted and varnished. 170 x 59.

St. Johns, N.B.
Club house for Elks Club, c/o H. J. Fleming, 130 Pond street. Architect, F. Neil Brodie, 42 Princess street. General contractors, A. R. C. Clark & Son, 51 Water street.

Toronto, Ont.
School, Deer Park. Elec. wiring, Hall & Dollery Elec. Co., 848½ College. Heating and plumbing, F. Armstrong Co., 227 Queen W. Sec.-treas., W. C. Wilkinson, Board of Education.

Wadena, Sask.
School, cost $26,700. Architects, Reilly, Dawson, Hancock & Reilly, 512 Westman Chambers, Regina. General contractors, Collun Bros., Humboldt. Six rooms, brick construction and foundation.

Winnipeg, Man.
Club and stores, Smith street, for Knights of Columbus, Birks Bldg. Architects, J. I. Atcheson & Co., Trust & Loan Bldg. General contractors, Frid Lewis & Co., Somerset Bldg.

Business Buildings and Industrial Plants

Dunnville, Ont.
Addition to factory for Canadian Engines, Ltd. Architects, Owners. 40 x 100, artificial stone construction, concrete foundation. Plans ready.

Guelph, Ont.
Factory, cost $7,000, Duke St. Architects and owners, Guelph Lumber Co. Two storeys, concrete foundation, brick construction. Plans in progress.

Medicine Hat, Alta.
Confectionery factory contemplated for Tabor Candy Co., Ltd. Managing director, J. H. Tabor, Lethbridge. President, Ald. W. H. Doty. Factory to be erected as soon as possible. By-law passed.

Montreal, Que.
Livery stable, cost $5,000, planned for Michael Stafford, 409 Aqueduct. Architects, Saxe & Archibald, 59 Beaver Hall Hill. One storey, concrete foundation, brick construction, felt and gravel roofing.

Paint factory, cost $90,000, planned for Martin-Senour Co., 655 Dralet. Architect, W. B. McLean, 204 St. James St. Messrs. Reid, McGregor & Reid were lowest tenderer. Building not likely to be built until spring.

Store and ice cream parlor addition, cost $15,000, 322 St. Catherine W., for Geo. Nicholas & Co., 322 St. Catherine W. Tenders will be received by Architect, D. J. Crighton, Jacobs Bldg., for two weeks for all trades. Three storeys, steel and brick construction.

Manufacturing building, Maisonneuve, for American Can. Co., Ontario St., Maisonneuve. Architects and builders, Owner. New factory to be erected next year. Special machinery required.

Office and warehouse repairs, cost $10,000, 18 St. Helen, for H. Joseph & Co., 16 St. Sacrament St. Architects, Phoenix Assurance Co., Ltd., 100 St. Francois Xavier, are looking after the work.

Ottawa, Ont.
Mill, Bridge St., owned by J. R. Booth, Chaudiere, destroyed by fire. Will rebuild at once, concrete and fireproof construction. Conveying machinery required.

Shop and residence, cost $4,000, for Mrs. R. Moore, Osgoode St. Architect, W. J. Montgomery, 444 Lewis. Two storeys, solid brick construction, stone foundation. Plans drawn.

Petrolia, Ont.
Bakery and store, cost $10,000, for Messrs. Bruce & Hartley, Main and Bedford Sts. Architect to be selected. Two storeys, white brick construction.

Regina, Sask.
Warehouse, cost $20,000, contemplated by Gutta Percha Co., 47 Yonge St., Toronto. Hove been offered lots by City Council.

Sarnia, Ont.
Addition to jam factory, for Sarnia Jam Factory. Architect to be selected.

Toronto, Ont.
Alterations to building, 54 Adelaide E., planned for Smith, McKenzie & Hall, 24 Toronto St., to be occupied by owners. Plans in progress.

Office and warehouse, 216-18 King St. W., contemplated by Can. General Electric Co., King and Simcoe Sts. Sketch plans drawn.

Addition to foundry, cost $9,000, for W. & J. G. Greey, 6 Church St. Tenders received by Architects, G. M. Miller & Co., 93 Yonge St. Two storeys, brick and steel construction, concrete foundation, felt and gravel roofing.

Bank building contemplated for Bank of British North America, Yonge and Wellington streets. Site purchased N.E. cor. Queen and Beech, 40 x 60 ft. Plans will be prepared.

Hotel, King and Simcoe, contemplated by A. L. Solman, 180 King W. Ten storeys, 46 x 90, terra cotta and steel construction. Plans will be prepared.

Bank building plonned by Home Bank of Canada, head office 10 King west. Site purchased 1218-1220 Yonge street. 52 x 100 feet.

CONTRACTS AWARDED

Hamilton, Ont.
Addition to plant, cost $12,000, Depew street, for Dominion Steel Castings Co. General contractors, H. G. Christman & Co., Chancery Chambers. Steel and concrete construction. Permit issued.

Montreal, Que.
One store and flat, cost $5,000, Maisonneuve, for Madam Ester Rousselle, 1313 Franchere, Montreal. Builder, A. Desjardin, 1313 Franchere. 25 ft., 22½ x 50, cement and stone foundation, frame and brick construction.

Stable, cost $6,900, for The Adair Coal Co., 146 Notre Dame W. Architects, Viau & Venne, 76 St. Gabriel. General contractors and masons, Marcello Construction Co., New York. Two storeys, 32 x75, concrete foundation, brick construction.

Addition to factory, cost $30,000, Parthenais, for Dom. Oilcloth Co., 1192 St. Catherine E. Architects, Hutchison, Wood & Miller, 50 Royal Ins. Bldg. General contractors, Church, Ross & Co., 40 Hospital St. Roofing, D. M. Long, rear 36 Windsor. Heating and plumbing, Jno. A. Gordon, 301 St. Antoine.

Store and garage, cost $3,000, Maisonneuve (1st ave. Viauville) for Ferd. Corriveau, cor. 1st ave. and Notre Dame. Builder, H. Papineau, 575 Papineau. 13 ft., 27½ x 25, concrete and stone foundation, frame and brick construction. Foundations in.

Office and warehouse, cost $2,000, 98 King street, for S. H. Ewing & Sons, 98 King street, Montreal. General contractors, Geo. Roberts, 79 Lagauchetiere W. Damage to interior plaster, painting and woodwork to be repaired at once.

Mt. Hamilton, Ont.
Stores, etc., for A. A. Lees, 47½ Main street east, Hamilton. Architect, E. B. Patterson, 167½ Main street east, Hamilton. General contractor, S. Burkholder, Mt. Hamilton. Three storeys, 60 x 122, reinforced concrete construction, concrete foundation, tar roofing. Excavating started.

Ottawa, Ont.
Addition to stores, cost $10,000, Lewis, for Matthew-Lang Co. Architect, W. E. Noffke, Central Chambers. Carpenters, Smith Bros., 448 McLeod. Excavating started.

Quebec, Que.
Confectionery store, cost $5,000, Joseph street, for W. McWilliams, John St. General contractor and carpentry, C. A. Vezina, 61 Desprairies. Two storeys, 40 x 62, steel beams, felt and gravel roofing. Excavation started.

Regina, Sask.
Warehouse, cost $45,850, for W. G. Downing Shoe Co. Architects, Storey & Van Egmond, Credit Foncier Bldg. General contractors, Frid Lewis Co., 901 Somerset Bldg., Winnipeg. Six storeys.

Rosemere, Que.
Stable, cost $3,000, for Otto Donner, Rosemere, Que. Architect, Wilford Gagnon, 1002 New Birks Bldg. General contractor, Jacob K. Hanson, 3055a St. Dominique. Concrete foundation, balloon frame construction, felt and gravel roofing. Excavating done.

Sault Ste. Marie, Ont.
Warehouse, cost $75,000, for Standard Oil Company. General contractor, Jno. Boyd, Soo.

St. John, N.B.
Bank building, cost $20,000, Main St., for Royal Bank of Canada. Manager, T. B. Blair, King street. Architect, K. G. Rea, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke street. Excavating done.

Bank, cost $50,000, for Bank of British North America. Architect, G. E. Fairweather, 84 Germain street. General contractors, B. Mooney & Sons, 112 Queen street. Erecting all concrete forms for first storey of reinforced concrete. Foundations in.

Toronto, Ont.
One pair stores and residences, cost $6,000, Danforth Ave. Owner and general contractor, Harry Lucas, 72 Fulton Ave. Three storeys, 40 x 50, brick foundation and construction, felt and gravel roofing. Store fronts and fixtures. Excavating done.

Warehouse, cost $60,000, Ladenhurst St., for Labatt Brewing Co. Architect, C. F. Wagner, 15 Toronto St. Mason, Teagle & Son, 55 Boswell Ave. Two storeys, 90 x 140, brick and mill construction, cement foundation.

Addition to store and bakery, cost $3,000, for W. Dole, Follis & Bathurst Sts. Architect, H. G. Paull, 395 College St. General contractor, E. C. T. Dole, 414 Dupont St., will sublet plastering, painting, plumbing and heating. Two stys., 20 x 50, brick construction and foundation, felt and gravel roofing, gas and electric lighting, maple and oak floors, store fronts and fixtures, mantels, built in fireplaces.

Two stores and apartments, cost $10,000, Oakwood and St. Clair. General contractor and owner, Jas. Crang, 906 St. Clair Ave. General contractor sublets. Two storeys, 37 x 68, brick construction and foundation.

Stable, cost $6,000, Roselawn Ave., for International Constr. Co., 2261 Yonge St. Architect, W. H. Mallory, 31 Queen St. W. General contractor, Owner. Will sublet tile work. Wood and tile construction.

Store and residence, cost $5,000, cor. Sumach and David streets. Owner and general contractors, Bernstein Bros., 134 Sackville street. Work being done by day labor. Two storeys, 18 x 50, brick construction and foundation, felt and gravel roofing, store fronts and fixtures.

Four stores and residences, 387-91 Donforth ave. Owners and general contractors, Weismiller & MacKenzie Bros. Ltd. 1431 Queen street west. Two storeys, brick construction, felt and gravel roofing. Foundations in.

Winnipeg, Man.
Bank building, Elmwood, for Bank of Nova Scotia. Architects, Jordan & Over, Canada Life Bldg. General contractor, Major Schurman, 34 Canada Life Bldg.

Warehouse and factory, cost $200,000, for Smart Woods Co., Ltd., Alexander Ave. Architects, Woodman & Carey, Lindsay Bldg. General contractors, G. H. Archibald & Co., Union Bank Bldg. Two freight elevators, fireproof doors, office fixtures, grille work, vaults, boilers, bag making machinery required.

Office and cafe, Smith St., for Olympia Cafe Co., 277 Portage Ave. Architects, Jas. Chisholm & Sons, Enderton Bldg. General contractors, Carter-Halls-Aldinger Co., Union Bank Bldg., Winnipeg. Building will be completed this year. Six storeys, 110 x 120.

Residences

Ft. William, Ont.
Residence, cost $7,000, Norah St. S., for W. H. Scott. Architects, Carson & Smithley, Murray Block. 2½-storeys, 42 x 36, brick veneer construction, stone and cement foundation. Plans ready.

Ottawa, Ont.
Residence, cost $4,000, Preston St., for Fred Hunt, 801 Carling. Two storeys, 42 x 24, frame construction, concrete foundation. Plans in progress.

Montreal, Que.
Four flats, cost $7,000, Maisonneuve (Adam), for Victor Bernier, 746 Adam St. Will build in spring. Three stys., 25 x 53, cement and stone foundation, frame and brick construction. Plans being prepared.

Semi-detached residence, cost $15,000, Westmount, for H. E. Plant, 112 St. Matthew St. Builders, general contractors and masons, Jno. Quinlan & Co., 4414 St. Catherine, W. Carpenter, D. M. Long, rear 39 Windsor. Steel, Dom. Bridge Co., Dom. Express Bldg. Tenders will be received shortly for roofing, plastering, painting, heating, plumbing and electric.

Flat, cost $5,000, Maisonneuve (Bouboniere), for Ferdinand Servant, 1039 Orleans. Two storeys, 25 ft., 22½x 35, stone and cement foundation, frame and brick construction.

Six flats, cost $$.500, Des Erables, for C. Beaudoin, 724 Des Trables. Three storeys, 50 x 67, stone foundation. Plans in progress.

Flats, cost $6,000 , Maisonneuve (Adam), for Jos. Lachapelle, 417 Orleans. Three storeys, 25 x 55, concrete and stone foundation, frame and brick construction, felt and gravel roofing, galvanized iron cornices. Plans in progress.

Ottawa, Ont.
Residence, cost $14,000, McKay, for A. Bioskinsky, 298 Murray. Brick, construction, stone and concrete foundation, felt and gravel roofing. Plans in progress.

Regina, Sask .
Residences, cost $20,000, for D. P. McColl, 2043 Rose St. Architects, Storey & VanEgmond, Credit Foncier Bldg. 2½-storeys, brick foundation and construction. Plans in progress.

Residence, cost $15,000, for H. M. McCallam. Architects, Storey & VanEgmond, 1 Credit Foncier Bldg. Two stys., brick and stone construction, brick foundation. Plans in progress.

Toronto, Ont.
Two residences, Shudell Ave. and Seymour, for P. W. T. Ross, 167 Howland Ave. Tenders received at once, for masonry, etc.

One detached residence, cost $7,000, Schofield Ave., planned for Dr. A. D. A. Mason, 2 College St. Architect, J. H. Stanford, Bloor and Ossington. Tenders received by Owner. 2½-storeys, 30 x 40, brick foundation, stone and brick construction. Honeywell heating system.

CONTRACTS AWARDED

Brantford, Ont.
Residence, cost $3,500, Roberts ave., for Cobden E. Kitchen, 75 Grand street. General contractor, John Richards, 115 Spring street. Two storeys, 27 x 35, Ragstaff brick construction, stone and concrete foundation, shingle on asbestos roofing.

Bridgeburg, Ont.
Residence, cost $6,000, Niagara St., for A. B. Hurrell. General contractors and carpenters, Benner & Davis. Mason, Louis B. Wendz. 2½-storeys, 30 x 40, brick veneer construction, cement foundation. Excavating done.

Canora, Sask.
Six residences, cost $12,000, for Terminal Cities Co., 207 Farmer Bldg., Winnipeg. Company's architect prepared plans. General contractors, Hanks & Bertram. 1½ storeys, 20 x 24, frame construction, stone foundation, spruce and B. C. fir floors.

Edmonton, Alta.
Apartments, cost $75,000, Jasper Ave. Owners and general contractors, Cannell & Spencer, Alberta Block. Heating and plumbing, Installation Co., Ltd. Elec., Burnham Frith Elec. Co., Rice St. Six storeys, 54 x 50, brick and structural steel construction, cement foundation. General Contractor doing all work except heating and electric.

Halifax, N.S.
Residence, cost $3,500, Summit, for J. Burbridge, 226 West Young St. Builders and general contractors, Gray & Flinn, 92 Charles St. Two storeys, 25 x 45, cement foundation, frame construction.

Hamilton, Ont.
Three residences, cost $9,000, Arkledun ave. Owners and general contractors, Hamilton Building & Real Estate Co., 37 James St. S. Brick construction, stone foundation, shingle roofing. Permit issued.

Residence, cost $6,000, for E. Carlton, Balmoral Hotel. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Carpenter, W. H. Bryant, 18 Clyde St. Masons, Yates & Randall. Other contracts not yet awarded. 2½-storeys, 33 x 40, stone foundation, pressed brick construction. Foundations in.

Montreal, Que.
Two residences, cost $20,000, Vendome. Architects and general contractors, Raoul Aubertin Co., 85 Monk Blvd. Tenders received by Owner. Two stys., 50 x 50, brick and stone construction, concrete foundation. Excavating done.

Three flats, cost $7,000, St. Hubert, for Jno. Vaughan, 1369 St. Hubert. Architect and general contractor, W. R. Boon, 2212 Mance St. Three storeys, 24 x 50, concrete foundation, brick construction. Excavating started.

Residence, cost $25,000, Pine Ave., for J. A. Trudeau, 22 Notre Dame E. Architect, Wilford Gagnon, 1002 New Birks Bldg. Brick, concrete and steel, Jno. Quinlan & Co., 4414 St. Catherine W. Carpenter, Alp. Bonin, 194 Adam. Roofing, heating, plumbing and electric, Jos. Belisle & Frere, 808 Papineau Ave. Painting, Z. Lapierre, 259 de Montigny E.

Four flats, cost $5,000, Christopher Columbus. Owner and general contractor, Saloator Ricie, 1753 De Chateaubriand Ave. Three storeys, 25 x78, concrete foundation, brick construction.

Five flats, cost $4,800, St. Dominique. Owner and general contractor, O. Lavoie, 579 Casgrain. Three storeys, 25 x 40, concrete foundation, brick construction, corrugated iron roofing. Permit issued.

Six flats, cost $8,000, 9th Ave., Rosemount, for J. E. Robin, 589 9th Ave., Rosemount. Builder and general contractor, Owner. Three storeys, 38 x 44, brick construction. Mr. Robin is building flats all the time—at the rate of about 50 per year.

Three flats, cost $5,000, Maisonneuve (Orleans), for Wm. Jacob, 434 Orleans. Architect and builder, Owner. Three storeys, 30 x 38, stone and cement foundation, frame and brick construction.

Cottage, cost $5,000, Maisonneuve (Sherbrooke), for J. P. Heroux, 212 Pie IX, Maisonneuve. Architect and builder, Owner. Two storeys, 24 x 38, cement and stone foundation, frame and brick construction.

Five flats, cost $4,000, Chambly. Owner and general contractor, Donat Lamonde, 283 Chamly. Three storeys, 23 x 40, concrete foundation, brick construction, felt and gravel roofing. Permit issued.

Residence, cost $10,000, Owners and general contractors, Martel & Leduc, 447 Outremont ave. Two storeys, 36 x 44, cement foundation, pressed brick construction. Excavating done.

Flats, cost $4,000, Viauville. Architect and general contractor, A. Choquette, 170 Bourbonniere. Three storeys, 25 x 50, concrete foundation, brick construction, felt and gravel roofing. Excavating done.

Cottage, cost $6,000, Rochameault, for H. Corbeil, 1506 St. Dominique. General contractors, A. Choquette, 170 Bourbonniere, will receive private tenders for all trades. Two storeys and basement, 30 x 32, Montreal stone foundation, brick construction, felt and gravel roofing.

Montreal West, Que.
Residence, cost $8,000, for Peden & McLaren, 20 St. Alexis street. Builder, Mr. Garrigan, Brock ave. Two storeys, and basement, 28 x 55, cement foundation, encased brick construction.

Ottawa, Ont.
Residence, cost $10,000, Echo St., for Geo. Gray, Marlboro Ave. General contractor, Alex. Christie, 359 Elgin St. Brick veneer construction, stone foundation.

Residence, cost $4,000. Owner and general contractor, W. O. Spearman, 32 Barton St. Brick veneer construction, stone foundation. Excavating started.

Residence, cost $8,000, Oxford. Owner and general contractor, Theo. Dean, Westboro, P. O. Two storeys, stone foundation, brick construction, felt and gravel roofing.

Residence, cost $11,000, Daly Ave., for Col. Sherwood, Daly Ave. Architect, C. J. Burritt, 193 Sparks St. Mason, Murphy Bros., Arthur St. Carpenter, Ferguson & Lambert, c/o Architect. Excavating done.

Quebec, Que.
Residence, cost $3,000. Owner and general contractor, Pierre Roberge, 144 8th ave., Limoilou. Three storeys, 35 x 28, concrete foundation, frame, red and Scotch brick construction, felt and gravel roofing. Work by day labor. Excavating done.

Residence, cost $7,000, 3rd ave., Limoilou, for Miville Racine, 220 1st ave., Limoilou. Architect, general contractor and carpenter, Art. Belanger, 22 Smith St. Other contracts will probably be done by day labor. Three storeys, 40 x 40, 12 x 12, stone foundation, Scotch brick construction.

Residence, cost $3,000, 8 Latourelle, for Louis Gagnon, St. Pierre Island of Orleans. General contractor, Nap. Ferland, 410 St. Francois, does all the work. Three storeys, 30 x 18, concrete foundation, frame, red and Scotch brick construction, felt and gravel roofing.

Port Arthur, Ont.
Residence, cost $5,500, Ambrose, for Geo. F. Foote, 64 Cumberland St. S. Builders and general contractors, Cox & Jones. Heating and plumbing, J. W. Barnes & Co. Two storeys, 26 x 34, red clay brick construction.

Qu'Appelle, Sask.
Residence, cost $5,000. Owner and general contractor, Chas. Hamilton. Brick construction and foundation. Excavating started.

Rosemere, Que.
Country residence, cost $25,000, for Jas. W. Domville, 183 Hutchison, Montreal. Architect, Wilford Gagnon, 1002 New Birks Bldg., Montreal. General contractor, Jacob K. Hanson, 3055a St. Dominique, Montreal. Concrete foundation, shingle roofing, field stone construction. Excavation started.

Sackville, N.B.
Residence, Charlotte, for Walter Ward. Builder and general contractor, Jas. A. Hicks. Masonry, carpentry, roofing, painting, builder. Heating, plumbing & electrical work, T. R. Ehrhardt & Sons. Two storeys, 23 x 28, cement foundation, frame construction.

Toronto, Ont.
Residence, cost $6,000, Foxley ave., for Architect (in trust) W. H. Mallory, 31 Queen street west. General contractor, P. W. Coltman, 167 Robert street. General contractor sublets. Three storeys, brick and frame construction.

Residence, cost $26,000, Russell Hill Road, for Jas. Hardy, c/o architects, Wickson & Gregg, 156 Yonge street. Masonry, Witchall & Son, 163 Havelock. 2½ storeys, 51 x 59, brick and stone construction, stone foundation.

Nineteen residences, cost $50,000, Boon ave. Owners and general contractors, J. W. & J. S. Rankin, 243 St. Clarens ave. Day labor. Walls up on one pair; foundations in for four pair. Excavation out for balance. 2½ storeys, 21 x 44, brick foundation, brick construction.

Residence, cost $10,000, Wells Hill. Architect, W. H. Mallory, 31 Queen St. W. General contractor, P. W. Coltman, 167 Robert street. Masonry, A. A. Kitchen, 1285 Dufferin street. General contractor will sublet. Three storeys, stone and brick construction. Foundations started.

Four residences, cost $16,000, Lauder ave., for Dr. F. A. Sollery, 530 Bloor W. General contractor, J. S. Case, 148 Close ave. Mason, Thos. Sykes, 563 Brock ave. General contractor sublets. 2½ storeys, 17 x 42, brick construction. Foundations in.

Apartments, cost $48,000, King and Dufferin, for A. J. Rattray, architect, 123 Bay street (in trust). General contractor, C. Proctor, 38 Melbourne. Three storeys, 90 x 68, concrete and brick foundation, stone, brick and steel construction, felt and gravel roofing. Excavating started.

Residence, cost $5,000, Pricefield Road, Owner and general contractor, Jos. Williams, 303 Dovercourt Rd. Owner will sublet. 2½ storeys, 24 x 36, brick construction, brick foundation.

Two residences, cost $4,600, Arundel ave., for Geo. Sheppard, 154 Arundel. General contractor, J. M. Walker, 721 Carlaw ave. 2½ storeys, brick construction and foundation, shingle, felt and gravel roofing. Foundations started.

One detached residence, cost $4,000, Glencairn. Owner and general contractor, F. D. Parmenter, 454 Gladstone ave. Work by day labor. 2½ storeys, 30 x 35, brick construction and foundation, shingle roofing.

Rectory, cost $12,000, First ave. and Degrassi street, for Rev. Thos. O'Donnell, 240 Bolton ave. Architect, A. W. Holmes, 10 Bloor St. E. General contractor, W. A. McNeil, St. Mary's, Ont. Toronto office, Gerrard and Degrassi streets. 2½ storeys, 32 x 44, stone, steel and brick construction. Stone foundation, gas and electric lighting, hot water heating, oak and maple floors, lime and sand plastering.

Residence, cost $7,500, 81 Wells Hill, for F. W. Warren, 58 Hilton avenue. Carpentry, Wallace & Page, 25 Radenhurst. Plastering, Page Bros., c/o 81 Wells Hill. Heating, A. Clark, 7 Follis ave. Plumbing, W. N. Atkins, 25 Hocken ave. Electrical not let. Gas and electric lighting, hot water heating. 2½ storeys, 22 x 36.

Four residences, cost $4,500 each, Kennedy and Barrie. Owner and general contractor, D. J. Tuck, 1012 Bloor St. W. Masonry, day labor. Roofing, R. Rennie & Son, 130 Dupont street. Plastering, Mr. Morris, 454 Roxton Rd. Heating & plumbing, C. B. G. Reid, 194 Jones ave. Two residences, plastering and two foundations in. 2½ storeys, brick construction, slate, felt and gravel roofing.

Vancouver, B.C.
Residence, cost $10,000, Shaughnessy, for R. S. Gordon. Architect, David Blair, 522 Pender street. General contractors, Stephen & Whittacker, 1116

(Continued on page 75)

Tenders and For Sale Department

NOTICE

Extension of Time

Town of Neepawa, Manitoba

Tenders for Machinery

Sealed tenders will be received up to noon, **Friday, Sept. 12, 1913,** for machinery for additions to the power plant at Neepawa, as follows:—

Specification Section No. 1—Two 72-in. x 18-ft. Boilers.

Specification Section No. 2—One 187½ h.p. Engine.

Specification Section No. 3—One 150 k.v.a. Generator, Switchboard, etc.

Specifications may be seen at the offices of the Electrical News, or obtained from W. F. Skinner, Limited, 204 Sterling Bank Bldg., Winnipeg, or from the undersigned:

J. W. BRADLEY, Sec.-Treas.,
Neepawa, Man.

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Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension and Repairs to Revetment Wall at Meaford, Ont.," will be received at this office until 4 p.m. on **Monday, September 29, 1913,** for the construction of an Extension and repairs to the Revetment Wall at Meaford, Grey County, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Meaford, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46238. 36-37

TOWNSHIP OF BRANTFORD

Cement Sidewalks

Sealed tenders will be received up to **Saturday, Sept. 13th, 1913,** at the office of the Township Clerk, County Buildings, Brantford, for the construction of 4,053 ft. of four-foot cement sidewalk.

Tenderers are expected to look over the site of the work before putting in their bids.

Plans and specifications may be seen at the office of the undersigned.

Tenders must be accompanied by marked cheque for $200 payable to the Township Treasurer.

Lowest or any tender not necessarily accepted.

ALAN MAIR JACKSON,
Township Engineer.

37

Sealed tenders addressed to the undersigned and endorsed "Tender for Interior Fittings, Post Office, Port Arthur, Ont.," will be received until 4 p.m. on **Thursday, September 18, 1913,** for the work mentioned.

Tenders will not be considered unless made upon forms furnished by Department, and in accordance with conditions contained therein.

Plans and specifications to be seen on application to Mr. D. McKenzie, Caretaker, Port Arthur, Ont.; Mr. T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 30, 1913.

—47186. F

Tenders Wanted

Sealed tenders will be received up to noon on the **16th day of September, 1913,** by the undersigned at Cayuga, Ontario, for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand.

The work will be let in three separate and distinct contracts, not necessarily to the same individual.

Tenderers are required to examine the localities of the work and are required to be present at the opening of the tenders at 2 p.m. on Wednesday, the 17th day of September, 1913.

Plans and specifications may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of $10, which sum will be refunded on return of the documents.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand,
Cayuga, Ont.

32-37

TENDERS

FOR

Fire Alarm Boxes, One Ten Circuit Protector Board, One Eight Circuit Storage Battery Board, One Motor Generator Set, Three Full Joker Sets, Copper Wire, etc.

Tenders addressed to the undersigned will be received by registered post up to noon on

Tuesday, September 23, 1913.

for supplying the above named articles.

Specifications and forms of tender, together with the conditions governing tenders, as prescribed by city by-law, may be obtained at the office of the Fire Department, No. 152 Adelaide street west, Toronto.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.

Toronto, Sept. 3, 1913. 37-37

Proposed Government Buildings

OTTAWA, ONTARIO

Architects are invited to submit sketch designs in a preliminary competition for the erection of Departmental and Courts Buildings.

From the designs submitted in this preliminary competition, six will be chosen by the Assessors, the authors of which will be invited to submit more matured designs in a final competition, for which the five unsuccessful competitors shall each receive an honorarium of Three Thousand Dollars ($3,000).

The author of the design placed first by the Assessors will be entrusted with the work which the Government intends carrying out at once.

The competition is limited to British subjects practising in the British Empire.

The Government has appointed Mr. T. E. Collcutt, Mr. J. H. G. Russell, and Mr. J. O. Marchand, as Assessors to act in its behalf.

The design in the first competition must be delivered in Ottawa (carriage paid) not later than 12 o'clock noon, 2nd January, 1914, addressed to the undersigned.

Conditions for both competitions may be had on application to the undersigned, and at the office of the High Commissioner for Canada, 17 Victoria Street, London, England.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 18, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—44890. 36-37

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Power Plants, Electricity and Telephones

(Continued from page 73)

Hamilton, Ont.
Underground conduit system, cost $177,822, for Hydro Electric Department. Mayor, John Allan. Engineer, E. J. Sifton. General contractor, G. M. Gest, 502 Power Bldg., Montreal. Above cost does not include wiring. Part of cost to be borne by the Cataract Power & Telegraph Companies.

Montreal, Que.
Transformer house, cost $5,000, Verdun, for Montreal Water & Power Co., Quebec Bank Bldg. Architect, Owners. General contractors, A. F. Byers & Co., 340 University Ave., open to receive tenders for roofing, concrete foundation, brick construction, copper roofing.

Port Henry, Ont.
Wireless Telegraph Station planned by Dom. Govt., Dept. of Marine & Fisheries. Secretary, Alex. Johnston, Ottawa. Station to be erected 300 ft. northwest from above location for purposes of forming a connecting link between Montreal on the east and Toronto on the west, in a chain of stations reaching across Canada from Labrador to Vancouver. Site secured, work to start shortly.

Shawville, Que.
R. A. Lister & Co., Ltd., 53 Stewart St., Toronto, have been awarded the contract for the installation of an additional automatic electric lighting plant of 6 kw. capacity, to be Lister Bruston automatic type, same as the first plant.

Toronto, Ont.
Transformer station, cost $35,000, Ft. Strachan ave., for Hydro Electric Power Commission, Continental Life Bldg. Architect, company's engineer. General contractors, Witchall & Son, 163 Havelock street. Brick, stone and steel construction.

Winnipeg, Man.
Addition to power house, cost $35,000, River street, planned by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King street. General contractors, Fort Garry Construction Co. Ross & Arlington. Heating, Charette Kirk & Co., St. Boniface. Foundations in.

Business Notes

Belleville, Ont.
Queens Hotel stables, Temperance Hotel stables, C. Owens livery stables destroyed by fire. Loss $15,000.

Inverary, Ont.
Cheese factory owned by the Model Cheese Co., burned. Loss $3,000; insurance $3,000.

Montreal, Que.
Cabinet works owned by Smith Estate, c/o Mr. Gallagher, 957 St. James St., damaged by fire. To be replaced by owners.

Rosthern, Sask.
Machine and blacksmith shop owned by Philip Kenzel, Strathcona ave., burned. Loss $5,000.

Miscellaneous

Calgary, Alta.
Fire apparatus, cost $52,000, contemplated by the City Council. Clerk, J. M. Miller. By-law to be voted on September 28th for motor pump and fire fighting apparatus.

Ottawa, Ont.
Cable required by Electrical Dept. Engineer, Supt. Brown, City Hall. Contract awarded to the Imperial Wire & Cable Co. of Montreal, for wiring for underground conduit system.

Regina, Sask.
City Council contemplate the purchase of new gasoline pump for fire department, recommended by Commissioner, L. A. Thornton. Chief of Fire Dept., A. J. White.

New Companies

Chats Falls Realty Company, Limited, has been incorporated with a capital of $50,000, to carry on business as a general land and building company, with head office at Ottawa. The provisional directors are G. P. Spittal, broker, T. A. Beament and A. H. Armstrong, barristers, all of Ottawa.

The Point Improvement Company, Limited, has been incorporated with a capital of $40,000, to carry on a general land and building business with head office at Windsor. The provisional directors are R. F. Hurst of the Township of Mersea, Edward Winter, agent of Leamington, and A. B. Drake, barrister, of Windsor.

Hepburn & Disher, Limited, have been incorporated with a capital of $150,000, to manufacture and deal in structural, ornamental and all other clases of iron, steel and metal work, with head office at Toronto. The provisional directors are C. E. Disher, engineer, J. T. Hepburn, machinist, and J. F. Boland, barrister, of Toronto.

The Ideal Electric Manufacturing Co., Ltd., has been incorporated with a capital of $40,000, to manufacture and deal in electric appliances of all kinds, with head office at London. The provisional directors are Jno. Sussex, R. J. Gracey, and W. A. Cooper, manufacturers, all of London.

Late News Items

Edmonton, Alta.
Residence, cost $5,000, for G. H. McDonald, King's Drive. Architects, Magoon & MacDonald, Tegler Block. General contractor, L. F. Kelsey, General Delivery. Two storeys, 25 x 34, brick and frame construction, concrete foundation. Two fireplaces. Excavating done.

Montreal, Que.
Machine shop planned between Guy and Beaver Hall Hill, St. James and St. Antoine for Estate J. K. MacDonald, 318 Craig W. Mr. D. A. MacDonald, of J. K. MacDonald Estate is looking for 3,000 feet of land on which to build or else would like to rent or buy two storey building.

Apartment house, cost $40,000, Lorne Crescent, for Hand & Pick, 609 Belmont ave., Westmount. Architect, D. J. Crighton, Jacobs Bldg., will receive tenders for reinforced or cement, 5 storeys, 58 x 71, concrete foundation, reinforced concrete, terra cotta and brick construction. Foundations in.

Semi detached residence, cost $34,000, Westmount, Blvd. ave., for A. Racine, 340 St. Paul street. Architect, L. A. Amos, 78 Crescent. General contractors, Robertson Bros., Chestnut avenue. Two storeys and basement, 50 x 65, concrete foundation, pressed brick construction, galvanized iron cornices. Excavating done.

Ottawa, Ont.
Stores and offices, Rideau street, owned by J. B. Duford, painter, Rideau St., burned; loss $35,000. Will rebuild. Owner has several large contracts on hand at present and will require paints of all descriptions.

Petite Riviere East, Que.
Breakwater. Tenders received by Secretary, Dom. Govt., Dept. of Public Works, R. S. Desrochers, Ottawa, until Oct. 7th. Plans, etc., at office of J. T. Bertrand, Dist. Engineer, Isle Verte, J. C. Tache, Dist. Engineer, Rimouski, Postmaster at Petite Riviere and Dept., Ottawa.

AGENTS WANTED

High Class Artificial Stone Company requires agents in every city to sell building stone, ornamental work, pipes, roof and floor tiles, etc. Liberal commission allowed. Address C. P. c/o "Contract Record," Toronto.

36-37-38

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

MANUFACTURERS OF
XCELADUCT
AND
ORPENITE
CONDUITS

*The Sign of
Good Conduit*

"Exceladuct" and "Orpenite" Conduit

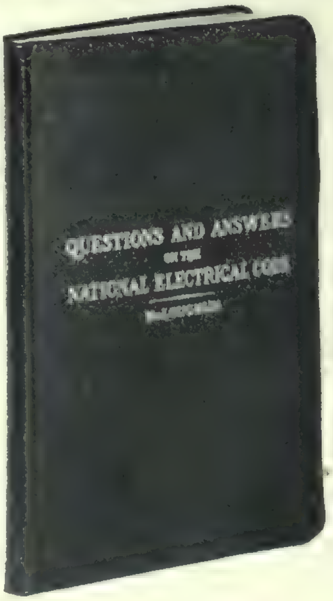
"Exceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

"Orpenite" Enameled Conduit—Easy Bending Spellarized Steel Tube; protected against rust by coatings of special enamel not affected by temperature conditions, smooth interior.

We solicit an opportunity to submit prices and other particulars.

Orpen Conduit Manufacturing Co. of Canada
TORONTO, CANADA **Montreal, Quebec**

You Can Interpret the Code Instantly with McLoughlin's



Questions and Answers
on the
National Electrical Code

It tells at once the answer to the questions on code requirements. Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.

Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 (4/2) net, prepaid.

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Contract Record - 220 King Street West, Toronto

We Manufacture

The Reliable Line of

VALVES

- Brass Globe and Gate.
- Steam and Hot Water.
- Packless Radiator.
- Iron Body "Keystone" Gate, (non-rising stem or outside screw and yoke, with screwed, flanged or hub end)
- Iron Body Swing Check.

Kerr Gate Hydrant.

Gate and Compression FIRE HYDRANTS

INDICATOR POSTS

CRANES FOR FILLING WATER CARTS

VALVE BOXES
Screw Adjustable or Slide Adjustable

6″ Hub End Gate

Forty Years of Experience has much to do with the satisfaction these goods give our customers.

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

New Code Rubber Covered Wires AND Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

Price list and discounts on application to head office or nearest agent.

Canada Wire & Cable Co., Limited
1160-1170 Dundas Street
Toronto Canada

Sales Agents

Roper Clarke & Co., Limited, 422 Coristine Bldg., Montreal; A.E. Esling 150 Princess St., Winnipeg; Macdonald, Marpole Co., Limited, Vancouver; Gorman, Clancy & Grindley, Limited, Calgary and Edmonton.

CRUSHED
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PORTLAND
CEMENT

The Rogers Supply Co.
28 King St. West
Telephone Exchange M 4155 Toronto

Toronto Agents for Dundas and Vinemount Quarries

CLEAN STONE

Quick Deliveries
By
G. T. R., C. P. R. or Team

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine desking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 40	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net $1.85

No. 4½ Fuller's .... net $2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50, less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered Toronto, bags extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. sidings.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime, per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINT AND OILS

Pure White Lead, ground in oil, $9.00 per 100 lbs.

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

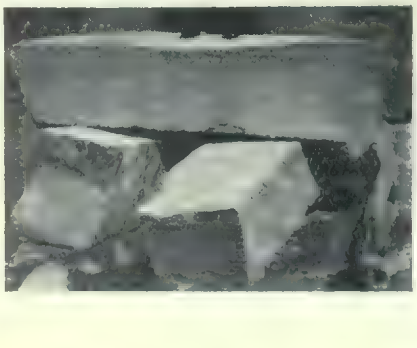
Raw Linseed Oil, in bbls., 64c per gallon.

Turpentine, in barrels, 60c per gallon.

Pure Red Lead, dry $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.



Argenteuil Granite Co., Limited

42 Craig Street West, MONTREAL

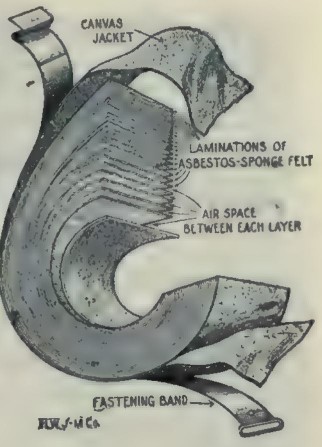
We are in the market to bid on your plans for granite on buildings.

Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

SEND US BUILDING PLANS TO-DAY

A Sure Way to Reduce Coal Bills

If the pipes of a steam plant are covered with only an ordinary covering, or not covered at all, hundreds, perhaps thousands, of dollars are wasted every year. Repeated tests have proven that when pipes are not properly insulated, from one-quarter to three-quarters of the fuel burned is wasted by radiation and condensation.


CANVAS JACKET
LAMINATIONS OF ASBESTOS-SPONGE FELT
AIR SPACE BETWEEN EACH LAYER
FASTENING BAND
H.W.J-M.Co.

J-M Asbesto-Sponge Felted Pipe Covering

positively prevents radiation and condensation. It carries steam a mile with practically no loss. It is the most efficient covering on the market, because it confines the greatest amount of dead air—the secret of insulation. J-M Asbesto-Sponge Felted is also the most indestructible covering on the market. It will not crack, break or lose its insulating value from vibration or rough usage.

Write nearest branch to-day for Catalogue No. 100.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD.

Manufacturers of Asbestos and Magnesia Products ASBESTOS **Asbestos Roofings, Packings, Electrical Supplies, Etc.**

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1096

WINDOW LETTERS

House Numbers and numbers suitable for Hotels, Apartment Houses, Church Pews, etc.

Brass Plates, Enamelled Iron,
Glass and Wood Signs

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147 Church St.
Phone Main 7363
Toronto, Ont.

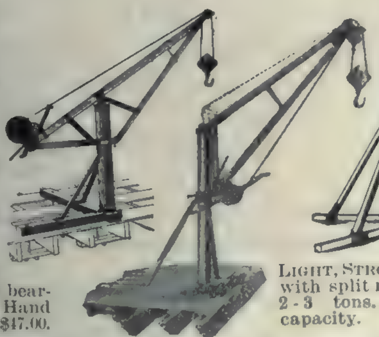
Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

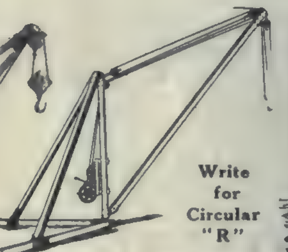
would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The Most COMPLETE LINE OF BUILDERS' DERRICKS MADE



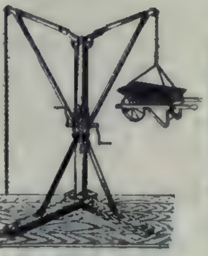
Reinforced Standard 2500 lbs. capacity with geared winch complete $48.00 or for Hand and Power $51.00.

Peerless Steel Derrick full circle swing, self-lubricating bearings, $45.00 Hand and Power $47.00.



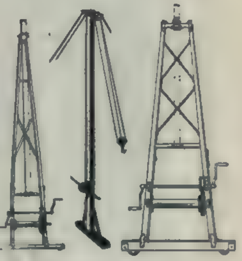
Light, Strong, Stiff Leg Derrick with split mast and boom, capacity 2-3 tons. Price according to capacity.

Write for Circular "R"



Double Boom Wheelbarrow Derrick full circle swing. Sufficient chain for 3 storey building. Price $68.

"A" Frame Builders Derrick 1800 lbs. capacity $48.00; 2500 lbs. capacity $51.00.

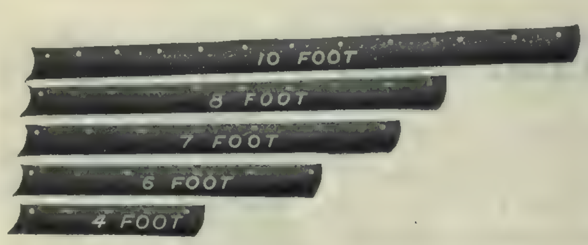


T. P. SETTER DERRICK.
POLE DERRICK.
REGULAR SETTER DERRICK.

At these prices you can't afford to be without one of these derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

Don't Hire Men to Carry Up Your Material, Hoist It with a SASGEN DERRICK.

SASGEN DERRICK CO., 13 Jarvis St. TORONTO
CHICAGO OFFICE : 2053-57 N. Racine Ave.



We manufacture and carry in stock road plows, scraper blades and moldboards ½ inch thick and lighter, of the very highest quality of steel and workmanship, for all makes of road scrapers. Blades guaranteed to be of the very best quality. Write for prices, discounts and list No. 20.

THE
SHUNK PLOW COMPANY
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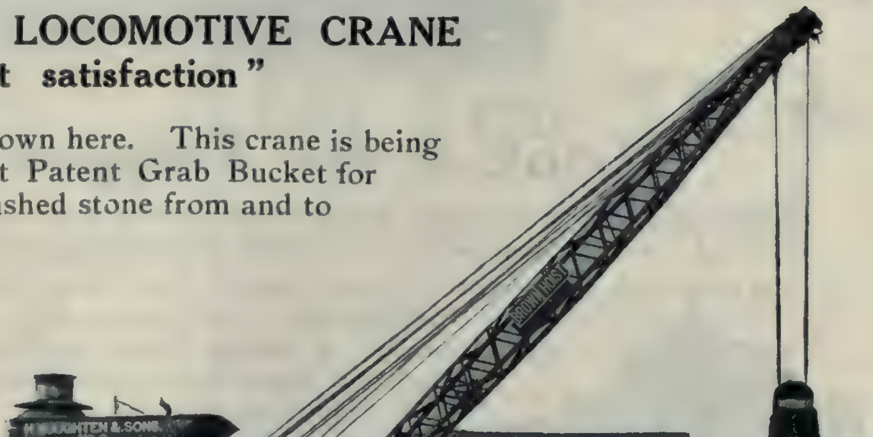

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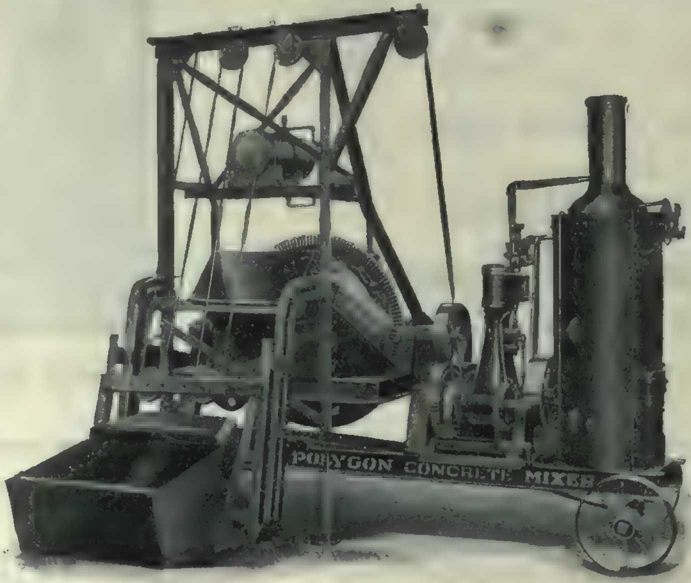

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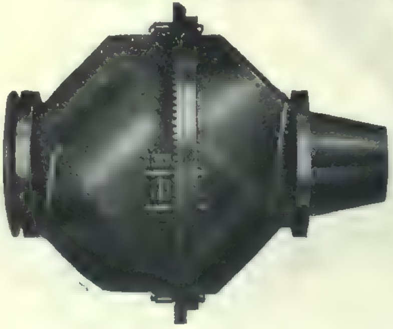

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Alphabetical Index of Advertisers
Page 16

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Problems of Finance and Distribution

IN spite of the fact that a number of alarmist statements have been going the rounds during the last week or two, general trade conditions throughout the country are very satisfactory. Particularly in the west has a change in the direction of improvement taken place. Excellent crop prospects have inspired a strong feeling of confidence and money is becoming more plentiful. It may be asserted safely that with the garnering of a crop estimated at a value of nearly three hundred millions the financial stringency—if such it may be called—will soon have passed into history.

Reports from a number of western cities showed that August was a better building month than either June or July. Building records to date show that Calgary is having one of the most active years in its history in this respect. The permits issued up to the end of July were close on six million dollars and thousands of dollars' worth of new permits are still being issued daily. At the end of the present month the permits are expected to total seven millions.

Toronto particularly has been complaining of decreased activity in the building trades, as evidenced by the number of men idle. Here, however, we believe the conditions to be peculiar to a city which is becoming the eastern dumping ground for thousands of immigrants. Not only that, but lately there has been a large influx of men from outside points who have been attracted to the city by reports of higher wages obtained in several trades earlier in the year. We are confident that with the amount of construction work going on throughout Canada there is ample room for all. It is simply a problem of distribution—one that will solve itself very quickly. Last week we referred editorially to the creditable showing of the city of Montreal, which, with an expenditure of nearly fourteen millions for the eight months, recorded an increase of nearly 25 per cent. over the corresponding period of 1912. Montreal would appear to be the solution of Toronto's surplus labor.

Railroad construction and road-building are progressing actively in all sections of the country. The work that is being carried out is of a more enduring character than ever before and greater attention is being paid to securing permanent roads rather than temporary surfaces. There have been numerous reports of extensions to railway buildings and the erection of car shops and repair plants. In the building field the activity has been greatest in residences in the east and in factories and other commercial buildings in the west.

In the supply market the prices appear to be well balanced between the consumer and the manufacturer, with present conditions arguing in favor of higher rather than lower levels.

Is Canada Big Enough for a Municipal Engineering Society?

IN a recent issue of this journal the suggestion of founding a municipal engineering society was brought forward by Mr. R. O. Wynne-Roberts, of Regina, who pointed out that this branch of the profession was practically unique in having no representative body; further, that the extent of the territory over which engineers were distributed in this country, so far as providing an argument against the formation of a society, was one of the most powerful reasons in favor of it, in that the work of a representative body would eradicate the present tendency to insularity brought about by the isolation of engineers in the cities and provinces of the Dominion.

Since the publication of Mr. Wynne-Roberts' letter, the proposal has come in for a good deal of attention and has called forth editorial comment from several of our contemporaries. It is gratifying to note that these have been favorable—with the single exception, perhaps, of a suggestion that has been made to organize the proposed society as a section of the Canadian Society of Civil Engineers. We cannot agree that there are already too many technical societies in Canada. Competition is essential to success. The city of London has a population of seven or eight millions but there is always a vacancy for the man who can achieve.

Viewed from the outside, the Canadian Society of Civil Engineers has not taken an active part in things of vital interest to municipal engineers. Admitted the Society has a long and honorable record and that it has done much to place the engineering profession in Canada on a higher plane. But we cannot overlook the fact that a few short months ago many of its prominent members were not afraid to sign their names to letters published in this journal which at times constituted severe criticism of the Society's activities—or rather inactivities. The Canadian Society of Civil Engineers, we repeat, has done excellent work, but it is just possible that, owing partly to the nature of its constitution and partly to the fact that a certain interest has been the controlling factor for a number of years, it is running in a groove.

Now from what we can gather, the idea of Mr. Wynne-Roberts and his supporters is to get the municipal engineering profession out of the groove and to organize and conduct its affairs upon somewhat different lines from those of the C. S. C. E. We are at a loss to understand why the membership of the prospective organization should be so difficult to build up when, as Mr. Wynne-Roberts stated in the communication to which we have referred, according to the Dominion census of 1911 there were 107 cities and towns in Canada having a population of four thousand and more, and that at the present rate of increase that number will be increased to two hundred by 1921. Mr. Wynne-Roberts contends that there are from three to five hundred engineers in Canada engaged on municipal work who would support a distinctly representative society. We believe the estimate to be a conservative one and the figures to represent the extent of the membership list before the close of 1913 if a society were formed and aggressive measures taken by the executive. The society might be extended, as suggested, by taking into the membership consulting engineers engaged on municipal undertakings.

The conditions under which many of our municipal engineers have labored during the past have been disgraceful. Such a thing is unheard of in England, where the engineers in this field are represented by the Institution of Municipal and County Engineers and other societies. The most libellous statements have been made with impunity about Canadian engineers, where in England, not so long ago, the institution to which we have referred provided funds on behalf of one of its members and secured judgment for him against a councillor who had emulated our Canadian practice of vilifying public officials without rhyme or reason.

The C. S. C. E. has been set upon a pedestal from which it can scarcely be removed. We have heard that it is not its work—that it would be undignified on its part—to investigate the affairs of an engineer and his council; that it stands for the advancement of engineering knowledge, and that it is not trades union. Well and good: it has its functions to perform and it is fulfilling its part creditably; but we believe that there is another and more active part that a well-organized society with good, rich, red blood in its veins could do to equal advantage.

Canada is expanding rapidly and we must look further than the end of our noses. The present appears to us to be the opportune time to lay the foundations of a society which might well do excellent work from the time of its inception and accomplish greater things in the years to come.

We understand that the matter is to come up for discussion at the convention of the Canadian Public Health Association, which is to be held at Regina September 18-20. It is to be hoped that there will be ample discussion of the subject by a representative gathering of municipal engineers.

Competition From the Outside

VIGOROUS protests were forthcoming at a recent meeting of the Victoria Builders' Exchange, convened for the special purpose of discussing the action of the directors of the Provincial Royal Jubilee Hospital in appointing a United States architect to the position of supervising architect in connection with the construction of the new hospital, which is to be erected at a cost of some $350,000, and to which the ratepayers of Victoria alone have voted $250,000. The president of the Exchange, Mr. Robert Dinsdale, took the stand that while the plans should be accepted strictly upon their merit, irrespective of whether they were prepared by Canadian or United States architects, the actual supervision of the work should be entrusted to local people, or at least to a Canadian.

Now we have always come out strongly in favor of home institutions, but we cannot but think that there is something radically illogical about the good people of Victoria if their opinion is voiced by Mr. Dinsdale. The bone of contention is that in the wake of the United States architect usually come United States contractors and United States supply dealers. To overcome this, according to Mr. Dinsdale, it would be necessary to purchase the plans outright and to distribute the rest of the work locally among those having the proper qualifications.

This is a one-sided view that we cannot take. Why pick out the United States architectural profession alone to give us the benefit of experience? Put it another way: why should the architectural profession in Canada be singled out to compete internationally and the contracting community have a closed field? If we can benefit from the one we can benefit from the other. There are improved methods of construction, modern machinery and quick cuts in a hundred ways of execution and organization that are employed by the big firms across the line. Can we not take an occasional object lesson in the practical work? Theory alone will not carry through our great constructional undertakings. The architect and the engineer have their limitations and the contractor has a well-defined and important part to play. It has often been stated by the champions of "Canada for Canadians" that we have all the resources in the way of brains and material that we want. The point is, have we? There are dozens of buildings and other structures throughout the country that attest the skill of contractors from across the border and from even more remote fields. Is it reasonable to assume that in any case the work could have been carried out with equal credit by Canadians? We leave it to the reader and to the special knowledge and experience that he may have acquired in his own particular line of work. For our part, strong as the British spirit is with us, we have always contended that our own people should get the preference only when all other things are equal.

Undoubtedly in this Victoria case the successful architect's plans were selected upon their merit. The selection having been made, surely it would be an impracticable and unwise step to have any other but the man responsible for the plans supervise the work.

As to outside contractors having secured an advantage under United States architects, if this be so then surely we may profit by experience and so frame our conditions as to ensure open and unbiassed competition.

It is interesting upon investigation to note that in this instance the United States architect has maintained an office in Victoria for the last three years and that he is a member of the B. C. Society of Architects. His disposition therefore would appear to be meritorious, even though he were a citizen of another state.

The principle of employing none but our own people and using none other than material supplied by Canadian firms would be an excellent one if we were big enough to put it into effect. Again we ask, are we?

Not so long ago, in the course of a conversation, we were waxing indignant because Toronto firms, apparently, had not been given an equal opportunity to tender on certain work, but our indignation was treated humorously in view of the fact—as we were told—that the magnitude of the job and the problem of financing it had scared all the local contractors into the surrounding country. No local men were on the job or after it.

When we are really as big as we desire to be perhaps we shall be big enough to stand up to any competition. This is a subject upon which we, in common with many of our acquaintance, are beginning to have an open mind.

A One-Hundred-Million-Dollar Programme

If any of our readers have a turn for statistics, let him essay to show what can be done with one hundred million dollars, the amount of expenditure represented by the C. P. R. programme. We are not given to mathematical feats ourselves and we have not the faintest idea how many miles of paving stone could be covered up with one hundred million one-dollar bills; nor could we give a rough guess at the distance they would cover laid end to end, or how long it would take to count them. Nevertheless we are impressed with the stupendousness of the amount. Not only are we impressed but we are gratified to reflect that this great sum is to be distributed among the constructional interests of Canada.

Directly or indirectly each one of us must get a slice of that one hundred millions. Not only will many industries benefit from the direct expenditure of the money, but all will reap some advantage—from the impetus that it will give trade, from the new business that will be created and from the outside investment money that will be attracted.

The unbounded confidence which these great institutions manifest in the future of our country as indicated by their expenditure of these enormous sums of money should convey something to many of us. It is difficult to reconcile the expenditure of such sums with the hesitancy displayed so frequently by those who are considering whether Canadian business is worth the trouble and expense of a publicity campaign.

Full details of the company's plans are not available, but it is known that the development includes double-tracking between Sudbury and Port Arthur, 113 miles, at a cost of $5,300,000; track construction between Brandon and Calgary, 178 miles, $5,000,000; 18 miles of second track and grade improvements between Six-Mile Creek and the "loop" near the Selkirks, $8,000,000; and 139 miles of double-tracking between Revelstoke and Vancouver, $7,000,000.

The Bonus and Penalty Clause

SAN Francisco has recently adopted a bonus and penalty form of contract under which, the city engineer writes to the mayor, very satisfactory results are being secured as to completion of work on time. He notes, for example, that on a street railway contract the time was cut from 45 days allowed to 25 days, while on a similar contract 48 days sufficed for completing work for which 60 days had been allowed.

These results have probably often been duplicated, and mention is made of them here principally to call attention to the psychological effect of the bonus and penalty clause, though certain other phases are briefly discussed.

As a plain business proposition one would think that a contractor with a fixed sum contract would rush work through in order to release his plant and use it elsewhere. It is the ordinary business method of turning over one's capital as many times as possible. As a fact, however, while this does theoretically appeal to the contractor—in that he recognizes its inherent economies—practically it makes very little difference in his pace. Custom and the particular types of plant used have set a certain speed and so long as that is maintained very little study is given to the elimination of small inefficiencies and the saving of minutes here and there. The release of his plant and the early receipt of full payment do not give just the sort of stimulus that is needed to make the contractor grudge the small losses.

The "hanging up" of a bonus, however, invests the job with the spirit of a game. Not only is there a schedule—he probably had that before—which it will be a satisfaction to beat, but a monetary prize to win. The bonus seems to be a challenge to him to "get under" the mark set, and with the love of a contest inherent in human nature he accepts the challenge. A contractor to whom $1,000 is a bagatelle will chuckle with delight over the earning of a bonus of that amount and brag about it to his friends. He will bend every effort to get it, spurring on his organization and tuning up his equipment to the top notch. The game makes him critical of even small delays, and inefficiency in the use of equipment grows intolerable. The purse looms big and keeps him at it. Oftentimes in his interest in the bonus he fails to recognize that the savings through better management amount to more than the monetary prize. It is recognized, of course, that emergency work, done under very high pressure, is generally costly; but it is the general run of contract in which the completion date is important that is here considered.

While undoubtedly a bonus clause does aid materially in securing the completion of work on or before schedule time, it must not, therefore, be considered as commendable in all sorts of contracts. Often there is no special need for hasty construction or harm from delay, while in other cases the schedule may be so liberal and the conditions as to materials and labor so favorable that there is every likelihood of a competent contractor finishing on time.

The setting of a fair completion date under a bonus and penalty clause, moreover, is not a simple matter. If the time estimate is too liberal, money is unnecessarily spent, while if too short the contract figures will be correspondingly high, and good men may refuse to bid, leaving the work to those who take "long chances." Presumably if the time is very short there will be some counterbalancing benefit to the owner from early completion.

With good records of construction performance it is possible to set fair schedules that will avoid the difficulties and, when the completion date is set, to name a per diem bonus or penalty that will be an incentive to the contractor and be profitable to the owner.

Clogging of Mechanical Filters

Mr. Frederick H. Storer, bacteriologist and chemist to the Louisville Water Company, has dealt with one of the causes of trouble in mechanical filters in a paper presented to the American Waterworks Association at Minneapolis.

It is shown that though it might reasonably be inferred that the operation of the mechanical filter would be easiest at times when bacteria and suspended matter are present in the raw water in the least amount, many filter superintendents are finding that such is not always the case, and that warm weather and clear water bring troubles peculiarly their own, shortening the filter runs and producing odours in the filters. At such times the unfiltered waters are found to contain very minute forms of life, diatoms and a few algae, accompanied by considerable amounts of very fine matter of indeterminate form capable of adhering together in flakes. This matter is supposed to be the result of bacterial action on organic substances. Thus, conditions of clear, warm, shallow water, abundant sunlight and sluggish current afford these micro-organisms the most favorable conditions for development, and their numbers increase rapidly at such times, while the sedimentation basins give the required conditions.

An instance is quoted where, during a period of twenty-six days, the number of micro-organisms present in the unfiltered water remained practically constant; yet during this period the length of the filter runs steadily decreased, and this result was considered as being due to the cumulative effects of a constant number of organisms. When, however, copper sulphate was added to the water in the sedimentation basins there was a general increase in the length of the runs. Also later, when the organisms had died from natural causes, a similar increase in the length of turbidity of the water had remained unaltered, and it was found that the length of the filter runs followed quite closely the variations in the number of micro-organisms present. The manner in which the clogging occurred is described as differing from that experienced with water of greater turbidity.

It was at first believed that with waters of very low turbidity, owing to the fact that the size and consistency of the film formed on the filter surface was reduced, the very fine suspended matter was able to penetrate into the sand in a manner which was not the case with water of greater turbidity, and in the absence of any considerable number of organisms the shortening of the filter runs was first attributed to fine turbidity alone. It was, however, found, on microscopic examination, that the sand generally showed the presence of numerous diatoms and other organisms apparently cemented together in a matrix of amorphous matter and fine turbidity, and the author is of opinion that the living organisms accelerate the formation and retention of this gelatinous film upon the sand grains. Practically, the surface of the sand under these conditions became abnormally hard and compact in a short time, and when broken up the sand grains showed a slight tendency to stick together, and this condition could not be wholly corrected even by thorough washing.

Under these conditions it was considered that some method of treatment should be adopted to prevent the clogging, and three methods were tried, though it seems that only one of these—the successful method—received any great degree of care, owing to the difficulties of application under the particular circumstances. The killing of the micro-organisms by chemicals was attempted, but owing to lack of equipment for applying it accurately as a continuously fed solution, hypochlorite was applied to one of the filter beds in the form of powder. This was done by draining off the filter till about 3 inches of water remained on it, and scattering the powder over the surface and allowing the bed to stand thus for twenty-four hours. The result did not prove to be useful, and the bacterial efficiency of the bed was, moreover, impaired. Copper sulphate was then applied in the second sedimentation basin, and in the coagulant basin, and favorable results were at once obtained. The method adopted was that of dragging bags of the copper sulphate through the water. The third method was that of using the river water without preliminary sedimentation, the water being run direct to the coagulant basins. This was done on two occasions, and in both cases encouraging results were obtained, although in each case an increase in turbidity followed within a few days, and thus left no opportunity to see how long the improvement would have lasted.

The summary at the end of the paper states that the water of the Ohio River, when of a turbidity below 30 parts per 1,000,000, almost invariably causes decrease in the lengths of the filter runs. If such turbidities are accompanied by micro-organism and much amorphous matter, still greater decreases follow. Filter runs may be greately increased by the judicious use of copper sulphate, although after-growths of bacteria sometimes follow its application, and must be guarded against. Small doses of hypochlorite of lime do not affect these micro-organisms in such a way as to increase the length of the filter runs. The determination of the time of filtration of samples of water through small laboratory filters will in some instances enable the operator to select the water from that point of his system which will give the longest filter runs.

Forms and specifications have been issued by the Dominion Government for the construction of a public dock between Salisbury and Commercial drives in Vancouver, on Burrard Inlet, the estimated cost of which will be $500,000. The dock will be of reinforced concrete with a concrete superstructure, having a length of 800 feet and a width of 300 feet.

A 216,000 h.p. hydro-electric development has been started at Nore in Norway. This development will be the largest in Europe. It will utilize the water at the Nore Falls and transmit power to the capital, Christiania, and to the southern part of the country. The power house, which will be 525 feet in length, is located at the foot of a mountain on which forebay and penstocks are placed. A 4-mile tunnel through this mountain connects the forebay with the storage reservoir. The net head is 1,378 feet and the installation comprises eleven 20,000 h.p. and two 10,000 h.p. turbines.

Air Compressor Plant, C.N.R. Tunnel

An Interesting Feature of the Great Undertaking at Mount Royal — The Equipment Described in Detail

By J. L. Busfield, B.Sc., A.C.G.I.

IN order to supply the large number of rock drills employed in the construction of the Mount Royal Tunnel with the requisite amount of compressed air it was necessary to build two plants capable of compressing 5,300 cu. ft. of free air per minute each, at a pressure of about 100 lbs. per square inch. These two plants are located at the opposite ends of the tunnel, one near the Dorchester Street Shaft and the other adjacent to the West Portal, at the Model City of Mount Royal. The former of these plants supplies all the workings from the Dorchester Street Shaft, and the other supplies all the workings east from the West Portal. Both are equipped with similar machines, and are identical except for a few details, so a description of one plant will suffice for the two.

In each plant there are four compressors, three of which are driven by electric motors with belt drive, and the remaining one is of larger capacity, direct connected to the motor. This large compressor has a capacity of 2,000 cu. ft. per minute, and was made and supplied by the Sullivan Machinery Company, known as their WN-2 type, and is illustrated in Figs. 1 and 2. It is of the two-stage, or cross-compound type, the low and high pressure cylinders being 26 and 15½ in. in diameter respectively, with a stroke of 18 inches, the normal speed being 185 r.p.m. A simple calculation will show that at this speed the actual piston displacement of air at atmospheric pressure is 2,040 cubic feet per minute.

The air inlet valves are of the Corliss pattern, operated by eccentrics on the crankshaft, a small amount of clearance is provided at the back of the valves which allows a small film of compressed air to get in and press the valve to the seat, automatically taking up the wear.

The air discharge valves are of the poppet type, and are in the upper edge of the cylinder head, and placed at such a distance from the ends of the cylinder that the piston travels past the openings to the pockets, thus reducing the clearance to a minimum. The valves are of cup-shaped form, guided by an extension of the cover plug, and held in place by light steel springs placed inside the cup of the valve.

To keep the air from reaching too high a temperature both the cylinders are surrounded with a water jacket, in which water is kept in constant circulation. Between the low pressure and high pressure cylinders the air is passed through an intercooler, which consists of a cast iron shell surrounding a number of copper tubes in which cold water circulates. These tubes are placed close together and staggered so that the warm air passing through the cooler is split up in a number of narrow passages between the cold tubes. This inter cooler is shown between the right-hand cylinder and the exciting generator in Fig. 1.

The lubrication of the moving parts of the machine is obtained by means of the splash system, the crank shaft eccentrics, etc., all being surrounded by enclosed chambers.

An unloading valve is fitted on the air inlet pipe. It is of the total closure, double beat type, and is controlled by the air pressure in the receiver. When the pressure reaches 105 lbs. per sq. in. the valve automatically cuts off the entire supply of air, and the compressor runs under no load except friction, reducing the power consumption to a minimum. When the pressure in the receiver drops to 95 lbs. per sq. in. the valve opens fully, and the compressor resumes its full load until the pressure again reaches the maximum when the whole operation is repeated. Experience has shown that this type of controlling valve is more efficient than a valve which permits the compressor to run under a partial load.

In addition to this unloading valve an atmospheric relief valve is placed on the high pressure cylinder to discharge into the atmosphere any air which might be drawn into the cylinder while the engine is running unloaded.

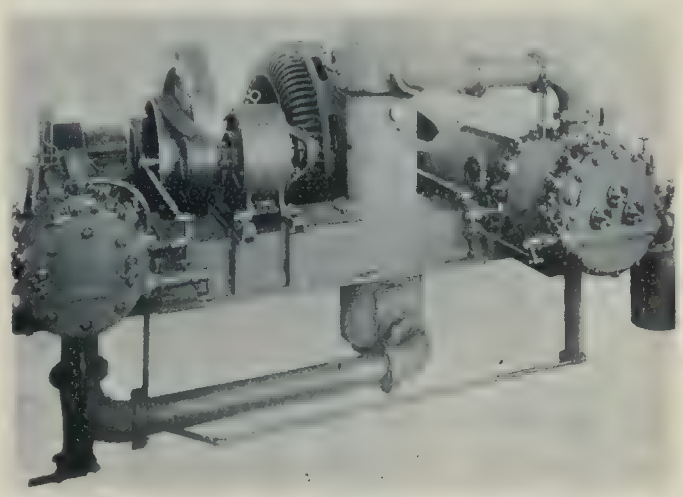


Fig. 1.—Shop view of Sullivan direct-connected compressor.

The compressor is driven by a Canadian General Electric synchronous motor mounted on the same crankshaft. This motor is self-starting, and is capable of developing 400 h.p. with 2,200 volts in the stationary armature. The revolving fields are excited by a d.c. generator belt driven from the main crankshaft at a speed of 675 r.p.m., and delivering the current at 125 volts. The exciting generator can be seen between the two cylinders in Fig. 1.

In order to compensate for the load fluctuations, and to enable the machine to pick up its load quickly, a flywheel weighing 7,000 lbs. is mounted on the crankshaft.

The smaller machines, of which there are three in each plant, are no less worthy of mention, as they are kept in more continous use, and have given very satisfactory service, frequently running from 7 to 9 days without a stop, and with practically no attention.

These machines, supplied by The Canada Foundry Company, are Blaisdell, Class C-2, enclosed frame, self-oiling compressor of the cross compound type similar in operation to the one already described. They have a stroke of 18 inches, and the low and high pressure cylinders are 22-inch and 14-inch diameter respectively, hence with a normal speed of 150 revs. per min. the actual piston displacement of free air is 1,186 cu. ft. per min., but the regular rating is 1,100 cu. ft.

The intercooler on these compressors is placed in a horizntal position over the two cylinders (see Fig. 2) and consists of a number of copper water tubes with baffle plates in a cost iron shell.

The inlet valves are of the Corliss type, operating from eccentrics on the crankshaft, and at the outlets are automatic poppet valves. An unloading valve is located on the inlet pipe and an atmospheric relief valve is situated between the intercooler and the high pressure cylinder. These machines being belt driven the operation of the unloading valves is fairly gradual to prevent too rapid a fluctuation of the load on the belt.

The motive power is transferred by 25-inch double-ply belting from 225 h.p. C. G. E. motors to a 5,700 lb. flywheel on the compressors.

The normal speed of these motors is 600 revs. per min. They obtain energy from a 2,200 volt, 3-phase, 60-cycle circuit, and a pulley 26 inches wide and 28 inches diameter is keyed to the rotatory armature shaft. They will withstand a momentary overload of 100 per cent. or 25 per cent. for two hours. The belt driven flywheel and intercooler of one of these units can be seen on the left of Fig. 2.

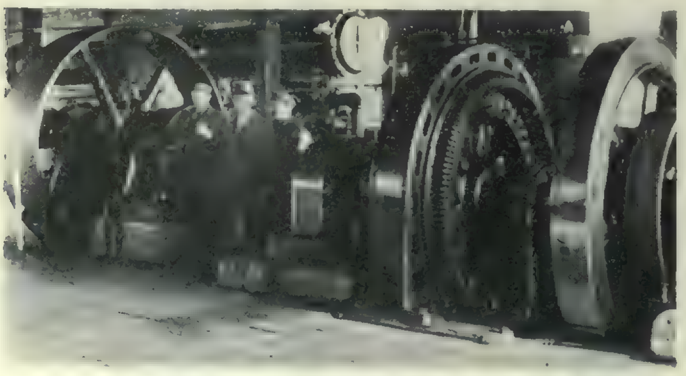


Fig. 2.—Sullivan direct-connected compressor on the right; Blaisdell belt-driven compressor on the left.

A switchboard has been installed for the control of the motors, including all the usual switches, ammeters, voltmeters, rheostats, etc.

The compressed air is supplied by pipes to a number of different types of drills, the commonest being the Sullivan Water Reciprocating Drills of the 2¾-inch and 3⅝-inch size, a number of small hand drills also being employed.

NEW York City has now under construction subways which will cost $81,000,000, aggregating twenty-seven miles in length, nearly all four tracks wide, or a total of 100 miles of track. Fourteen different contracting firms are doing the work and they employ daily nearly 6,000 men. Brick is extensively used in the construction and 225,000,000 will be required in this work. These are the common brick. It is impossible to say how many enamel brick and tile will be required. That depends on the decorative features, which have not yet been made public. It is a curious feature of construction work in New York that many brick are used in the subways under the streets, but none on the streets themselves. New York has no brick streets and the street department has never interested itself in brick for the streets. But even though they have failed in that way, the building above the ground and the subways under the ground are liberal consumers of brick, more so, perhaps, than any other city in the world.

Railroad Bridge Moved to New Site.

THE provincial government of British Columbia recently decided to build a combined highway and electric railway bridge over the Pitt River, a few hundred yards above the point where this stream is crossed by the main line of the Canadian Pacific Railway. While plans were being prepared for the government bridge the railroad company was constructing piers for a double-track bridge to replace the single-track structure across Pitt River. It was suggested that the abandoned single-track railroad bridge, which is a comparatively new structure, might be moved in complete sections and placed upon new piers at the location selected for the government highway bridge.

This plan was found to be feasible, according to the Engineering Record, and the government bought the railroad bridge at a figure said to be highly satisfactory to both parties, as it relieves the railroad company from the necessity of dismantling the structure and makes it possible for the government to open the new highway a year ahead of the expected date. Plans for the highway bridge piers are being revised so as to accommodate the railroad spans, which will fit nicely in the new location, drawspan and all, because the river width is practically the same at both points. The only change in the superstructure moved to the new location will be the construction of a flooring suitable for highway traffic.

The largest span to be moved is the 250-ft. drawspan, which weighs 400 tons. This was taken from its original location on August 20th and placed upon pile supports near the site for the highway bridge. The actual moving was accomplished in less than an hour, four scows being used to float the span, and a tug at each end serving to move it to the temporary supports. The scows were each 30 x 80 ft. in plan and 8 ft. deep and a framework of 12 x 12-in. timbers was erected on each to bring the bearing up to the required height.

When ready to move the drawspan, the scows were partly filled by drawing plugs, so that the framework on each would just pass beneath the floorbeams of the bridge. The scows were placed athwart the bridge, one at either end and one on each side of the pivot pier. On each of the four scows were two 4-in, diaphragm hand pumps, and each pivot-pier scow was also served by a 4-in. steam-driven centrifugal pump, while the outer scows, to which the tugs were attached, were tapped by the steam pumps on the tugs.

The effective width of the bridge resting upon supports was about 20 ft., and this was found to be sufficient to give the span ample stability when floated on the 80-ft. scows, although the upper chord was about 60 ft. above water at its mid point. After being floated the span was towed several hundred yards upstream and swung through a quarter turn. A kedge anchor was then placed to hold it steady in the current, and the line was paid out slowly until the structure was eased carefully into position over the temporary piers prepared for it near the river bank. When in exactly the right position over the rest piers the plugs in the scows were drawn again and the span settled safely to the supports.

Design of a Small, Bascule Highway Draw Span

THE following article treats of a small bascule highway draw span which is operated by hand. Many designs have been made of large, heavy bascule bridges, operated at a very considerable cost, but few small, light spans have been designed where it was necessary to keep the cost down and where the bridge was not opened frequently. The material for this article has been abstracted by Engineering & Contracting from a paper presented before the Boston Society of Civil Engineers, by Mr. L. E. Moore.

General Conditions Governing the Design

Most civil engineers look upon a movable bridge as a bridge pure and simple, with certain machinery for operating it as an adjunct to the bridge. This point of view often leads to designs which are unnecessarily expensive to maintain and in which facility and cheapness of operation are subordinated to certain theoretical considerations which are often given undue importance. It seems to the writer that the proper point of view to take with reference to movable bridges is that they are machines, existing, it is true, only because of the demand for a bridge at some particular location, but designed primarily with a view to cheapness of maintenance and operation as machines, as well as reasonable first cost.

The most important consideration in designing a machine is that it should be as simple as possible; that is, it should contain as few moving parts as possible, and these moving parts should be so arranged that they will not readily get out of order. It should also be, as far as possible, fool-proof.

The writer was engaged by the George M. Bryne Company to design a draw span as a part of a bridge which they had contracted to build for the town of Barnstable. The contract provided that the bridge should be built in accordance with certain plans furnished to the contractor, and contained the provision that the contractor should furnish the design for a steel draw span and build it subject to the approval of the town's engineer. The bridge extends from the mainland to Grand Island in the village of Osterville, in the town of Barnstable, Mass., and replaces a wooden pile structure which contained a double-leaf wooden stringer draw span of the type found quite commonly in this vicinity.

The completed structure consists of four 42-ft. spans of the concrete girder-and-slab type with a central draw span of about 38 feet. The contract plans showed a sketch of a double-leaf steel draw span similar in type to the wooden one which was part of the old bridge; having the usual gallows frames, windlasses and chains for raising the bridge.

The writer found that the bridge was to be operated by hand in a manner similar to the former bridge. As there was only one draw tender, he was obliged to raise one leaf of the draw, get into a boat, row across to the other side, and then raise the other leaf. As it was desired to operate by hand, the double leaf was at once eliminated from consideration because of the awkwardness of operation and because of greater first cost and greater cost of maintenance.

After making several trials of different combinations of girders, the writer settled upon the bridge as shown in Fig. 1. This view shows clearly the type of construction adopted, which consisted of two longitudinal girders having four floorbeams with wooden stringers and a wooden floor of the ordinary type resting upon them. At the mainland end is an axle extending completely across the bridge, supported in bearings resting on the piers. The portion of this axle between the girders was made of two I-beams for the double purpose of cheapness and of having the I-beams act as the fifth floorbeam. The whole structure is counterbalanced by a solid concrete counterweight, the upper surface of which forms part of the floor surface of the span adjacent to the draw. When completely opened, the counterweight swings downward into the space between the two concrete columns at the ends of the draw pier. The draw is opened and closed by the quadrant shown, which is keyed to the axle, and a train of gears.

Figure 1 shows a plan, elevation, and cross-section of the bridge, also a section through the counterweight. As will be seen, the floor is of the ordinary type of construction, having two layers of 2-in. planking on 2 x 14-in. hard pine stringers, spaced 2 ft. on centers. Holes were punched in the top flange of the floorbeam and ¾-in. lag screws were driven into the bottom of the stringers to hold them in position when the draw is open. The stringers abut against the counterweight at their right-hand end, which relieves the floorbeams from any bending in a direction perpendicular to the face of the web when the bridge is open, and also obviates the expensive bracing of these beams. The outer bracket is held by a single hitch angle, and no provision is made for a plate connecting the top flange of the floorbeam to the top of this bracket. The tension upon the connecting rivets is relied upon to hold the bracket in place. Any tendency of the brackets to twist is amply resisted by the wooden stringers, which are fastened to the bracket, and by the plank flooring which is continuous over the entire width of the roadway.

The composition of the girder is shown on the elevation. See Fig. 1 b. It will be noted that the girder is carried back nearly to the extreme end of the counterweight. As stated before, the upper surface of the counterweight forms a part of the wearing surface of the adjacent fixed span. Except for the draw span itself, the wearing surface of the whole bridge is formed by the upper surface of the slabs and is concrete. When the bridge is opened, the counterweight drops, leaving an open well, about 10 ft. long and 15 ft. wide, in the surface of the adjacent fixed span. The outline of the floor is of the shape shown in the plan.

By considering the elevation and plan together, it will readily be seen that when the bridge is opened, the counterweight drops and the bridge rises. Owing to the configuration of the floor, as the bridge rises the flooring over the channel rises away from the flooring of the pier. The counterweight, as before stated, drops away from the floor surface of the adjacent span. The result of this is that the apron so commonly used on wooden bascule draws is entirely done away with, and the operator is only obliged to unlock the outer

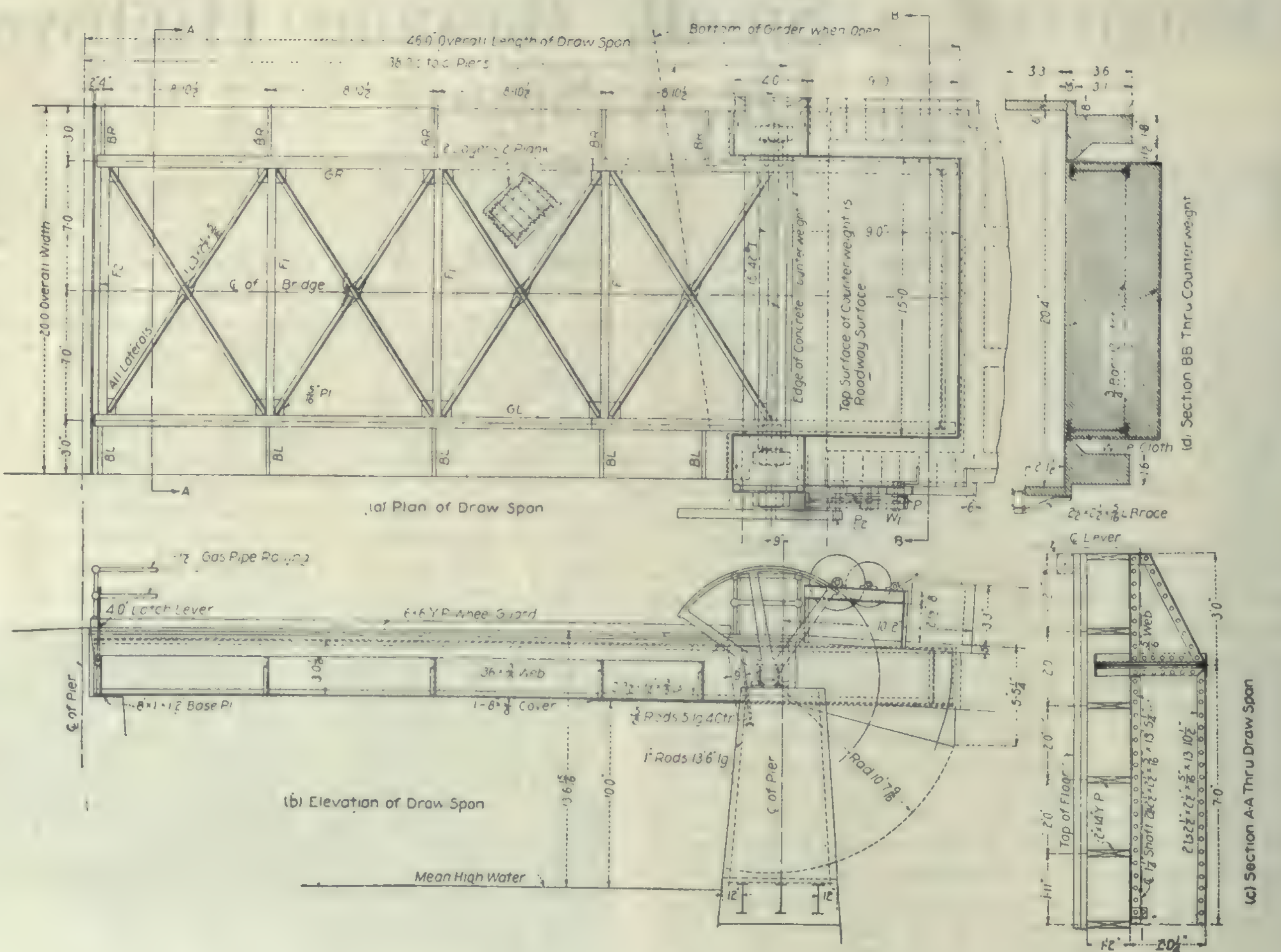
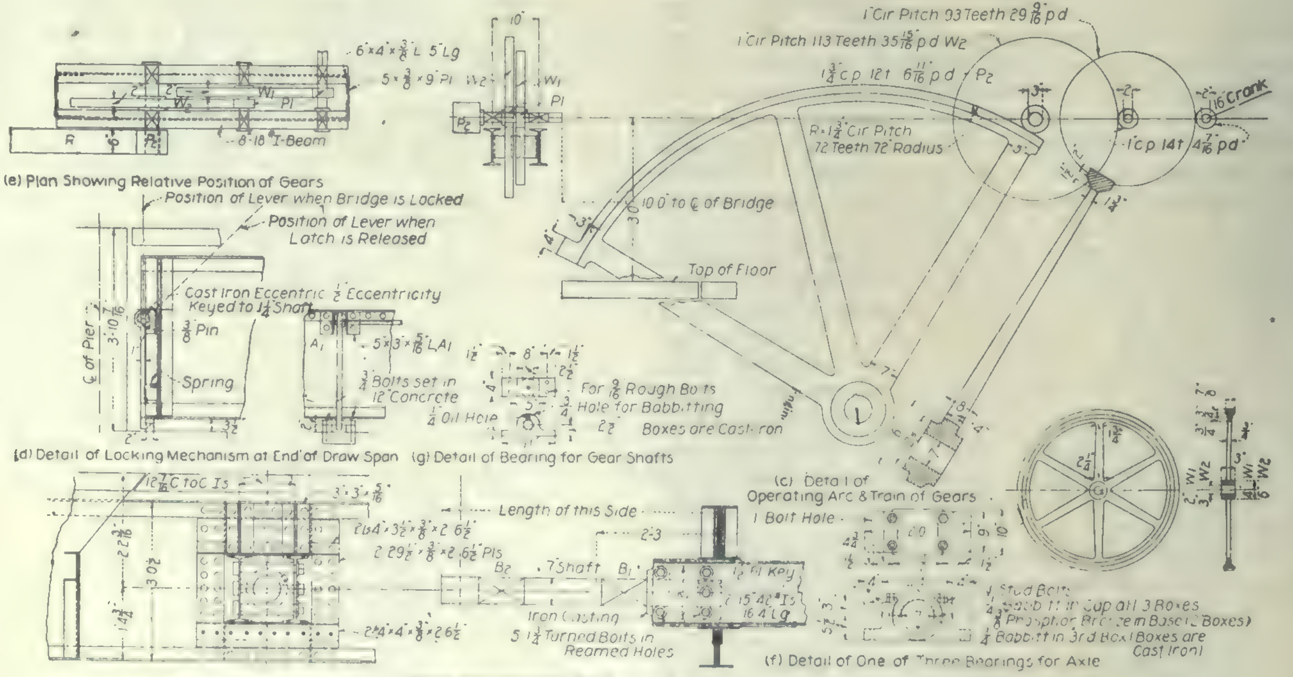


Fig. 1—Plan, elevation and cross section of draw span; also section through counterweight.


6×4×⅜ L 5' Lg
5×⅜×9" Pl
8-18" I-Beam
W1
W2
P1
P2
B2
10"
1" Cir Pitch 93 Teeth 29 9/16 p d
1" Cir Pitch 113 Teeth 35 15/16 p d W2
1¾ c p 12 t 6 11/16 p d P2
R=1¾ Cir Pitch 72 Teeth 72" Radius
1 c p 14 t 4 7/16 p d
16" Crank
10'0" to c of Bridge
Top of Floor
Position of Lever when Bridge is Locked
Position of Lever when Latch is Released
Cast Iron Eccentric ½ Eccentricity Keyed to 1¼ Shaft
⅜ Pin
Spring
c of Pier
5×3×5/16 L A1
¾ Bolts set in 12" Concrete
For 9/16 Rough Bolts
¼ Oil Hole
¾ Hole for Babbitting
Boxes are Cast Iron
12 7/16 C to C Is
2 L's 4×3½×⅜×2'6½
2 Pls 29½×⅜×2'6½
2 L's 4×4×⅜×2'6½
Length of this Side
7 Shaft
Iron Casting
5-1¼ Turned Bolts in Reamed Holes
1" Pl Key
2-15" 42# Is 16'4" Lg
1 Bolt Hole
Stud Bolts
Phosphor Bronze in Base (2 Boxes)
¼ Babbitt in 3rd Box (Boxes are Cast Iron)

(e) Plan Showing Relative Position of Gears

(d) Detail of Locking Mechanism at End of Draw Span

(g) Detail of Bearing for Gear Shafts

(c) Detail of Operating Arc & Train of Gears

(a) Detail of Girder Showing Connection to Axle

Detail of Connection of I-Beams to Shaft

(f) Detail of One of Three Bearings for Axle

Fig. 2—Details of axle, operating quadrant, gears, boxings and locking mechanism, and sketches showing relative positions of movable parts.

end of the bridge and to turn a crank to open it. A portion of the flooring about 3 ft. wide by 4 ft. long over each end of the supporting axle is made removable to allow of ready access to the machinery at any time. The adoption of this type of construction necessitated the re-design of the span adjacent to the draw, making it U-shaped next to the draw pier. The upper surface of the concrete girder on one side is utilized as a space on which the draw tender stands when opening and closing the bridge, and forms part of the roadway surface when the bridge is closed. It is offset, to permit the railing on the draw to swing past the railing on the fixed span.

Operating Mechanism and Counterweight

The axle upon which the bridge turns is composed of two 15-in. 42-lb. I-beams, which extend through a rectangular hole cut in each girder. See Fig. 2 a. An iron casting, of elongated separator, is used between the I-beams at each end and extends from a point just inside the web of the girder to the face of the bearing on the abutment. See Fig. 2, b. A 7-in. shaft is secured in this casting by means of keys and bolts and this shaft forms the journal upon which the bridge revolves. At one end the shaft is made just long enough to extend through one bearing and at the other end it is extended through two bearings and has keyed to it, at its outer end, a gunmetal quadrant which is operated through a train of gears. A detail of this quadrant and its train of gears is shown in Fig. 2, c. The bearings are of phosphor bronze and babbitt. A detail of the three bearings which carry the main 7-in. shaft is shown in Fig. 2, f. By referring to this figure it is seen that phosphor bronze is used in the lower half of the two boxes which are closest to the girder and that babbitt metal is used for the lower half of the third box. The babbitt metal is used in all three of the caps. A detail of the bearings for the gear shafts is shown in Fig. 3, g. A plan of the gears, showing the relative positions of the different gears and of the quadrant is shown in Fig. 2, e. The hand method of operating the bridge can be seen by referring to the elevation shown in Fig. 2, b.

The concrete counterweight is fan-shaped in elevation and completely envelops the girders for the full length of the counterweight. A section through the counterweight is shown in Fig. 1, d. The girders are tied together by angles at their right-hand ends, and a vertical stiffener is put on the inside of each girder to serve as an anchorage for the counterweight. The counterweight was computed as a reinforced concrete beam between the girders and was designed to carry the roadway loads in addition to its own weight. It is reinforced by ¾-in. bars, spaced 12 inches on centers, laid on the bottom flanges of the girders. The lower edge is similarly reinforced, the bars in this case being hung on vertical rods bent over the top flanges of the girders.

Description of Piers

The old solid masonry pier was cut off horizontally at a point just above high water, and two stout concrete posts were carried up at each end. These posts are each approximately 2 ft. 6 ins. by 3 ft. 6 ins. The bearings for the support of the draw span rest on top of these posts, as do the girders of the approach span, Figure 1 shows clearly the way in which the floor of the draw rises, and also shows the removable part of the flooring over the machinery. The sloping concrete bracket at the top of the pier is designed to carry the outer edge of this removable section of the floor. In general, the piers for all the spans, of which the draw span is one, are constructed of split granite with a concrete cap. To prevent any possibility of the draw pier splitting, three 20-in. 65-lb. I-beams were laid on the top course of granite to distribute the weight of the bridge. The concrete which surrounds these I-beams is protected from the action of the salt water by a belt course of granite laid around it and this course was thoroughly tied in by means of iron dogs. The granite course was laid first and was used as the form for the concrete which surrounded the I-beams.

As the upper surface of the counterweight forms a part of the floorings of the approach span, any live load which comes upon it tends to make the outer end of the draw rise. This makes it necessary to lock the outer end. It is also necessary that the locking be done in such a way that the end of the draw is held tightly to the abutment, so that it cannot hammer as a load passes over it. The mechanism for locking the draw is shown in Fig. 1 and Fig. 2, d. It consists of an eccentric carrying an elongated hook. The hook is free to swing about the eccentric, being held against the end floorbeam by a spring. When the bridge is nearly closed, this hook snaps over a loop on the abutment and is then tightened by revolving the eccentric by means of a lever and a rope which extends to the place occupied by the draw tender. The action of this eccentric is to raise the hook, thus drawing the ends of the bridge tightly down onto the wall plates. When it is desired to open the bridge, the rope is pulled and the lever moves, which lowers the eccentric and relaxes the tension on the hook. Just before the extreme motion of the hook is reached, the notched collar strikes a pin on the hook and moves it out clear of the loop. The bridge is then free to open.

Cost Data

The cost of the structure herewith given does not include that of the pier, which should be no more expensive than an ordinary pier having the same depth and height. The itemized cost to the contractor of the draw span is as follows:

Steelwork and machinery, f.o.b. Boston..	$945
Freight, erection and painting	625
Wooden floor	200
Concrete counterweight	225
Total cost of draw span	$1,995

A contractor in Dunfermline, Scotland, recently invented a new type of wall tie. While the tie heretofore in use in this district gripped but two bricks, with the tie invented half a dozen bricks are caught, giving not only additional strength to the wall, but requiring fewer ties and a considerable saving in the bricks used in a large building operation, reports Consul H. D. Van Sant. An additional merit claimed for this tie is that it can be seen before the wall is plastered, thus avoiding any dispute about using less bricks than the number specified by the architects.

In a new process for wood impregnation described by a Canadian engineer diatomaceous earth (a silicious material) is finally ground until 92 per cent. will pass through a 200-mesh screen. This is mixed with melted parafine and naphthalene, and timbers immersed in this mixture for four hours by open vat process. Treated wood is said to resist marine bores as well as decay. The cost of material is said to be about 5 cents a cubic foot.

Importance of Sand Tests in the Use of Concrete

By Cloyd M. Chapman*

THERE is no novelty in the assertion that the quality of the sand used in making Portland cement mortar or concrete is a very important consideration. Neither is there anything new in the statement that many of the difficulties, or even complete failures, experienced with concrete which are charged up to Portland cement are actually due to poor sands. But, in the face of repeated assertions of these facts by competent and recognized authorities on the subject, there are still firmly fixed in the minds of many engineers and contractors convictions that "sand is sand," and that a mixture of 1 part of cement, 2 to 3 parts of any old sand, and 4 to 6 parts of broken stone or gravel will make good concrete. The average engineer or contractor fails to realize that slight differences between two available sands which may be used on a piece of important construction may contribute largely to the success or failure of the finished work. This lack of realization on the part of the engineer or contractor, of the importance of the quality of the sand used, is responsible for at least some of the difficulties encountered in the use of concrete, which might be avoided by a better understanding of the subject.

In an Eastern city, the writer found that a sand of very inferior quality had been used in nearly all the construction work carried out during many years. This sand did not develop much over one-half the strength of standard Ottawa sand in short-time tension tests, and yet the question of quality had never been raised by a local engineer or contractor. The sand dealers had never been asked a question relative to the quality of the local sand, nor had they ever heard of the possibility of its being of inferior grade. One dealer in particular had a considerable quantity of sand on hand, which he was willing to dispose of at a low price because it contained coarse particles and was of a dark color. It was not considered a good sand, because of the variation in the size of the grain; and he had experienced some difficulty in disposing of it. Yet this sand, when tested, proved to be of a decidedly higher quality and more suitable for concrete work than other local sands commanding a 50 per cent. higher price. This condition of affairs is regrettable, and it appears to be the duty of the technical press and of technical societies to emphasize the necessity of properly testing all sands entering into important concrete structures.

In the following discussion, the term "sand" is applied to fine aggregate used in mortar or concrete, whether it be a natural sand or an artificial sand produced by crushing and screening stone.

In general, the defects in a poor sand may be classified into the two broad subdivisions of size and presence of deleterious material. The defects of size are chiefly those in evidence where individual grains prove to be either too fine, too coarse, or too uniform. Deleterious matter that may cause defects include organic matter, ores, clay, or other soft or finely divided powder which prevents a proper bond between the cement and the sand. Also, the entire make-up of the sand may be of such a nature that strong, sound concrete cannot be made from it.

Size Requirements.—The requirements as to size are not very strict. By this is meant that no very definite line may be drawn as to the limits and distribution of sizes which are permissible in a suitable sand. For example, a sand may contain as much as 20 per cent. of fine material passing a 100-mesh sieve, and still be first-class; while another may be ruined by the presence of even 5 per cent. of material possessing the same degree of fineness. As a general thing, an artificial sand or crushed stone may with safety contain a greater percentage of these "fines" than a natural sand.

A sand which is too coarse, as, for example, one in which not enough fine or small particles are present to fill the voids between the larger particles, will require an abnormally high proportion of cement to make a strong, dense concrete. Similarly, sand in which the variation or gradation in the size of the particles is within narrow limits will have a high percentage of voids, requiring a large amount of cement to produce god results.

Foreign Matter Requirements.—The requirements as to deleterious matter are much more stringent than those relating to size. The presence of a very small percentage of loamy soil or organic matter in a finely divided state may render an otherwise suitable sand totally unfit for use so long as the organic matter remains in it. The amount of objectionable matter present may be as low as ¼ of one per cent. and still cause serious trouble.

In some cases the presence of small percentage of metalliferous ores in the sand has caused subsequent failure of the concrete in which it was used, by disintegration due to chemical change in the metallic constituent.

In bank and river sands a considerable quantity of clay or other finely divided though inert material is often present. This clay or silt may have been carried down through the sand bed by percolating waters, and so be fairly uniformly distributed through the mass, or it may have been deposited in layers or seams in the sand bed, and then remain more or less distinct and separate from the remainder of the deposit. In some such cases the objectionable strata or seams may be removed when the sand is taken from the deposit. The amount of such material which is capable of causing trouble seems as yet a rather uncertain quantity. In some cases trouble has been charged to as little as 2 or 3 per cent. of silt or clay, while other sands containing as high as 15 per cent. have given excellent results.

The cases in which the material as a whole is unsuitable are those in which the sand is composed of a soft, porous, or brittle substance which could not produce a hard strong concrete even when properly combined with the cement.

The best method of ascertaining the extent to which a given sand possesses the objectionable qualities above mentioned, has never been standardized or fully determined. Although a test is now in use which will show the general quality as compared with the Standard Ottawa sand, yet this test does not show wherein lies the defect of the sand is poor. This test consists in making 1:3 cement-sand mortar briquettes of the sand to be tested, and also of Standard Ottawa sand, and comparing the results of the tension test of these two sets of briquettes. If this comparison were made in compression instead of tension, such a test would be a very valuable indication of the quality of a sand, even though it gave no clue of the nature of the defect in a weak sand.

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Sand Tests.—Two general classes of tests may be applied to a sand: (1) Tests to determine the general suitability of the sand—that is, the quality of the mortar or concrete that the sand will make. (2) Tests to determine the characteristics of the sand which have an influence on its quality. In the first class belong such tests as compression, tension, and density tests of specimens made up with the sand under test. In the second class are such tests as sifting or sizing, determining amount of silt, organic matter, voids, etc. A sand which gives high results in tests of the first class need not be subjected to tests of the second class, because a sand which makes good concrete may have what characteristics it will.

The details of the many tests which are of use in an investigation of the quality of a sand, vary greatly with different investigators. As a general thing, tests of the first class, designed to ascertain the quality of the concrete or mortar which a sand will produce, consist in making up briquettes of standard size, and cubes, usually 2 in. on a side, of mixtures of 1 part of Portland cement, preferably of the brand that is to be used with the sand on the job, and 3 parts by weight of the sand under test. At the end of 3, 7, or 28 days, or all of these periods, these briquettes are broken in a testing machine, in order to ascertain their tensile and compressive strengths. Similar briquettes and cubes are usually made of the same cement and Standard Ottawa sand, and broken at the same time, in order to secure a comparison between the two sands. As a means of judging its quality, it is commonly required that the sand under test shall show a strength of at least 70 per cent. that of Standard Ottawa sand. Tests of this class likewise include determining the amount of absorption of a specimen of mortar made from the sand under test. This indicates the density of the mortar and its freedom from voids.

As stated above, a sand which shows high strength tests and a satisfactory density need not necessarily be tested further unless one wishes to ascertain the characteristics which go to make up a good sand. If, on the other hand, a sand shows low strength or high porosity, it may be possible, after determining the cause of the weakness, to remedy the trouble and produce a stronger or denser concrete or mortar. If the sand is found to give weak mortar because of the presence of clay or silt, the trouble might be eliminated by washing the sand; or if the product is porous because of a higher percentage of voids in the sand than the cement will fill, the density may be increased by adding a proportion of another sand to produce a better grading of the particles.

Thus, by means of properly conducted tests, it is easy to determine the relative suitability of a sand for use in making mortar and concrete; and in many cases of poorer sands, it is possible to determine, and in some cases remedy, their existing weaknesses. There are, however, many deposits of sand which will not, in 1:3 mixtures, show a strength equal to 70 per cent. of that of standard sand, and which yet contain nothing objectionable for use in concrete. By using a greater proportion of cement with these sands, a concrete of ample strength may be made, which should be in all respects as desirable as another concrete made of a better sand using less cement.

In some localities the only sands available at reasonable cost give low strengths as compared with other and better sands; yet there does not appear to be any good and sufficient reason why these sands should not be used, even in important structures, if sufficient cement is used to give the required strength. This being the case, it would seem that the proper tests to be applied to such a sand should be those that would determine, first, whether the sand contained matter detrimental to good concrete, and second the proportion of cement to be used with it to produce a concrete of the proper strength for the purpose for which it is to be used.

Such a procedure seems to the writer to be the proper one to pursue under these conditions, and the matter is one which merits the attention and investigation of engineers and contractors interested in the subject.—Engineering Record.

Problems of Surfacing in Road Work

THE necessity for building roads to suit the traffic they are to carry has frequently been pointed out, says "Good Roads," and has formed the subject of many discussions. That a road should be so constructed seems obvious, yet it is a fact that in a very large percentage of the road improvement work done, this most fundamental principle is not observed.

Besides negligence, there are other causes to which the unsuitable construction of many improved roads may be attributed. In the first place, it is a matter of some difficulty and expense to determine the traffic which will come upon an improved road. The determination of this involves not only a census for the purpose of ascertaining the traffic carried by the road which it is proposed to improve, but also the making of an estimate of the additional traffic which will be brought to it because of the improvement. And in the taking of a traffic census the character of vehicles using the road and the weight of single vehicles should be considered as carefully as the data on the amount of traffic.

Having made the best possible estimate of the expected travel, it is necessary to select the foundation and surfacing to be put down and decide upon the other features of construction that will give the best results under the existing conditions—not only of traffic but also of topography, climate and the like—bearing in mind, too, the amount available for construction and maintenance. These factors have to be considered together, if the best possible pavement is to be secured at the least possible cost. This, as any highway engineer knows, is a problem far from simple.

Of late years the art of building roads has been undergoing a change, and we have not yet reached the point where it can always be said that a certain kind of pavement is going to give the best results under given conditions of service. A new kind of traffic, automobile travel, must be provided for, and road builders are working with comparatively new materials and are employing new methods of construction. Roads of some of the types that are now being put down have not been in use long enough to demonstrate just what can reasonably be expected of them, nor are there sufficient data of cost and service to justify anything but the most general conclusions, except in some few specific instances. There is great need for experimentation with various types of surfacing under different conditions, and this work should take the form not only of putting down experimental sections, but of keeping the most careful and detailed records of their behavior in service. Much work of this kind has been done; yet there is little doubt that in many cases the construction of elaborate experimental sections has been followed by an inexcusable neglect to keep suitable records.

There is an almost universal demand for road betterment, and there are many evidences that the public—which has to pay for the work—is awakening to a realization of the need of better methods of financing road improvement. There remains, however, a more or less widespread lack of appreciation of the importance of building with forethought. And until the character of the surfacing to be laid down is determined with due regard to the use to which the roads are to be put and not by whimsical preferences, and until foundations are built for the loads they must carry, there will necessarily be large sums wasted in building roads unfit for the service they are expected to render.

Use of Liquid Chlorine in Water Sterilization

THE use of liquefied chlorine gas in water sterilization has only recently been successfully applied to the entire water supply of a city. The trade name of this liquefied gas is liquid chlorine. The commercial process by which the gas is now generated almost exclusively is the electrolysis of brine, which under the influence of the electric current is split up into chlorine and caustic soda.

The chlorine thus generated is subsequently dried, compressed and cooled until it liquefies. In the course of this process the gas is simultaneously relieved of all such impurities as water, carbondioxide, oxygen, air, etc., so that the final product represents the element chlorine in its most efficient form of about 99.5 to 99.9 per cent. purity.

Chlorine in this liquid state occupies only 1/400 of the space of the gas under the same temperature conditions and is placed into steel cylinders of about 80 lbs. weight having a capacity of 100 to 110 lbs. of chlorine. These units of about 180 lbs. gross weight have been found to be the most convenient form for all practical purposes. The chlorine can be drawn off at will by opening the valve on top of the cylinder. It does not matter how much or how little is taken from the cylinder liquid chlorine being the pure compressed gas does not deteriorate or lose in efficiency by storing, as is the case with bleaching powder.

In a recent paper before the American Water Works Association, Mr. John A. Kienle, formerly chief engineer of the water department at Wilmington, Del., read a paper on the use of liquid chlorine in water sterilization. The paper gave the history of the development of this method of sterilizing water and related especially to the application of this method at Wilmington, while Mr. Kienle was connected with the water department of that city. The present article is based on that paper and on information furnished by the Electro Bleaching Gas Company.

The experimental work in water sterilization by means of liquid chlorine as conducted at the plant of the Western New York Water Company, at Niagara Falls, and at the filtration plants at Belmont in Philadelphia and at Wilmington, Del., demonstrated the advantageous features of the use of liquid chlorine and definitely determined its exceptional bactericidal properties, yet, on the other hand, the drawbacks and inefficiencies of the various methods of applying the chemical were forcibly impressed upon the minds of those who attempted its control. The difficulty arose in the development of a commercial and practical apparatus for efficiently regulating the rate of flow of the chlorine gas. Most of the failures on this score were due to the strong corrosive effects of chlorine on all kinds of metals, wood, rubber, etc.

The majority of these when used in the presence of moisture were either totally destroyed or made inoperative in a very short period of time, seldom lasting more than 72 hours. Another and most important feature in connection with the experimental work was the development of an economical method of securing a proper absorption of the chlorine gas without the escape of any to the atmosphere and without loss of efficiency. That chlorine has a remarkable affinity for water is a well known fact, it being possible to absorb in water at ordinary temperatures (60 deg. F.) approximately 2½ volumes, equivalent to 8,000 parts per 1,000,000 by weight. However, notwithstanding this, experience disclosed the fact that upon the liberation of the gas in an open body of water it quickly bubbled to the surface and escaped as free chlorine. The varying heads under which it was introduced also affected the rate of discharge of the gas.

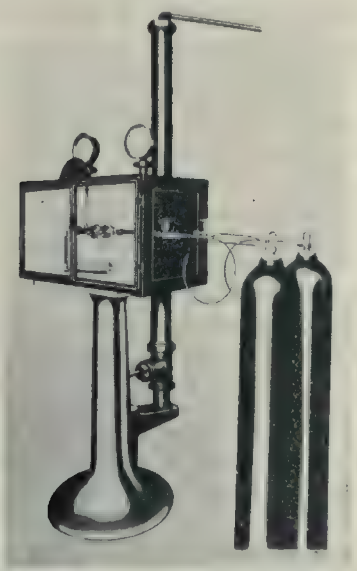
In December, 1912, Mr. Kienle undertook to sterilize water in Wilmington by means of liquid chlorine which he applied by means of a home-made apparatus. The apparatus employed was somewhat crude, but the treatment gave good bacterioligical results. The method of application, however, was not commercially satisfactory and, moreover, parts of the apparatus lasted only a few hours. These experiments resulted in the acceptance by the Wilmington Water Board of a proposition for the installation of an apparatus by the Electro Bleaching Gas Company, who agreed to demonstrate the efficiency of their controlling mechanism for a period of 30 days and to guarantee the apparatus against deterioration for one year from date of installation.

This installation was completed on February 1st, 1913, and since that time has been giving excellent satisfaction. During February the valve controlling the discharge of gas was set at a position which delivered ¾ lb. per hour, equivalent to 1½ lbs. per 1,000,000 gals. of water upon a 12,000,000 gals. daily basis, which was the maximum daily rate of filtration. As this amount was known to be sufficient to eliminate B. Coli no further attempt was made to regulate the rates of flow of gas.

The city at that time was purchasing liquid chlorine in small quantities at the rate of 10 cts. per pound f. o. b. Niagara Falls, while the freight charges and hauling to the plant added approximately ¾ ct. per pound. As four 100 lb. cylinders were connected to the apparatus and the daily quantity consumed was but 18 lbs., the only labor involved in operation was that of changing the tanks once in every three or four weeks, a task requiring about 15 minutes of the filter attendant's time. It is therefore evident that the cost of the treatment is very low, not exceeding in this instance 10½ cts. per 1,000,000 gals. of water treated.

The apparatus employed at Wilmington for the application of the liquid chlorine was described in Mr. Kienle's paper. That particular apparatus is not here described since the apparatus for applying the chlorine has been changed somewhat since the Wilmington chlorination plant was installed.

The accompanying illustration shows the most recent design of the apparatus. It is self-contained with the working parts encased and the absorption tower bracketed at the rear of the pedestal. Where the supply to be treated passes through a Venturi tube an automatic controlling device can be installed in the case which will regulate the supply of chlorine in any desired proportion to the flow of water.



Self-contained type of manually controlled liquid chlorine apparatus for water sterilization.

The apparatus here illustrated consists essentially of three parts, namely, a manifold to which the chlorine cylinders are attached, the regulating and controlling valves with indicating gages, and the absorption tower. Next to the manifold is a specially constructed gage which indicates the initial gas pressure. Beyond this gage there are two pressure regulating devices, the first being used primarily to reduce the initial cylinder pressure to a predetermined maximum, and the second for controlling the pressure through a range sufficient to give the desired discharge of gas. A low pressure chlorine gage is attached to a branch outlet on the line between the last regulator and the discharge outlet. This gage is calibrated to indicate the rate of flow of gas in pounds of chlorine delivered per hour. After passing the discharge opening the gas is conducted by composition hard rubber tubing to the absorption tower. This tower is of special design and construction for the purpose of obtaining a complete absorption of the gas in a small volume of water. There is no loss of chlorine in this operation. The chlorinated water solution so formed, utilizes the full efficiency of the chlorine gas. It may be introduced in the water to be treated at any point. The apparatus is constructed of materials which withstand the corrosive action of chlorine. This device is manufactured and marketed by the Electro Bleaching Gas Company, Madison Ave. Building, New York City.

The experiments conducted at the Belmont filters in Philadelphia demonstrated to the satisfaction of the Water Bureau officials the economic and aesthetic advantages of the use of liquid chlorine as a sterilizing agent. At this plant attempts made by the officials in charge to control the flow of gas with ordinary type of valves proved unsatisfactory. Later the chlorine cylinders were enclosed in an asbestos lined metal box which was heated in order to maintain a more even temperature around the cylinders with a consequent regularity of internal pressures. The gas flow was then controlled by adjustment of the cylinder valves, the quantity discharged being checked every three hours by the use of platform scales.

As the gas was delivered direct to the water in the effluent gate house well and the level therein varied with the fluctuating height of water in the adjoining reservoir from 6 to 14 ft. (approximately), there were numerous periods when a portion of the chlorine bubbled through and escaped to the atmosphere. The bacteriological results, however, were exceptionally good, the count in the treated water ranging from 4 to 10 bacteria per c. c. with negative tests for B. Coli in one c. c. and 10 c. c. samples.

These results were secured with the use of only 1 lb. of chlorine per 1,000,000 gals. of water, which is indicative of the nominal cost of treatment.

At the Western New York Water Company's plant at Niagara Falls, N.Y., experiments with the use of liquid chlorine were begun in November, 1912, under the supervision of Dr. G. Ornstein. Though the bacteriological results obtained from its use are not available at this time it is stated that they are perfectly satisfactory. Economy of operation has also been effected as advices from the plant indicate that the use of ½ lb. of liquid chlorine per 1,000,000 gals. superseded the prior use of 4 lbs. of chloride of lime. In fact, during one period of the experimental treatment covering one week's operation good results were obtained with the use of 1-6 of a pound of chlorine per 1,000,000 gals.

The labor cost for mixing hypochlorite solution was eliminated and prior to the use of liquid chlorine 100 per cent. more sulphate of alumina was used. Irregularities in the original hypo treatment were also overcome by the prevention of the clogging of the pipes conveying the sterilizing agent to the water supply.

At Somersworth, New Hampshire, equally satisfactory results have been obtained though at somewhat increased cost due principally to the lower daily consumption and organic matter in the water. The use of gas at this plant is at the rate of 1/3 lb. per hour, which is slightly more than actually required. This excess quantity is accounted for by the difficulty in maintaining a very low pressure on an extremely fine orifice required for such small velocities, a feature which has been overcome in more recent designs of apparatus.

In Mr. Kienle's opinion the method of treatment described has many points of superiority over the use of hypochlorite. Briefly these may be summarized as follows:

1. Economy in cost of installation. The apparatus is very compact, requiring but a limited floor space, therefore it can be conveniently set up in any existing

building. Storage space required reduced 300 to 500 per cent., due to concentrated form in which chemical is shipped.

2. Labor and power costs in operation practically eliminated. No mixing and agitating of chemical required. Decreased bulk to be handled.

3. Simplicity in regulation of quantity of chlorine applied. No tests required to determine available chlorine in solution. No mineral salts introduced and consequently no difficulties in clogging of orifice boxes and chemical solution pipes with resulting unreliability of treatment.

4. Uniform strength of chemical with increased efficiency and activity. Liquid chlorine is 99.9 per cent. pure and is not subject to deterioration from storage. More active particularly in cold weather with efficiency stated at 1 lb. to 7½ or 10 lbs. of chloride of lime.

5. Disagreeable tastes and odors in treated water eliminated notwithstanding the addition of 8 lbs. of liquid chlorine per 1,000,000 gals., which is considerably more than experience has shown is actually required for sterilization purposes. No residual chlorine is left in water.

6. No provision required for sludge disposal and elimination of corrosive influences of flying lime dusts.

The Patch System of Road Maintenance

ASSUMING that a road shows no structural defects and that the available metalling material is sufficiently hard and tough, the wheel-way can, in general, be maintained in suitable condition by the aid of the patching system, even when the demands of the traffic are considerable in degree.

The fundamental rules that must be applied are the following:

The patching up of the "blow-holes" and small damages to the wheel-way in general must be done after every spell of wet weather. After a preliminary removal of the layer of mud from the hollow in question and a simultaneous roughening of the surface of the latter, in the case of smaller unevennesses only fine-grained and as far as possible cube-shaped metal material of from 1 to 3 cm. size of grain is to be used and the cement addition (stone-splint, grit, or sand) of the same material as the metal is to be restricted to a minimum. The use of road mud or of other earthy or clayey constituents is to be avoided.

The quantity of the patching-metal material is to be so chosen that it reaches up to or somewhat above the edge of the hollow. The individual grains of metal are here to be laid very closely together and in as even a layer as possible, the surface of which projects slightly above the adjoining wheel-way surface, but only so much that, on the pressing down of the patching layer, the original level of the surface at this point is reached, and that, after consolidation, neither a lump nor a hollow remains behind. The height of heaping of the metal required depends upon the quality of the material of the latter and mainly on the compression strength of the wheel-way.

Care must, moreover, be taken in the base of deeper "blow-holes," that, beyond the edges of the hollows, and especially in the direction of motion of the vehicles, i.e., of the axis of the road, quite small-grained metal is arranged, so that a ramp-like transition is provided for the wheel-tires, the thumping action of the latter is diminished, and the uniform pressing together and ramming down of the layer of metal is promoted.

Pieces of metal squeezed out or pushed aside by the horses' hoofs and wheels from the patching places are to be reinserted, whereby the strips that have already been driven firmly in by the wheel-tires are not to be injured and are as far as possible to be left entirely undisturbed, except in cases in which they have cut so deeply into the wheel-way that they can bear a fresh covering of small-grained material. In the application of the metal the patch must, in general, be made to take a form that is elongated in the direction of the axis of the road or direction of motion of the traffic, and experience teaches that little round unevennesses must also be metalled-up in this way.

This stands in connection with the circumstance that the wheeling down and pressing together of the metal by the weight of the wheels takes place in the longitudinal strips. Since the grains of metal at the edges rest on harder, less softened parts of the wheel-way, these are exposed in an increased degree to destruction or crushing into small fragments and are at the outset intended to effect the transition between the old wheel-way and the new layer of metal. The further these transition areas are extended in the longitudinal direction of the road—of course up to a certain practical limit of about ½ to at most 1 m. from the edges of the hollows—the shallower and more gradual will be the inclined plane up which the wheels have to run, and the more favorable are the conditions for the rolling down of the patches by them. Similar conditions prevail in regard to the sides of the patches, which may also with advantage be bounded by transitional strips of small-grained metal. The sole purpose of these edgings, however, is the attainment of a better cohesion of the metal and to prevent the lateral slipping and rolling away of the stones.

In regard, now, to the main metallings annually carried out on the patching system, care must, in the first line, here be taken, that an ample supply of broken stone, if possible, of two kinds, of about 3 and 6 cm. size of grain respectively, so that the patching, which, according to the condition of weather of the expired period of maintenance, may require a very variable quantity of metal, may be carried out in accordance with the actual requirements and in a proper manner, and that the necessary levelling and filling up of the section of the wheel-way may not be neglected on grounds of momentary economy—a procedure which is apt to bring its own punishment during the succeeding period of maintenance. It is, indeed, here that the economy of the patchwork maintenance lies, that, at a time at which a stretch of road is very much worn and requires a great deal of metal to bring it into good condition, the quantity of material needed for the maintenance of the transverse section of the road in a favorable manner is duly applied; a result of this, meanwhile, is that for the next few years the requirements of material for a road thus amply metalled will be considerably diminished, while, in the opposite case,

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*From a paper by Zdensko Vytvan, Brunech (Tyrol), presented at the Third International Road Congress.

in spite of the yearly bedding-in of a uniform and pretty large average quantity, a like success will not be attainable.

The supply of metal to be provided must be so large that, after the main patching is done, a small reserve of metal, in particular of the small-grain kinds, is left over, which is then heaped up on storing places along the side of the road ready to hand for urgent local repairs that may become necessary in the course of the complete year—especially during a time of long-continued wet weather. Similarly quite small-grained metal—of from 1 to 3 cm. size of grain—and the corresponding cement material that may be needed for the repair of "blow-holes" and small unevennesses must at all times be held in readiness at the depositing places in close proximity to the road.

To avoid a hampering of the road traffic over a long stretch on the occasion of the main metalling, it will be advisable, at a place where a roller is not used for the rolling down of the often very extensive patch-layers, to resort to a systematic subdivision into shorter stretches of about 500 to 600 m. of such description that metallings of large extent with corrections of the section only occur on certain stretches in one year while the remaining sub-stretches are alternately subjected to a main metalling in the next two or three years.

It is of especial importance that, immediately before the metalling, which is to be undertaken only at a time when the wheel-way is soft and damp, the mud be removed from the road.

For the metalling operation itself, it is regarded as the principal rule that the larger stones be in all cases bedded in the deep ruts and in the middle parts of the wheel-way that are most run down, and that the small-grained ones be used on the side strips of the way and for the filling and levelling up of minor unevennesses.

Should certain places—in particular ruts—be specially deeply worn down the bottoms of these should be bedded out with special care with large lumps of stone laid as close together as possible and covered over with a layer of medium-sized metal-stones.

This second layer serves at the same time to make the top of the patch even with the adjoining surface, and is to be extended with a downward slope over the edges of the defective spots. In the arrangement of the patch surfaces, the form of the wheelway surface must be kept under careful observation and the work must be carried on under the constant supervision of an experienced road-man.

Track-Metalling

When a case of decided track-metalling is in question, i.e., of metalling up of parallel ruts in combination with side strips of patch-metalling for the leveling up of the section, it is advisable also to cover the rounded longitudinal ridge between the ruts with a very thin layer of medium-grained metal in such a way that only a very narrow strip of about 15 to 20 cm. in the middle of these raised parts remains free.

Although this layer of metal is not very durable and is for the most part knocked aside by the horses' hoofs, so that the individual grains of metal only remain over for bedding and filling purposes, the measure in question effects the practical object that the draught-horses, which otherwise avoid the metalled ruts and only make use of the raised stoneless intermediate strip, are misled in the keeping of the course that is by these means rendered less recognizable, and the wheels of the vehicles in consequence move more in sinuous lines.

By this means the successive wheeling down of the metal from the bulged-up strip towards the ruts is promoted and the wheels get on the freshly metalled ruts much more often than they could otherwise be got to do. If the edges at each side of the rut metalling have once been rolled firmly down and become covered with mud, the stone material in the former ruts is so tightly pressed together and boxed-in from the sides that it can no longer escape, and the middle parts of the track, which can then be traversed without any great amount of friction, very soon become firmly rolled down.

The procedure illustrated in connection with the mending of the track shows in a typical manner how the consolidation of layers of metal is effected. As will be shown further on, it also gives a very good idea as to the manner of mending "blow-holes" and irregular defective patches.

The second kind of metalling-up of patch-system roads, which is adopted where no ruts or only very shallow ones occur and where the wear shows itself for the most part in "blow-holes" and unevennesses, consists in the laying of irregularly formed patches of metal of different thicknesses; its use for the most part is confined to very broad wheel-ways. This requires considerable practice and special diligence in the laying of the metal patches. The different patches may here be profitably connected together in long-drawn surfaces of metalling of considerable size, which often extend over half or the whole of the wheel-way, and the removal of the unevennesses is effected by the application of thicker or more large-grained covering-layers at the places concerned. The procedure described in connection with the metalling up of "blow-holes" is thus repeated, though in a somewhat modified manner, in so far that the separate transition surfaces between the edgings round the damaged places are drawn together, so that they only occur before and behind and at the outer sides of the combined patch of metalling.

Arrangement of Surfaces

In what form can these patch-metal surfaces now be most advantageously arranged?

As already mentioned above, the metal material at the front and back edges of the patches, i.e., at those transverse to the axis of the road, which have to receive the shock of the wheels at the points of transition from the smooth unmetalled wheel-way to the rough and somewhat raised surface of the layer of metal, is stressed in a particularly detrimental manner, so that the rolling down of these edges by the traffic weights is effected with much greater difficulty and much less evenly than that of those that lie parallel with the axis of the road (side edges), as is particularly well shown in connection with the rut-metalling described above.

The reason for this is to be found principally in the axial direction in which the wheels of the vehicles move; that is to say, in the circumstance that the pressing down and consolidating of the metal everywhere takes place in the narrow parallel strips produced by these.

A wheel that cuts through the metalled surface will only be able to assist in rolling down the metal at the narrow places of entrance and exit, while, during the rest of the way, it will more or less plough into and up-heave the material, unless the lateral escape of the latter is prevented. A longitudinal strip that cuts through the metalled surface cannot be consolidated unless it has undergone long-continued wheel-pressure combined with repeated filling with fresh material. When, on the other hand, a wheel indentation lies pretty much along one side of the metalled surface, it will assist in the consolidation and in the getting on to the metal throughout the distance traversed.

Considering, then that as experience shows, a layer of metal can be most effectively wheeled firmly down when this phenomenon at the points of transition (edges) to the unmetalled surfaces begins and is continued towards the middle, care must, in the applications of metal for the attainment of firm durable covering patches, above all be taken, that a quick consolidation of the side edges takes place, by which at the same time the rapidity of the rolling down of the whole surface can be considerably increased.

As has been successfully tried, this purpose can be effected by the expedient of extending the metalled surfacing at several places of this kind, with due regard to the locality of the patches, and forming them to such a manner that they consist of longitudinal strips that run parallel, but are shifted one with another.

In stretches, where the wear shows differences of no very considerable amount and extends principally over the central strip of the road, the latter can often with advantage be covered in a width of about 3 m. in breadth with a layer of metal, and the patching work proper be effected by a suitable distribution of the pieces of metal during the rolling in.

Another rule which must be closely followed in the laying of the metal on the patch system is the careful looking after of the surfaces covered up to the point at which they are run onto. This takes the form of constant filling and leveling of the tracks and ruts formed, and of collecting the scattered grains of metal and applying them to depressions or bare places, a light blunt iron instrument being used therefore. By this, however, the places that are already consolidated will not be disturbed, only the loose metal is in so far to be distributed and shifted about as may appear desirable for its suitable rolling in and as may be necessary for the attainment of the desired height and firmness of the places patched.

Finally, in the maintenance of a metalled road on the patch system all the well-known rules and experiences for the construction and maintenance of metalled roads in general are to be rationally observed.

THE Australian government is constructing a railway line 1,063 miles long between Kalgoorlie in West Australia and Port Augusta in South Australia. The purpose of the line is to bring Western Australia in touch with the eastern states. The railway will be government owned and will be constructed by day labor, but with the exception of 1,500,000 sleepers, the materials for construction are being supplied by private parties. Work is progressing from both ends of the line. There are very few engineering problems in connection with the construction but there are serious difficulties of another nature. The government will have to arrange for the supply of water, food, medical attention, clothing and amusements of all the men engaged immediately they get away from Kalgoorlie and Port Augusta. The absence of water along the route will be overcome for 295 miles by gravitation from Kalgoorlie. For 700 miles water will have to be obtained by conservation, boring or transport. The line will cost $20,000,000.

City Manager Plan

THE city manager plan is gaining ground, comments Engineering and Contracting. Last month two large cities in Ohio—Dayton and Springfield—adopted new charters which provide for the commission-manager form of government. The Dayton system provides for a commission of five members elected at large for a term of two years. They are nominated by petition and are subject to recall. The head of the administration is a city manager, who is appointed by the commission for an indefinite term, subject, however, to recall within six months after he takes office or to removal by the commission at any time. The charter provides that the city manager shall be appointed without regard to his political beliefs and that he necessarily need not be a resident of Dayton when appointed. This manager appoints all heads of departments and is responsible for the efficient administration of all departments. Dayton and Springfield will do well to bear in mind that much of the success of the plan in the cities where it is now in operation is due to the fact that the city managers are engineers.

Limiting Height of Building in U.S.

The following is a partial list of the restrictions as to heights of buildings enacted by cities and towns in the United States:

Baltimore—Fireproof buildings limited to 175 feet, and non-fireproof to 85 feet.

Boston—Two and a half times the width of the street, the maximum being 125 feet.

Buffalo—No height greater than four times the average of least horizontal dimensions of the building.

Chicago—An absolute limit of 200 feet.

Cleveland—Two and a half times the width of the street, with maximum of 200 feet. Recesses or setbacks to be counted as added to the width of the street.

Denver, Colo.—Not to exceed twelve storeys, and those more than 125 feet to be fireproof.

Jersey City, N.J.—No building or structure except a church spire shall exceed in height two and a half times the width of the widest street upon which it stands.

Los Angeles—A limit of 150 feet.

Newark, N.J.—Not to exceed 200 feet, but warehouses and stores shall not exceed 150 feet.

New Orleans, La.—The height at the street line shall not exceed two and a half times the width of the street which the building faces. Setbacks are to be counted as added to the width of the street.

Paterson, N.J.—Warehouses and stores must not exceed 100 feet in height.

Portland, Ore.—All buildings except churches are limited to 150 feet.

Scranton, Pa.—The limit is placed at 125 feet.

Ninety per cent. of rail failures, as stated by Mr. M. H. Wickhorst, engineer of tests for the rail committee of the American Railway Engineering Association at the recent convention of the association, are failures either of the head or web, which constitute 50 per cent. of them; or of the base, which constitute 40 per cent. The cause of the former he ascribes to unsound ingots, and the remedy he says is a more uniform chemical structure in the ingot. For the base failures he blames laminations in the base, and suggests as a cure better mechanical rolling.

Canada's Great Inland Ports

Port Arthur and Fort William—Live Facts Which Emphasize Their Importance in the Constructional World

DURING recent years the industrial and constructional activities of Port Arthur and Fort William have brought these great inland lake ports into much prominence. These cities are situated at the head of deep water lake navigation and are 1,200 miles by water and 1,000 miles by rail from Montreal, to which port a passage of 14 feet in depth is open. This depth allows vessels with a carrying capacity of approximately 2,500 tons to navigate, and makes possible the receiving at Montreal of a vast amount of grain and western products, which without this cheap water route would find its outlet via Buffalo and other American seaports. With the deeper channel available which is now being advocated, thus making possible still cheaper transportation, Montreal will not only still further increase her western grain receipts, both Canadian and American, but will control it for the American route, which now receives over 40 per cent. of Canada's European-bound wheat shipments.

Thunder Bay, on the shores of which the city of Port Arthur is built, is a magnificent body of water, 16 miles wide and about 35 miles in length, and is surrounded, except for two entrances to Lake Superior, by bold and rugged hills.

Fort William is situated in lowlands bordering the Kaministiquia River, and lies almost under the shadow of Mount McKay, which rises to a height of 1,000 feet and which forms parts of a long range of hills which lie directly to the south of that city. On the range of hills is Loch Lomond, the source of the water supply for Fort William, a beautiful lake over 5 miles long and situated 600 feet above the level of Lake Superior, only a few miles distant. Port Arthur begins at the northern boundary of Fort William, directly on the shore of Thunder Bay a site which is unsurpassed, rising as it does in gradual terraces from the lake level to a height of over 400 feet, giving a panoramic view of hill, lake and stream covering approximately 2,500 square miles.

Fort William's harbour facilities are splendid. These, with Port Arthur's more open water-front, where ice does not form too excessively to prevent loading during all the winter months, make a harbour which it would be difficult to surpass. The river is navigable for deep water lake vessels for about six miles, and from that point to the lake, two more outlets are available, the Mission and the McKellar rivers, both of which are now being deepened for the passage of large ships, making altogether about 35 miles of water-front which is possible for docks, and all not more than 6 miles from the central point.

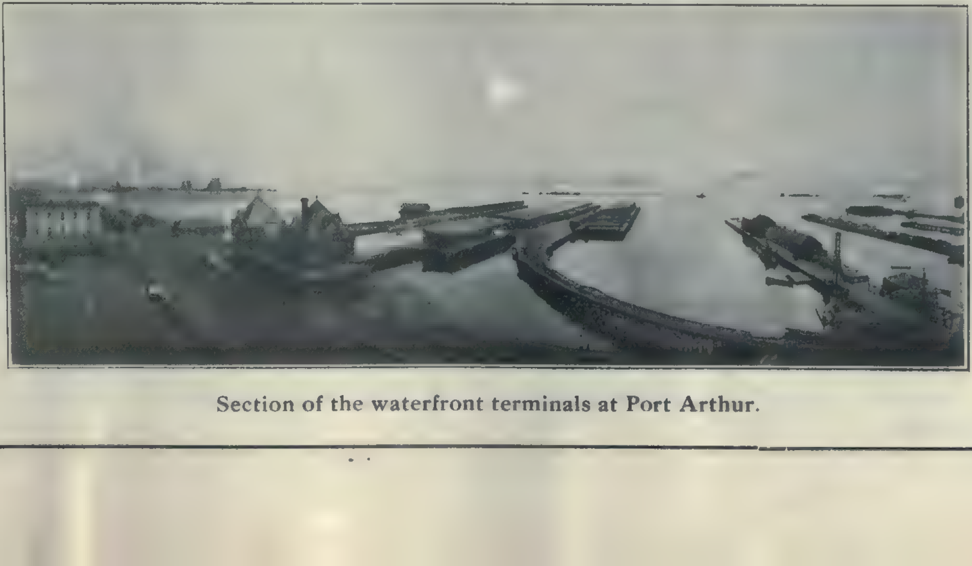
At these ports are the great transfer points for grain shipments from the west to the east, it will be taken for granted that the facilities for handling grain are as complete as possible, and such is indeed the case, for Port Arthur and Fort William are now leading the world not only in the grain storage and handling facilities in completion, but also in elevator construction. Barely eighteen months ago the grain storage capacity of these ports was approximately 25,000,000 bushels, and now, when present contracts are completed, it will be approximately 42,000,000 bushels. This stupendous construction in elevator storage capacity will have to be continued in order to keep abreast of the grain receipts which are increasing by leaps and bounds, as illustrated in the lake wheat shipments alone which in 1911 were approximately 70,000,000 bushels and in 1912 97,000,000 bushels.

Port Arthur has 40 per cent. of this vast storage capacity, which includes the world's greatest elevator with a capacity of 9,500,000 bushels. This building is only one of 14 large terminal elevators.

These cities have also three of the finest coal dock plants on the continent, at which it is possible for a 7,000 ton cargo of coal to be unloaded within the 10 hours. The Canadian Northern coal dock at Port Arthur has a storage capacity of 750,000 tons. At Port Arthur the finest dry dock in Canada is situated, having a length of 736 feet, the property of the Western Dry Dock and Shipbuilding Company.

Mammoth Steel Plant Contemplated

Port Arthur, at the request of the MacKenzie and Mann interests, is reserving 300 acres out of the 1,300



Section of the waterfront terminals at Port Arthur.

Coal docks of the Canadian Northern Railway and section of the waterfront at Port Arthur.

The Atitkokan Iron Works, a well equipped industry whose plant is situated near Port Arthur.

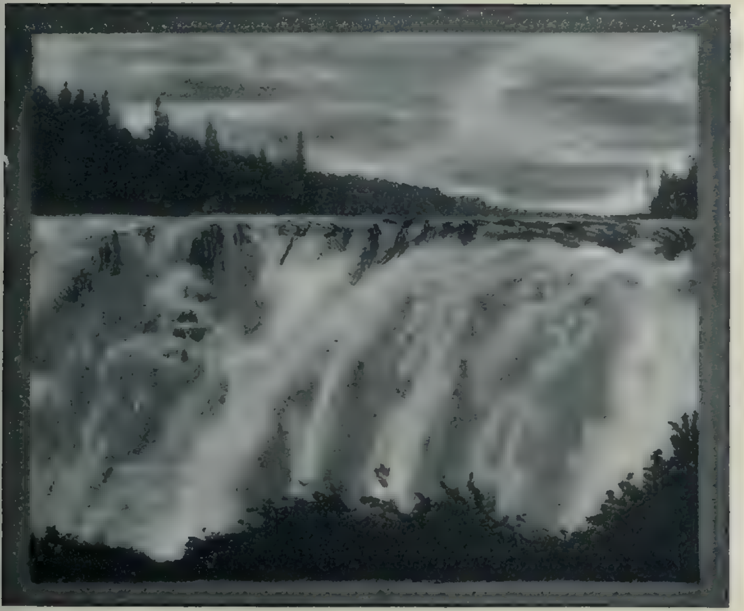
The Canadian Northern elevator at Port Arthur, Ont. This building has a capacity of 10,000,000 bushels and is said to be the largest in the world.

CANADA'S GREAT INLAND PORTS

acres of free industrial sites which the city possesses. These 300 acres are destined for what is to be the largest steel plant in Canada. It is to cost in its initial stage over $5,000,000, and when the plant is fully completed, with the addition of subsidiary plants, it is estimated that the cost will amount to over $10,000,000. This steel plant is the culmination of a series of experiments which big European steel interests have been making with the local iron areas, which exist in almost inexhaustible quantities.

Building Activities

There is under construction at Port Arthur at the present time a $75,000 church for the Presbyterians. There is also about to be commenced in the same city a $100,000 church for the Roman Catholics. The new Italian Church, which was commenced last year will be completed this season.



Kakabeka Falls, the source of Fort William's light and power.

The erection of commercial blocks and dwellings is also progressing. Fort William has under construction the new Commercial Chambers Block, which is to cost about $250,000. Port Arthur has the Port Arthur Building under construction, a modern ten-storey fireproof structure, which will cost over $400,000 when fully completed. An armoury is also being built at a cost of over $150,000 at Port Arthur. Dwellings are being erected rapidly to meet demands, it being estimated that so far this year over $500,000 has been spent in Port Arthur in the erection of two hundred modern residences. The value of new buildings in Port Arthur will amount to over $4,000,000 this year.

Cutting off piles under water was accomplished by the use of an air drill in the work of rebuilding a railroad bridge some time ago across the Pitt River, in British Columbia. Piles in an old pier had been driven in a double row so as to form a sharp-pointed ellipse, and in the reconstruction work it was necessary to cut off the inner row 1 ft. lower than the outer row. This fact, coupled with the depth of water, which was 25 ft. at high tide, prevented the use of any ordinary method of sawing. The work was done by Mr. H. A. Bayfield, of Vancouver, by the use of a Little Giant compressed-air hand drill operated by a diver and supplied with air from a floating plant. The diver commenced work on the outer row, and, taking one pile at a time, drove 2-in. holes at the required depth until the pile was so weakened that it could be pulled over by a rope attached to the top. With the outer row out of the way, the same method was used to cut off the inner piles at a lower level, and these were removed in the same manner. On page 717 of this issue of the Engineering Record is a description of the methods of putting in the foundations for the Pitt River bridge near Vancouver.

Economical Proportioning of Concrete

By Sanford N. Thompson

ECONOMICAL proportioning of concrete does not always consist in causing the leanest possible mixture. If the quantity to be laid is small, it is sometimes cheaper to use materials at hand, selecting the proportions arbitrarily and adding an excess of cement to insure the required strength and water tightness, rather than to make the tests required for the more scientifically proportioned mixture. On the other hand, upon large or important work, it pays from the standpoint of dollars and cents to make thorough studies of the aggregates, carefully grading the materials so as to use the smallest possible quantity of cement, which is always the most expensive ingredient.

This fact has been seriously overlooked in the past, and thousands of dollars sometimes have been wasted on single jobs by neglecting laboratory tests and studies or by errors in theory. By adjusting the proportions of the aggregates instead of selecting them arbitrarily, a concrete of equal density, strength and water-tightness may be made almost always with the use of less cement. On a certain job, for example, where water-tight concrete was required, a net saving was effected of 74 cents per cubic yard by carefully grading the materials, the resulting concrete being as watertight as the richer mixture, having proportions selected by judgment.

The Associated Metal Lath Manufacturers, Youngstown, Ohio, have issued standard specifications for exterior plastering which represent exhaustive research and constitute the last word in this construction. This type of work has been retarded in the past owing to failures due to improper methods. The constructional interests generally, however, are coming to look upon exterior plastering with increased favor and the reliable information afforded by this document is timely in its presentation.

Mr. T. G. Holt, general manager of the Canadian Northern Pacific Railway, has awarded the contract for the construction of the railway from Patricia Bay to the entrance to the Songhees Reserve terminals at Victoria, which will complete the Island link in the rail and ferry service between Vancouver and the provincial capital. The successful bidders for the contract were Mr. J. Macdonald and the Littleton-Bruce-Elsback Company, the work embracing a joint contract. The distance covered by the work is about twenty miles from Patricia Bay, formerly known as Union Bay, on the north-westerly shore of the Saanich Peninsula, to a junction with the main line of the railway. The same contract also covers the work from mile 4.7, outside Victoria, through the city and up to the approach to the terminals on the old Songhees Reserve.

Calgary's Record Well-Maintained

Building Permits Still Being Issued to the Value of One Million Dollars a Month—The Work in Hand

Correspondence of the Contract Record

Calgary, September 10, 1913.

CONDITIONS in the building world of Calgary continue to show improvement, reflecting the improved financial markets throughout the Dominion. While not up to the totals for 1912, building permits continue to pour in at the rate of over $1,000,000 each month, the total for the month of August being $1,083,530. The whole tone of the contracting field is improved, and about the same amount of men are employed this year as last. The most noticeable falling-off in building has been a decrease in the number of houses built for speculative purposes. One feature of the larger buildings now under construction is the increased number of reinforced concrete structures required by owners. There are now under construction in this city twelve large buildings having reinforced concrete frames. The largest is the ten-storey office building for the Herald Publishing Company, costing over $400,000, while the smallest is the new theatre for the Canadian Film Exchange, Limited, costing $75,000, in all aggregating a total cost of over $2,000,000.

New Bijou Theatre, Calgary.

One result of the increased amount of concrete being placed, not only in buildings, but in the street paving, has been to render the question of suitable materials very acute. Heretofore contractors and architects have been content to accept bank run gravel for aggregate for concrete of all classifications, but following the lead taken by the City Engineer, requiring all materials to be washed and graded, there has been an increased demand for better materials. In order to fill the demand, there have been incorporated in the province of Alberta, during the current year, for operation in Calgary, at least four new companies dealing exclusively in sand, gravel, or crushed rock, with a total capitalization of over $125,000. There have been besides about five other companies in operation, all using machinery. One of the most interesting of these developments is that of the Alberta Gravel Company, Limited, of which J. J. Wilson, of Calgary, is the president. This company is operating on the Bow river, in the heart of the city, and is removing the gravel from the river bed by means of a one cubic yard Hayward orange-peel bucket travelling on a steel cable back and forth across the river. The cable has a span of 550 feet, and is 1¾ inches in diameter. The materials are dropped over grizzly bars and washed and screened before dropping into the bins below. The bins have a capacity of 100 cu. yds., with six gates for loading six teams at once, giving the plant a capacity of 400 cu. yds. per day. Two plants, installed west of the city, will sluice materials from the hillsides down to washing and screening plants loading by gravity to cars.

The New Bijou Theatre

Among the more interesting buildings to be completed recently is the new Bijou moving picture theatre, a cut of which is shown. The building occupies a lot 25 feet wide and 130 feet deep on Eighth Avenue, in the heart of the business district, and cost about $50,000 complete. In all its arrangements, the theatre represents the most advanced ideas for this class of building, and is a well paying investment to the owners. The frame is structural steel, with laminated floors. Seventy-five tons of steel, supplied by the Hamilton Bridge and Iron Works, Limited, were erected by the contractors, McDougall & Forster, Limited, of Calgary. The front elevation is entirely of ornamental plaster, with marble wainscotting. Besides the main auditorium, there is a balcony, suspended from the roof beams by steel rods, the theatre having a capacity of 650 persons. In addition to the ordinary features to be found in such buildings, this theatre has a motor-generator set for supplying electric light and also power for running the fans for the forced draft heating and ventilating system installed. All electric lighting is indirect, with large bowl fixtures suspended from the ceiling of the auditorium, and provided with weighted pulleys so that the fixtures may be lowered in order to replace the lamps. The architect was James C. Teague, of Calgary.

Important Bridge Work

The city of Calgary are advertising by-laws to be voted upon September 27th next for the reinforced concrete bridges formerly contemplated, as well as for the erection of an industrial building, to cost $250,000, for the housing of small manufacturing businesses, and similar to the well-known Bush Terminal Warehouses in New York. The largest of these bridges will be the high-level bridge across the Bow River at Center street, for which the sum of $468,900 is required. Those most likely to be authorized, certainly those most needed, will be the three-span bridge at Fourth street west, over the Elbow River, requiring $82,500, and another to replace a three-span steel bridge over the Bow River, requiring $173,000. By-laws for other public works will bring the total of the by-laws to be submitted to almost $1,500,000, It is not probable that all of these will be adopted, but at least two or three of the bridges will be constructed during the coming year.

McDougall & Forster, Limited, of Calgary and Edmonton, have about completed the contract for a new hotel on Seventh avenue east. The building is six storeys high, with basement, and is 50 feet wide by 130 deep and 83 feet high above the sidewalk. There will be a total of 95 rooms available on the five upper floors. The lower floor, which will be rented for store purposes, has a unique feature in the lobby in front of the showcase window. A deep plate girder having a span of about 35 feet, in the front of the building allows the window to be recessed from the street line, enabling passersby to step into the lobby thus formed to view the displays and also enlarging the prism-light area for the basement. The foundations of the building are of concrete, the superstructure being structural steel with laminated floors. The front elevation is white terra cotta, supplied by the Washington Brick, Lime and Sewer Pipe Sales Company. The exterior walls are of common red brick and were laid complete the full height of six storeys, a total of 420,000 brick in 15 days. The interior partitions are of gypsum block. One passenger elevator is being installed. Two hundred and fifty tons of structural steel were supplied for this building by the Hamilton Bridge & Iron Works, Limited, of Hamilton, Ont., and were erected by the contractors in the short period of 18 working days. One 7 in. by 10 in. American steam hoisting engine operated the two derricks used, a 15-ton stiff-leg, with 80 ft. timber boom, and a 5-ton stiff-leg, with 35 ft. timber boom. A small Sullivan air compressor was used for the pneumatic rivetters. The superintendent for the steel erection was Mr. E. M. Huyck. The estimated cost of the building is $100,000. The architect is Alexander Pirie, of Calgary.

Interesting Law Suit

Prior to the erection of the above building, the owners conducted a suit against the abutting property which had no precedent in the province. The Alberta Loan & Investment Company, Limited, entered into a party-wall agreement with the owners of the hotel, and when the abutting building was constructed some two years ago, the architectural facade of the Loan Company's building was completed to the outside of the party wall. When the owners of the hotel now under construction, through their architect, desired to complete the design of the facade, it was essential for the terra cotta facing to come to the center line of the party wall. In the suit which followed, the court held that the defendants had encroached upon the party wall and allowed the plaintiffs to remove the brickwork in the facade of the abutting building to enable them to carry out the designs of their architect.

Canadian Stewart Company's Contracts

The Canadian Stewart Company, Limited, of Montreal and Chicago, have under construction an addition to the warehouse of the Canadian Consolidated Rubber Company, Limited, on Tenth Avenue West. The existing building has a frontage of 57 feet 11 inches, and the addition will have a frontage of 75 feet, making the building nearly 133 feet in front. It is 110 feet deep and will have five storeys and a basement. The exterior walls are of solid brick construction, on concrete foundations, the interior being of mill construction, with 2 x 6 laminated floors throughout. The roof will be covered with a 5-ply tar and gravel roofing. The estimated cost is $100,000.

The same contractors have commenced the foundations for an addition to the grain bins and malt house of the Canada Malting Company, Limited ,which will double the capacity of their present plant, built last year. The addition to the germinating house consists of further germinating compartments with the corresponding air attemperators, and will be 77 ft. wide, 120 ft. long, and 27 ft. high, of reinforced concrete construction with solid brick exterior walls. The additions to the elevator will exactly duplicate those erected before, and will consist of nests of circular tanks with conveyor house next the malt house. There will be a total of 35 tanks, having a capacity of 500,000 bushels. Ten of these will be 21 feet in diameter, with shells 7 inches thick, and twelve will be 13 feet 10 inches in diameter, with shells 6 inches thick, the other tanks being formed in the pockets between the circular tanks. All the tanks are 90 feet high above the foundations, and are charged by 30-inch belt conveyors running in the pent-house over the tanks and will be emptied by similar conveyors running in tunnels beneath.

Electric Trucks in Calgary

The city of Calgary recently purchased 7 electric trucks comprising one 5-ton, two 3-ton, two 1-ton, and two 1,000 gallon sprinklers and flushers. The complete outfit is shown in one of the accompanying photographs and the sprinklers are shown in action in the other picture. It is difficult to imagine a scene that would speak more forcibly of the rapid development of the West and their progressive attitude in all the phases of modern business life. We are indebted to Commissioner A. G. Graves, of Calgary, for the photos and the gratifying information that "electrics" are proving entirely satisfactory in meeting municipal requirements.

In regard to mileage, Commissioner Graves states that they make from 40 to 45 miles per day with the one-ton trucks, without boosting them at noon. The three-ton truck that is used in the Stores Department is doing very good work, so far as mileage is concerned. It has recently been hauling 6,090 lbs. of cement a distance of about 3½ miles. Nearly half of this distance is on paved streets, but after this there is a 11½ per cent. grade of about 1,500 ft. in length, which is still in an unimproved state. Beyond this there is about one mile of mud roads. They have been getting about 39 miles per day out of this particular truck, under the above mentioned conditions, without boosting when the roads were in a dry condition. On the other hand, when the roads are wet and slippery, it is necessary, to get the above mentioned mileage, to boost the batteries during the noon hour. So far they are getting splendid results, and the Commissioner has no doubt but that the operative costs will be well below the estimate which was compiled at the time of purchase.

Two storage sprinklers in operation at Calgary.

The new catalogue of the Heenan refuse destructor, manufactured by Messrs. Heenan & Froude of Canada, Limited, is illuminating as to the great strides that have been made in this important field. The wide range of application is shown conclusively by the excellent illustrations which adorn the catalogue. Heenan destructors are in use all over the world, while the fact that they have been successful in open competition at Ottawa, Westmount, Calgary, Moose Jaw and other cities attests their growing popularity in Canada. Copies of the catalogue in question may be obtained from the managers, Messrs. Laurie & Lamb, Board of Trade Building, Montreal.

Montreal Harbor Commissioners' Report

To use the words of the Montreal Harbor Commissioners, in the annual report just issued, 1912 was "a record year of constructional achievement." The report gives many details showing that the port did the largest business in its history, and that great progress is being made with the programme of improvements authorized by the government. "There has been achieved, with a measurable degree of success, the solution of one of the biggest problems which transportation presents, in the co-ordination of rail, river and road traffic, all meeting at a point of interchange, with possibilities of assembling cargo with economy and dispatch."

The harmonious and comprehensive scheme of port development that took three years of careful study to prepare, and which, before being adopted by the Commissioners, was subjected to an independent board of engineers, is now well on its way. When completed it will provide Canada with a national port containing ten miles of first-class harbor accommodation, combining close co-ordination of railway, river and roadway accessibility, with ample warehousing areas, thus ensuring the best obtainable transportation results upon a moderate capital investment.

During the year Elevator No. 2 was under construction. Since then it has been decided to add to No. 1 elevator and also to build a third elevator, the site of which has not yet been settled. The Commissioners' high level railway now extends nearly as far east as Dominion Park and will ultimately extend to the end of the Island. This system replaces the old low level railway that was only operated for seven months and furnishes access to the harbor from the city by means of subways instead of level crossings. This high level railway service furnishes Montreal with a railway terminal under neutral control and managed for the benefit of all railways and the public alike. This will ultimately lead to all the steamship sheds being used as freight distributing warehouses during the winter and place in the heart of the city a first-class freight emporium accessible to all railways, merchants and cartage companies for the assembling and distribution of freight economically. The system will ultimately furnish to all industrial concerns established near the water front an all-the-year-round railway service with every railway doing business with the port, and supply every manufacturing centre there established with continuous railway service throughout the year with all railways. This is in addition to deep water communication provided by the piers.

Mr. F. W. Cowie, M.I.C.E., the chief engineer, gives details of the engineering work of the year, including the new Victoria pier and market basin. In the construction of the quay walls several new features have been employed. The cribwork substructure is built with double face timbers and very great additional strength. The concrete wall of the superstructure is also built of additional strength, with new designs for the mooring of vessels. A new arrangement has been designed and successfully carried out in connection with the construction of the lower part of the concrete quay walls. Mass concrete deposited in water has always proved difficult of perfect construction, and when the face is imperfect in the vicinity of the low water, where the November frosts attack it, the wall, in a few wears, becomes eaten away and undermined. Footing blocks of concrete moulded in air have been used for some years. They are quite successful as regards giving a permanent concrete face in the vicinity of low water which is not attacked by frost. The blocks, however, do not fit themselves to the top of the wooden Canadian cribs in such a way as to give the degree of stability or such uniform bearing surface as is considered necessary where the heavy concrete retaining wall is founded on timber substructure.

Reinforced concrete shells of an absolutely new design were tried in 1911 and 1912 and proved fully successful. These shells are six inches thick, fully reinforced with steel rods, the surface glazed and hardened, and are made to fit the top of the cribwork. They are in sections about 20 ft. long and the full width of the bottom of the concrete wall.

A derrick lifts them from a scow and places them accurately in position, and when the interior is filled with concrete from the mixer it forms four feet of solid wall above the top timbers and gives a perfectly stable foundation for the wall, with even bearing surface so as not to strain any parts of the timber. When the top shell is reached the wall is above water and the wall is built as a direct wall in air with a perfect face.

It has been found that vertical quay walls are much more convenient for present day ships than walls having an angle, and the quay walls are now designed vertical. This requires careful design for stability, but when completed it obviates much of the danger of either the ship or the crib being damaged under water, as is the case in walls having a batter.

Several other important works were carried out, while a large amount of dredging was also done. Altogether $2,892,129 were spent on capital account.

Annual Convention R.A.I.C.

The annual convention of the Royal Architectural Institute of Canada was held in Calgary, September 15-16, under the presidency of Mr. J. H. G. Russell, of Winnipeg. Addresses of welcome were delivered at the opening session by Mayor Sinnott and others prominent in the civic life of Calgary. The annual report disclosed a most satisfactory year's work, with the institution in good financial standing. Interesting papers were delivered by Professor Brydone-Jack, of the Civil Engineering Department of the University of Manitoba, and by Mr. F. Goldie Engholm, of Vancouver. The delegates were entertained at a smoker given by members of the Calgary Builders' Exchange. The annual dinner of the Institute, which was a most successful function, was held at the Alexandra Hotel. The arrangements reflected the greatest credit upon the local organizers, Messrs. L. M. Gotch and G. M. Laing. Further details will be given in our next issue.

American Road Congress

Systematizing the purchase of all road materials and equipment through the establishment of purchasing departments, somewhat along the lines followed by great railroad corporations, is strongly advocated by Maj. Henry G. Shirley, Chief Engineer of the Maryland State Roads Commission, in a paper which he will present at the Third American Road Congress, which will be in session at Detroit, Mich., during the week of September 29. An intelligent selection of material and equipment, exact knowledge of values and prices and utilization of discounts and credits are among the advantages claimed for a centralized system for the purchase of road materials and equipment.

The construction and maintenance of concrete roads, a type which is attracting attention among road builders, will be explained in a paper by Mr. F. F. Rogers, State Highway Commissioner of Michigan, and the discussion on his paper will be opened by Mr. A. N. Johnson, State Highway Engineer of Illinois. A similar treatment will be given the subject of brick roads by Mr. J. M. McCleary, County Engineer of Cuyahoga County, of which Cleveland is the county seat and which has a large mileage of excellent brick roads, the discussion to be opened by Mr. R. Keith Compton, Chairman of the Paving Commission of Baltimore.

Tars, oils and asphalts in connection with the construction and maintenance of roads have been so generally used in the east as to bring out much valuable data. The basic paper on this subject will be presented by Mr. S. D. Foster, Chief Engineer of the Pennsylvania State Highway Department. The discussion will be opened by W. A. McLean, Chief Engineer of the Province of Ontario, Canada.

The lessons learned at the International Road Congress held recently in London will be presented at the big meeting in Detroit by Col. Wm. D. Sohier, Chairman of the Massachusetts State Highway Commission.

A paper which will attract attention will be presented by Mr. Austin B. Fletcher, State Highway Engineer of California, in which he will describe the successive steps in the building of California's great $18,000,000 state system of trunk lines.

The News in Brief—From Coast to Coast

Sewer contracts to the total value of $700,000 have been let recently by the Works Department of the city of Toronto.

According to a Winnipeg dispatch it is the intention to replace the present St. John's Cathedral by a new building estimated to cost $250,000.

The wages of the Montreal plasterers have been advanced 5c an hour to 55c, for an eight-hour day. The new scale started on September 1st.

The permits issued at Vancouver to the end of August, 1913, amounted in value to $8,433,942. The corresponding figures for 1912 were $11,151,702.

The Saskatchewan Government has been petitioned to set aside half a million dollars for building extensions to the provincial university of Saskatchewan.

New plans are to be prepared for the proposed Toronto Barracks. This will mean the postponement of the commencement of construction for at least seven or eight months.

A pipe-line 44 miles long to bring water into Calgary from the foot-hills of the Rocky Mountains is recommended by Mr. A. W. Ellson Fawkes, Waterworks Engineer of Calgary.

The building permits issued at Regina for the current year to the end of August represented a value of $3,201,050, as compared with $4,622,479 for the corresponding period of last year.

The 10th annual convention of the American Road Builders' Association will be held in Philadelphia, December 9-12. Mr. E. L. Powers, 150 Nassau street, New York, is the secretary.

The Canada Cement Company have in preparation plans for a new mill at Medicine Hat which will have a capacity of some 4,000 barrels. Three or four hundred men will be engaged at the outset.

The 20th annual meeting of the American Society of Municipal Improvements will be held in Wilmington, Del., October 7-10. The secretary is Mr. A. Prescott Folwell, 15 Union Square, New York.

The building permits issued at Prince Albert, Sask., from January 1 to August 31 amounted to $1,545,375. The August total was $201,000. The figures are supplied by Mr. H. L. Fitzsimmons, Building Inspector.

The Shea-MacVaugh Engineering & Construction Company, of 608 Couch Building, Portland, Oregon, has established a branch concern in British Columbia, with head office at 312 Jones Building, Victoria, B.C.

Last week the Winnipeg City Council passed a $13,000,000 by-law for the construction of a water system from Shoal Lake. Voting will take place on this by-law October 1. A by-law granting $275,000 to the Winnipeg General Hospital also passed.

Construction work on the Dominion Government public dock to be built on Burrard Inlet, Vancouver, is to be started within the next week. The Public Works Department awarded the contract for the project last week to Messrs. Henry, McFee & McDonald, at the sum of $1,250,000.

Lockwood, Greene & Company, architects and engineers for industrial plants, 60 Federal Street, Boston, announce the establishment of a Canadian office under the name of Lockwood, Greene & Company of Canada, Limited, with headquarters in the McGill Building, Montreal.

The Napanee Brick & Tile Company have completed the installation of a first-class plant at Napanee and are now commencing operations. The company will employ some 35 hands at the start. It is expected that about eight or ten million brick will be made next season.

Contracts for two government elevators at Saskatoon and Moose Jaw have been awarded to the Barnett-McQueen Company of Minneapolis. The contract price is slightly under a million dollars for each elevator. The successful tenders were some $300,000 lower than the next bidder.

Operation on what is reported to be the largest reinforced concrete bridge were commenced at Saskatoon last week when Dr. Murray, president of the Saskatchewan University, turned the first sod. The bridge will be 1600 feet long and 63 feet wide, having a 45-foot roadway. Mr. R. J. Lecky is the contractor.

Work has now commenced on the new 25th street bridge over the South Saskatchewan river. This will be the fifth bridge at this city. It will cost $400,000, and will take over a year to construct. Work will be rushed throughout the coming winter. The bridge will connect the university with the central portion of the city.

A United States syndicate is prepared to enter into negotiations with the Regina city council for the purpose of securing a franchise to install a gas plant, and will put up bonds to the extent of $500,000 if necessary, according to a statement made by Mr. C. E. McQuaid, at the monthly meeting of the Board of Trade last week.

The contract for the excavation of the Hudson's Bay Company's department store at Victoria has been awarded to Messrs. Luney Bros., of that city, and it is expected that the contract for the construction of the building itself will be made while the excavation is in progress. The project involves the expenditure of $450,000, exclusive of the site.

The Sault Dredging & Construction Company have been awarded the $90,000 contract for dredging the channel between Goat Island and Little Current on Manitoulin Island to a depth of 22 feet. The largest freighters on the lakes will then be able to dock at Little Current and it is probable that the dredging is but the first part of a big program of terminal facilities at that point.

Hon. Robert Rogers, Minister of Public Works, has been giving his attention to many plans for the improvement of the harbors of the Dominion now in progress or being considered. It is estimated that within the next few years the government will find it necessary to spend $100,000,000. These works to include dry docks at Victoria, Vancouver and Esquimalt and harbor improvements at Montreal, Toronto, St. John, Hamilton, Halifax, Fort William and Sault Ste. Marie.

City Engineer Rust, of Victoria, B.C., reported to council last week that it would cost $250,000 to extend the permanent pressure pipe line of the Sooke Lake water works system from its present terminus on the Gorge Road to a point near Parson's Bridge, so that a permanent connection could be made with the system of the Esquimalt Waterworks Company. Once the connection was made, however, the company would be in a position to provide the city with 10,000,000 gallons daily.

Tenders will be called shortly for the new Transcontinental shops to be erected at Quebec. Representatives of a number of big contracting firms are in the city figuring on the specifications. The works will cost in the neighborhood of two million dollars and it is the intention to erect the most modern and up-to-date shops. Among the firms which are figuring on the work are, Peter Lyall & Company, of Montreal, and Quinlan & Robertson, of Winnipeg. The latter firm recently built the big shops of the Transcontinental at Winnipeg.

The Ontario National Brick Company is now manufacturing over 200,000 bricks a day. Not all of this output is being shipped as made, but a good proportion is being delivered and sales are quite satisfactory. The Ontario National Brick Company was organized a few months ago with a capitalization of $2,000,000 common stock and $1,250,000 bonds issued. The president is J. N. Greenshields, K.C., of Montreal. The plant has been operating since about June 1st, and already is turning out two-thirds of its maximum output of 300,000 tons a day.

A despatch from Ottawa states that plans and specifications have been submitted by the Harbor Commission of Montreal to the Marine Department for two new freight sheds at sections 24 and 25 of Montreal harbor, at a cost of $300,000. Shed number 24 is to be 275 feet long and 106 feet wide and two storeys high, and shed No. 25 485 ft. long and 112 ft. wide and also two storeys high. The foundation will cost $100,000 and will be laid this year, while the general construction will take place in the early spring and will be available for business next navigation season.

Extensions to the development plant of the Kaministiquia Power Company are pending, but no definite decision has as yet been announced nor any tenders called nor contracts let. The nature and extent of these additions will depend somewhat on trade conditions and business prospects of the next few months. The present installed generating capacity has a nominal rating of 15,000 h.p. with overload rating of 22,000 h.p. The hydraulic development, including dams, intakes, forebay, etc., was originally installed for an ultimate capacity of 35,000 to 50,000 horse power.

The largest flour milling industry in the British Empire is claimed to have been organized at Calgary where a crowd of United States capitalists have formed a company know as Calgary Flour Mills, Limited, for the purpose of carrying on an extensive milling and elevator business in the city. A 15-acre site has been secured and a flour mill having a capacity of 6,000 barrels daily, together with a large terminal elevator, will be erected at an initial cost of $1,400,000. The promoters of the company include Senators Healy and Knapp, and Alexander Ingraham, of Minneapolis, who will become managing director.

The collapse of a wall, carelessly built 50 years ago, was the cause of the disaster at the J. C. Turnbull departmental store, Peterborough, on August 28 last, according to William Langford who inspected the building on behalf of the Trusts and Loan Company while alterations to connect it with the adjoining Barrie store were in progress. His view was concurred in by W. J. Johnston, the contractor in charge of the alterations who examined the building after the accident and found that a weak wall had collapsed. Mr. Langford testified that the biggest opening in the wall without a support was 19 feet wide, that the beams rested on an 18-inch wall and were amply strong enough to carry the weight. There was no doubt that the wall, which was built 50 years ago and did not appear to be carefully built in the centre, gave way and caused the outer walls to bulge and the floors to fall in.

According to a dispatch from Victoria, an extensive programme of bridge construction is about to be inaugurated on the Esquimalt & Nanaimo Railway Company's line. Last week a large shipment of steel, to be used in this connection, was received from the Canadian Bridge Company. The work of most interest is the erection of a fine steel viaduct over Arbutus canyon, one of the specially attractive points, scenically, between Victoria and Duncan. The concrete piers for it have been ready for some months, and now that the superstructure is at hand, it will not be long before the trains are using it in traversing the ravine.

Canadian Railroad Development

The C. P. R. bridge over the St. Lawrence at Lachine is nearing completion. The work of the railway has not been suspended a single moment during its double-tracking. The total expenditure will amount to $3,000,000.

According to Mr. A. W. Smithers, chairman of the Grand Trunk Pacific, the line will be completed next year. He stated in Montreal that there will be no let up on building operations while there is a mile of steel to lay or a fraction of a dump to construct between the eastern and western terminals of the railway.

Most important of the legislation to be taken up at the session of the Alberta Legislature will be the building by the Provincial Government of the Alberta and Great Waterways Railroad from Edmonton to Fort McMurray, 230 miles, from which point the Athabasca, the Great Slave and the Mackenzie Rivers are navigable to Fort McPherson, 2,100 miles.

Engineer Carleton of the Grand Trunk Pacific, announces that that road will undertake the construction of a line through Moose Jaw, Medicine Hat, and through the Crow's Nest country into Southern British Columbia. The Calgary-Edmonton line will be extended south to make connections with the proposed line, work on which will be commenced in the spring.

Mr. F. Somerville has submitted a report on the railway situation in Hamilton with a view to the concentration of the existing railways and the proposed C. N. R. railway at a union station to be situated near the cross of the G. T. R. tracks. Mr. Somerville advocates six main lines and recommends the widening of Stuart Street cut at a cost of $50,000. The report has been sent on to the city council.

Three miles of steel a day are being laid by the Canadian Northern Ontario Railway on its Sudbury-Port Arthur line in an endeavor to complete this section, which is to connect the eastern and western Canada systems, by the end of the present year. According to official figures, there are only 180 miles to be finished. Grading is in shape sufficiently far ahead to allow of steady track-laying, the bridges are up, and there seems little doubt that the rails will be connected up in 1913. This is in accord with the announcement that the company would be operating freight trains to western Canada in the early months of winter.

The Canadian Northern Railway has decided to make four divisional points on the Sudbury to Port Arthur section of their new transcontinental line. They will be located at Capreol, Foley, Fitzbach, and Hector. All points will have round-houses, yards, and repair shops. The latest report shows that there are yet 180 miles of steel to be laid. At present the contractors are making a new record by laying three miles of steel per day, and it is probable that it will be fully completed within the next two months. The grading is now so far advanced that it will not interfere with the track-laying. The bridges are all completed, and the ballasting is being rushed.

Tenders have been put in for constructing the North Railway from Montreal to the Transcontinental at Bell River, and a decision will be made in October. Five parties, consisting of a hundred men, have been in the field for the past five or six months. Some 150 miles of the line from a point 25 miles beyond the Gatineau to Bell River will be practically over a comparatively level country and little or no difficulty in the construction of the road will be experienced. On the upper part of the North Railway little construction work will be done this winter, although camps will be established so as to ensure active operations on the opening of spring. In the Laurentide a good deal of the work can be done quite as well this winter as in summer so here operations will go ahead rapidly.

In order to facilitate the driving of the 22 x 30-foot double track C. P. R. tunnel, over five miles long, through Rogers Pass at the summit of the Selkirks, Messrs. Foley, Welch & Stewart, contractors, have decided to adopt a new method which will be watched with interest by the engineering world. The expedient consists of the boring of a parallel tunnel, seven feet by eight, for virtually the same length and from this tunnel crosscuts will be made at short intervals to the site of the proposed tunnel and enable gangs of men and machine drills to attack the work simultaneously at scores of points. Incidentally the "pioneer" tunnel, as it has been called, will also provide ventilation. The proposed tunnel, for the greater portion of its length, will be driven through with a bore, probably not much larger than the pioneer tunnel; later, in addition to the boring from either approach, machinery will be installed at various points and the working enlarged to the standard size provided in the contract. Steam shovels are now busy grading the half-mile approach through soft earth to the site of the western portal of the tunnel below Glacier station. From near the proposed entrance will also be started the parallel "Pioneer" to provide easy access to the site of the big tunnel; and at the east side of the mountain but some distance from the future east end of the permanent tunnel, a start is being made on the other end of the pioneer tunnel. The latter working, being driven at an angle, will be driven westward into the mountain about 2,000 feet before a crosscut will be made to the ground to be traversed by the permanent tunnel.

Personal Mention

Mr. W. C. Willard has secured an appointment on the staff of McGill University, succeeding Professor Smart as lecturer on railway engineering.

Mr. Isham Randolph, consulting engineer, of Chicago, has taken a new suite of offices in the Commercial National Building, to which address communications should be sent.

Mr. Hilder Daw, A.M.C.S.C.E., Montreal, has been retained by the Corporation of Sherbrooke, P.Q., to revise the drainage and purification system to meet the growth in the city's population.

Mr. A. M. Wright, the representative of E. F. Giberson & Company, Limited, New Birks Building, Montreal, New York, and Bedford, Indiana, is on a trip to the West, in the interests of the firm, who are owners of big limestone quarries at Bedford, and whose product is known as "Real Bedford."

New Head of Canadian British Insulated

Mr. A. E. Grant

Mr. A. E. Grant has succeeded his brother, Mr. Lawford Grant, as managing director of the Canadian British Insulated Company, Ltd., Power Building, Montreal. Mr. A. E. Grant has had a wide experience as a marine, mechanical and electrical engineer, and has supervised some extensive contracts. His first position as an electrical engineer was with the Notting Hill (London, Eng.) Electric Light Company, for whom he erected some three-phase machinery, the second of its kind used in the British Isles. Subsequently he joined the engineering staff of the British Insulated and Helsby Cables, Limited, England, which has a large interest in the Canadian British Insulated Company. During his 14 years' connection with the British Company, Mr. A. E. Grant had charge of some important work, including the complete equipment of the Chesterfield tramways, and also the laying of extra high tension mains of the Metropolitan tramways. In 1906 he was appointed manager and chief engineer of the Cardiff office, which takes care of the company's business in South Wales and the south-west district of England. He comes direct from Cardiff to Montreal, and has now taken over the duties of Mr. Lawford Grant, who resigned to accept an important position with the Eugene F. Phillips Electrical Works, Limited, Montreal.

The Maritime Bridge Company, Limited

The William P. McNeil Company, Limited, of New Glasgow, announce a change of name of their firm. Hereafter the company will be known as The Maritime Bridge Company, Limited. This change marks an additional step in development and inaugurates a movement to keep in advance of the continued increase in the structural business of the Maritime Provinces.

The William P. McNeil Company, Limited, was incorporated in 1908. A good market for the product of the company was developed under the capable management of the McNeil brothers, and the business grew until, in the spring of 1912, it was deemed advisable to place the plant and business in the most advantageous position possible for the handling of its requirements. As a result of this decision the control of the company was purchased jointly by The Canadian Bridge Company of Walkerville, Ont., and The Dominion Bridge Company, Limited, of Montreal.

Following this change of control, Mr. Walter McNeil retained his interest and the presidency of the corporation, while Mr. K. W. Bash, of The Canadian Bridge Company, Limited, went to New Glasgow to take up the work of plant revision. A new office system was introduced, the working capital was increased, and in the fall of 1912 the shop was thoroughly overhauled. The growth of the business in the eastern provinces and the development of the plant under the impetus of the changes made, led the directors to recommend to the stockholders, at their recent annual meeting, the present movement, as one of great advantage.

The executive and directorate of The Maritime Bridge Company, Limited, is as follows:—Executive: Mr. Walter McNeil, president; Mr. Kenower W. Bash, vice-president and manager; Mr. Robert C. Grant, secretary. Directors: Mr. Francis C. McMath, President Canadian Bridge Company, Limited; Mr. Phelps Johnson, President Dominion Bridge

Company, Limited; Mr. Charles T. Miller, Secretary Canadian Bridge Company, Limited; Mr. G. H. Duggan, General Manager Dominion Bridge Company, Limited.

The shop is under the capable management of Mr. R. A. Stewart and has a largely increased capacity, with plans for further extension in view. A new steel and reinforced concrete office building, of two storeys and a basement, is now in the course of erection at the plant site. This structure replaces the former building burned in the fire of last December. A far larger tonnage of structural steel shapes, plates and bars is carried in stock, ensuring prompt delivery of work to customers. Printed monthly stock lists are issued to the trade.

It is the intention of the management to keep pace with the growth of the eastern provinces and to supply their customers with the best quality of work.

Decorative Sandstone in British Columbia

The Denman Island Stone Quarries described for this Journal by Mr. L. G. Robinson, Consulting Engineer, Vancouver.

It is said that the mineral products of British Columbia are practically unlimited in extent and variety. In the cities of the east it is quite common to send away hundreds of miles for decorative sandstone, but British Columbia is specially fortunate in the vicinity of Vancouver in having a supply of excellent quality of sandstone near at hand.

The Denman Island Stone Quarries are located on the Denman Island about seventy-five miles from Vancouver in the Gulf of Georgia. The formation of the island is such as to indicate that the whole structure has been built up by deposits of material under water at great depth, and nature has been kind enough to shove up a portion of the earth's crust at this point and expose to view great quantities of the most homogeneous building stone to be had.

Unloading sandstone blocks at the Vancouver market.

The face of the quarry is exposed by reason of a fault or crack in the stratified rocks where the rock on one side of the fault or crack has been shoved upward a distance of seven hundred feet or more than it was on the other side. The face of the quarry is not, however, seven hundred feet high, but has been scrubbed and scoured since the glacial period until the present with the result that the face of the quarry stands only about one hundred and twenty feet above the level of the surrounding country.

The earth's movement which brought about this exposure must have been very gradual and even, for there appear to be very few seams in the stratified rock and those which do appear are practically at right angles with the face of the cliff. These seams and the lines of stratification are such as to render the rock available in most advantageous shapes and sizes. The strata lie upon a plain which dips about ten degrees away from the face of the quarry and at right angles to it. There is no danger, therefore, of the rock falling into the workings when being quarried.

This quarry has been in operation since 1908, Vancouver being the principal market. It has been found that the more the workings are extended the better the condition of the rock is to be found. Ten layers of this stone have been opened up and it is found that they vary in thickness from four feet to fifteen feet, but the quality of the stone remains the same in all. The color is a bluish-gray and does not change greatly after long time exposure to the elements. This feature alone is enough to recommend it to architects, for the reason that the appearance of a structure faced with this sandstone is likely to remain permanent for a long period of years.

The manner of working the sandstone depends largely on the character of the demand. The greatest demand appears to be for the stones in the shape of slabs for the purpose of veneering lintels, sills and copings. Ordinarily the stone is hewn out of the quarry by channelling machines into blocks measuring four feet square and twelve feet long. These are placed on carriages by means of huge derricks and wheeled into place under the gang-saw and there sawn into slabs of a thickness from four inches to eight inches. These slabs are then laid upon railway cars and transported to the dock, about a half mile distant, where they are laid upon scows or directly into ships to be transported to the market. They are then unloaded at the destination and cut into smaller forms suitable to the purpose for which they are desired.

Modern fireproof structures are made up of steel and concrete, but the external appearance of a concrete building is ordinarily not desirable and so the facing of brick, stone or tile is put on to give the building a better appearance and more stability. Sandstone lends itself to this use most readily, in that it may be easily carved or cut to the shapes desired, and ornamentation with this material is not difficult to acquire.

If the demand for this stone should continue to increase as rapidly as the history of the quarry would indicate, then it would be a matter of only a few years when the whole face of the quarry would have to be worked at the same time. Even then, the output would be increased by working the quarry in two levels so as to develop the working face twice the length of the cliff, or forty-six hundred feet.

New Concrete Industry

A plant for the manufacture of concrete sewer pipes and other concrete products is being constructed at St. Francois de Sales, 18 miles from Montreal, by the Montreal Concrete Works Company, Limited, 225 St. James street, Montreal. The estimated output will be 25 cubic yards daily and this will be increased as circumstances warrant. At the present time large quantities of pipe come from England and the United States, due to the fact that this industry is still in its infancy in this country and is yet to be developed. The company intend to manufacture sewer pipe by the slush process and reinforced by the best Clinton welded wire. Within the next three months it is expected that all sizes of pipes will be ready for the market, both in the oval and round.

The company are also dealers in cut, crushed, one-man and dimension stone, and own 20 acres of quarry land at St. Francois de Sales. A special switch line connects the plant with the main line of the C. P. R. The stone used in the construction of the C. P. R. Windsor Station, Chateau Frontenac and piers for the new C. P. R. bridge at Lachine was quarried from this property.

The capital of the company is $99,000. The officers are E. Lavigne, president; F. A. Sylvestre, manager director; Ed. de Jong, treasurer, and W. Allen Walsh, secretary.

Electric Trucks in Contracting Work

Thousands of tons of coal and general building supplies have been delivered during the past three years in Detroit by three 5-ton electric trucks installed by the Electric Truck Company of Detroit and made by the General Vehicle Company, Inc. These three huge trucks, with traveling cranes, have attracted much attention on Detroit streets, where they have been seen daily and practically without interruption year after year, during warm and cold weather and on rainy days and on days when the snow was so deep that it prevented street cars from maintaining their schedule.

It is stated by the J. A. Mercier Company that these trucks have hauled on an average of slightly above 40 tons of coal and have traveled an average of 48 miles daily for years. It is the custom of the truck drivers to boost the batteries at noon. Under these conditions 48 miles are covered each day, but where the batteries are changed at noon the trucks will carry as high as 50 tons per day and will travel over 60 miles.

This is stated to be two and one-half times the amount of work that was accomplished by horses in the old days, and the Mercier company cannot see how it could have attended to the added work which has come to it within the last three years without the motor trucks. The work performed by these trucks during most of the day is the hauling of coal to the plants of the Central Heating Company, and a full 5-ton load is taken each time. The body is lifted clear of the truck with its load, dumped, and replaced, thus saving much time.

Another important installation is that of the A. A. Albrecht Company, whose offices in Detroit are in the Penobscot Building. This company employs constantly one truck of 2½ tons capacity and another of 3½ tons. The company has had the 2½-ton truck in use constantly for 3½ years, and the 3½-ton truck in use for one year. These trucks cover 35 to 40 miles a day, and are employed in carrying building material for use in the various business ventures of the company, which is one of the largest builders in Detroit.

Mr. Albrecht says "I cannot say too much for the work of my trucks. They are running all of the time. All we have to do is to keep them charged and they are constantly on the run. I have yet to see the time when there was an opportunity to 'knock' this installation, which has been a godsend to us. I presume that were we to install horse-drawn wagons for this labor our expense would be increased to at least three times what it is at present.

"The cost of taking care of our increased business during the past several years with horses would have been practically prohibitive, and would have cost us a fortune. The trucks entered our business when they were most needed, and horse-drawn wagons rapidly became obsolete with us. The total increased demand upon the delivery facilities in our business and its numerous branches was entirely taken care of by our power wagon equipment. The trucks have been in the repair shop but very little, and in fact I know of no serious complaint. We have often-times carried great over-loads without any trouble whatsoever. I believe that our general satisfaction has been due to the electric trucks, although I am informed to-day that since we secured these trucks, gasoline-driven vehicles have improved greatly. We use former teamsters, who have been educated in the operation of the trucks.

"Our men look very carefully after their trucks at all times and are very proud of their work. Upon returning from their day's work, the truck is placed in its regular location, the battery is taken away and charged, and the men arrive in the morning regularly in plenty of time to replace the batteries and to start their day's work. Each of the trucks receives a yearly overhauling."

In the yearly overhauling of the trucks, every part receives careful examination, and all parts needing renewal are replaced. It is noteworthy that there have been few replacements during the time the Albrecht company has owned these trucks.

As regards speed, with full loads of tile, lumber and cement, the trucks had at times covered easily six miles per hour. With five tons, the 3½-ton truck has covered six miles easily, although the regulation speed of the truck is but seven miles. The electric vehicle has proven a splendid puller.

Mr. Albrecht believes that the economy of the electric truck over the gasoline truck for short hauls is in the neighborhood of fifty per cent. at least, and in his enthusiasm he stated that the beauty of the trucks he had, laid in the ease of operation and in the fact that the trucks were working all of the time.

The Largest Gas Engine

The Ford Automobile Company are installing what is probably the largest gas engine in the world, at their works in Detroit. There are four double acting cylinders 42-in. x 72-in., two in tandem upon each side, held together with four 6-in. tie-bolts. The engine is designed to run at 85 r.p.m. or 1020 ft. of piston speed. The length of the engine from the front of the pillow block to the end of the tail-rod extension is 73 feet and its over all width is 32 feet. The crankshaft is 32 inches in diameter and 25 feet long and carries an 80-ton fly wheel and the armature of a 2,500 kw. generator. The generator is capable of carrying a 25 per cent. overload and the engine is rated at 5,000 h.p.

The Conservation of Our Water Powers

The Commission of Conservation have just issued their fourth annual report on the progress of investigation into the natural resources of our Dominion. The report includes contributions by Mr. Leo. G. Denis and Mr. Arthur V. White concerning work done by them in connection with the collection of water power data at different points in Canada. These latter reports are written in the form of a condensed diary which makes almost as interesting reading as the log-books of Stanley, Nansen, Shackleton, Scott, and other explorers of unknown regions. The only difficulty is that the information is as yet too meagre. There is enough, however, to indicate that the work of these engineers is along lines which are certain to give, ultimately, valuable and far-reaching results, showing that the Commission have been well advised in the type of work they are undertaking. That the results will come slowly is only to be expected, as the field of investigation is large, the work is onerous, and the funds available are not unlimited. Apparently however, the government is prepared to deal fairly liberally in the latter respect, a course with which we entirely agree, for, quite aside from the immediate monetary value of accurate knowledge about our water powers, the definite assurance of their actual magnitude will give our Dominion a considerable added prestige among the other nations of the world.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
Extension to waterworks system contemplated. Clerk, W. H. McFadden. By-law passed by Council to raise $16,000 by issue of debenture.

Twp. of Dunham, Que.
Municipal Council of the Twp. has appointed councillors G. M. Beach and W. F. Lee and Mayor to purchase a 12-ton gasoline road roller. Mayor, E. E. Hall, Dunham.

East London, Ont.
Sewers, cost $40,000, to new factory district planned. By-law will be submitted October 1st. Mayor, C. M. R. Graham. Engineer-in-charge, W. N. Ashplant.

Hamilton, Ont.
Asphalt pavement, cost $6,472, McNab, Vine and John Sts., planned by City Council. Clerk, S. H. Kent. Engineer, A. F. Macallum.

Montreal, Que.
Sewer, Mt. Royal Heights, for City Realty Investment Co., Ltd., 41 Mayor St. Engineer, Thos. Iverson, 10 Cathcart St. Plans being prepared for laying out 9 miles brick or concrete pipes.

Ottawa, Ont.
City Council plans subway, drainage, etc., cost $14,000, on Bank street. Repave the street with stone blocks, new sidewalks, drainage, gullies, etc. Debenture to be raised. Mayor, J. A. Ellis, City Engineer, Archibald Currie.

Regina, Sask.
Irrigation system contemplated. City Council have applied to Commissioner of Irrigation, H. A. Thornton, for right to divert from Boggy Creek and Beaver Creek.

Sherbrooke, Que.
Drainage system contemplated by City Council. Sec., F. J. Griffith, Wellington St. Mr. Hilder Daw, C.E., Kings Hall Bldg., St. Catherine W., Montreal, will revise present plans and design a drainage and purification system to meet requirements of city.

St. Catharines, Ont.
Water services, cost $4,450, contemplated by City Council (Water Comsn.), for the Clay Products & Flax companies. Full information from H. K. Woodruff.

Toronto, Ont.
Grading, Indian Road, planned by H. A. Goldblatt, c/o Equitable Securities of Canada, Ltd., Traders Bank Bldg. About 25,000 cubic yards to be moved. Tenders called.

Pavements recommended by Board of Control. Tenders received by Mayor H. C. Hocken until September 23rd. Asphalt on Gerrard, Gough, Russett, Sorauren and St. Nicholas. Brick block on Sorauren and Sterling. Bitulithic on Williamson Rd. and Wineva ave. Concrete on two lanes. Rocmac macadam on east side of Humber River and Bloor street west.

Sewers recommended by Board of Control. Tenders received by Mayor H. C. Hocken until September 34rd. Danforth ave. storm overflow Sec. No. 1. Earlscourt drainage system No. 3. Wilton ave. storm overflow Sec. No. 3. Dufferin, Beaver, Brandon, Elmer, Ashdale, Bloor, Morrison and number of lanes.

Concrete walks and curbings. Tenders received by Mayor H. C. Hocken until September 23rd. Curbings on Sorauren, Gerrard, Sterling and St. Nicholas. Walks on Aldergrove, Avondale, Beech, Chandos, Danvers, Davenport, Duncan, Edith, Essex, River and West Lodge.

Extension to water mains planned by Town Council of Weston. Clerk, Mr. Taylor. The Water, Power & Light Commission will have plans prepared for extensions on Holley, Maria, Joseph and Hillcrest Road.

Walkerville, Ont.
Pavements and sewers planned by Town Council. Tenders received by Clerk, H. Robinson, until September 23, for (1) pavement in alley; (2) re-paving various street; (3) extension of sewers. Plans at office of engineer, Owen McKay, C.E. Mayor, R. H. Revell.

Paving, cost $8,123, Victoria Rd. from Wyandotte to Assumption, Walker Rd. from Ontario to Ottawa St. By-law passed. Mayor, R. H. Revell.

Winnipeg, Man.
Water system, cost $13,000,000, planned by Board of Control. Engineer, H. N. Ruttan, 223 James Ave. Concrete aqueduct, 85 miles, steel pipe 10 miles, from Shoal Lake, concrete reservoir at Transcona to have a capacity of 250,000,000 gals. Report furnished by experts has been adopted. By-law to be submitted to ratepayers Oct. 1st.

CONTRACTS AWARDED

Brantford, Ont.
Paving, cost $8,000, Brant ave. City Engineer, T. Harry Jones. General contractors, Warren Bituminous Paving Co. of Ontario Ltd., 103 Bay street, Toronto. Re-surfacing old pavement with asphaltic concrete, 6,400 sq. yds.

One and a half miles cement walks Echo Place, planned by Township Council. Clerk, James A. Smith. General contractors, Royal Artificial Stone Paving Co., Guelph. 12½c. sq. ft.

Hull, Que.
Asphalt pavement, Champlain Ave., planned. Mayor, Dupuis. Engineer, J. A. Laforest, City Engineer. General contractors, Ottawa Constr. Co., Central Chambers, Ottawa.

Lasalle, Que.
Sewers, near Lachine. Sec.-Treas., J. S. Ashby, 15 19th Ave., Lachine. Engineer, V. H. Dupont, 225 St. James St., Montreal. General contractor, Michele Lombardi, 243 Westminster Ave., Montreal W. Pipe, Stinson Reeb, E. T. Bank Bldg. Montreal.

Macleod, Alta.
Sewage disposal planned by Town Council. Engineer-in-charge, G. H. Altham. Work being done by day labor.

Peterboro, Ont.
Pavements, George, Charlotte and Hunter Sts., planned by City Council. Chairman Board of Works, William Buller. Engineer, R. H. Parsons. General contractors, Foley & Gleeson, Ottawa. Asphaltic concrete and paving blocks, $62,745.37.

Winnipeg, Man.
Asphalt pavement on lanes between Main and King, and Market and James, recommended by Board of Control. Secretary, M. Peterson. General contractor, J. W. Astley, Engineer of Construction.

Concrete pavement planned by Board of Control. Secretary, M. Peterson. General contractor, J. W. Astley, Engineer of Construction.

Railroads, Bridges and Wharves

Edmonton, Alta.
Railway planned by Alberta & Great Waterways Railroad. Edmonton to Fort McMurray, 230 miles. Matter to be taken up by Alberta Legislature.

Montreal, Que.
Dock work contemplated by the Board of Commrs. Sec., L. N. Senecal. Board of Control recommends that $1,500 be spent to get expert opinion on establishing New Ferry system including docks to St. Helen's Island.

Regina, Sask.
Bridge, cost $5,000, Elphenstove St., over Wascana Creek at Elephenstove St., planned by City Council. Engineer, F. McArthur.

Roy's Beach, B.C.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Dist. Engineer, C. C. Worsfold, New Westminster, and J. S. McLachlan, Victoria. Specifications at offices of Dist. Engineers, Postmaster, Roy's Beach, and Dept., Ottawa. Tenders received by Secretary till Oct. 9th.

Steelton, Ont.
Town Council has signed agreement for street railway system with the International Transit Co. of Sault Ste. Marie, Ont.

Thamesford, Ont.
Dam, cost $7,000, contemplated for Cawthorpe Milling Co. Engineer-in-

charge, F. W. Farncombe, Edge Block, London. Reinforced concrete construction, 150 ft. wide, 5,000 cu. yds. cement. Surveys have been made.

CONTRACTS AWARDED

Bayfield, Ont.
Repairs to pier, cost $3,200. Clerk, H. W. Erwin. General contractor, S. Moore. Wood and stone construction.

Brantford, Ont.
Elevating bridge for Lake Erie and Northern Rly. Co. General contractors, Wright, Hazzard & Cohen, Buffalo, N.Y. Raising Lorne bridge several feet and building concrete wall below Jubilee Theatre, etc. Work to start at once.

Dundas, Ont.
Bridge, cost $4,500, Ogilvie. Engineer-in-charge, P. H. Latham, c/o Toronto, Hamilton & Buffalo Rly., Hamilton. General contractors, The Hyland Constr. Co., Belleville. Clerk, J. S. Fry.

New Hamburg, Ont.
Bridge for County of Waterloo. Engineers, Bowman & Connor, 36 Toronto St. General contractors, Pipe & Clements, Berlin. 35 ft. concrete bridge at Hawkesville, Ont.

Prov. of Ontario
Railway stations, etc., cost $12,000,000, for C. P. R., head office Montreal, Que. General contractors, mason, carpenter, steel, plastering and painting, Jno. S. Metcalfe Co., 54 St. Frs. Xavier, Montreal. Roofing tenders for several stations received by General Contractors in about a week. Heating, plumbing and electrical tenders will be received by General Contractors later. Indiana limestone for 7 stations supplied by E. F. Giberson, 701 New Birks Bldg., Montreal.

Rainy River, Ont.
Dredging planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, J. T. Horne, Room 18, Graham and Horne Block, Victoria Ave., Ft. William.

Stratford, Ont.
Bridge, cost $2,400, Romeo. Mayor, C. N. Greenwood. City Engineer, A. B. Manson. Chairman Board of Works, Ald. Pauli. General contractors, Stratford Bridge & Iron Works. Steel, 60 ft. span, 14 ft. wide, concrete abutments. Abutments in.

Sutton, Ont.
Bridge for Twp. of North Gwillimbury. Engineers, Bowman & Connor, 36 Toronto St., Toronto. Retaining wall, Lewis Constr. Co., Toronto. Steel span, Corbett Foundry Co., Owen Sound. 82 ft. 6 in. steel bridge, concrete abutments.

Trenton, Ont.
Canal, cost $130,278, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, York Constr. Co., Ltd., Traders Bank Bldg., Toronto. Contract for Port Severn section.

Public Buildings, Churches, Schools, etc.

Baie Des Febvres, Que. (Yamaska Co.)
College for R. C. School Commrs. Sec.-Treas., N. U. Frechette. Tenders were received by Architect, A. Trudel, 15 St. Philippe St., Montreal. Four stys., 64 x 82, cement foundation, brick construction, felt and gravel roofing, iron stairs, seating, fire escapes, ventilating system.

Blenheim Twp., Ont.
Addition to school, cost $4,000, for School Sec. No. 24. Twp. Clerk, Hugh Allan, Drumbo. Architect, C. H. Beckman, New Dundee. By-law passed by Council. Plans in progress.

Canora, Sask.
School, cost $30,000, contemplated for Canora School District No. 1152. Treasurer, H. M. Sutherland. Four room, brick construction.

Chapleau Twp., Ont.
Completing public library, cost $10,000, contemplated. Clerk, T. J. Godfrey, Chapleau, Ont. Ratepayers will vote on by-law Sept. 15th.

D'Arcy, Sask.
School, cost $6,500, contemplated for D'Arcy School District No. 3016. Treasurer, D. N. Bontain. Plans will be prepared.

Montreal, Que.
Public lavatories planned by Board of Commrs. Sec., L. N. Senecal. Architect, E. J. Courval, Drawing Office, City Hall. City Commrs. will call tenders. Presto heaters.

Council has authorized plans to be prepared for new roof for market place at Lachine. Sec.-Treas., Hector Charette.

Alterations to St. Louis bath, Ontario St., planned by Board of Commrs. Sec., L. N. Senecal. Architect, Dalbe Viau, 76 St. Gabriel. Tenders will be called in about 10 days by Sec. Concrete foundation, stone and brick construction, felt and gravel roofing, marble, plate and wire glass, galvanized iron, architectural iron railings, boilers.

Alterations to public market, cost $15,000, Wolfe, planned by Board of Commissioners. Sec., L. N. Senecal. Architect, Mr. Chausse, City Hall. Tenders received by Board of Control. New concrete floor for market, 500 x 72.

Newmarket, Ont.
Home building planned by York County Industrial Home Commissioners. Tenders received by J. G. Cornell, Scarboro P. O., until Sept. 22nd. Plans, etc., with above, also J. S. McNair, Elgin Mills, County Clerk's Office, Adelaide St. E., Toronto, and the Home, Newmarket. Bulk tenders preferred. Extended time.

Newport, B.C.
Jail contemplated by Dom. Govt. Dept. of Public Works. Tenders received by Engineer, J. E. Griffiths, till Sept. 26th. Plans, specifications, etc., at offices of Mahoney, Govt. Agent, Vancouver, The Prov. Constable, Newport, or at the Dept., Victoria.

Ottawa, Ont.
City Council recommend the expenditure of $20,000 in putting up and equipping prison farm. Mayor, J. A. Ellis.

Church, cost $6,000 or $7,000, Lyon, for St. Peters Evangelical Lutheran, c/o Pastor, 250 Lyon St. Architect, c/o Pastor. Tenders will be received until Sept. 18th. Brick veneer construction, concrete foundation.

Regina, Sask.
Church contemplated in Eastern Annex, for Presbyterian Congregation. Pastor, Rev. Murdock MacKinnon, 1839 Lorne St. Plans will be prepared.

Saskatoon, Sask.
It is the intention of the Governors of Emmanuel College to double size of College next year. Plans will be prepared.

Smithville, Ont.
Heating and ventilating system for High School contemplated by School Board Trustees. Estimates required for hot air, steam and hot water heating. Building 2 storeys, 4 rooms, brick, plastered, stone basement, concrete floor.

Toronto, Ont.
The Exhibition Association contemplate building new machinery hall, sheep pens, dog building, poultry building, judging arena. President, J. G. Kent. Manager, Dr. J. O. Orr.

Theatre, cost $6,000, 1137 Yonge St., planned for Teck Amusement Co., 1137 Yonge St. Architect, N. G. Beggs, 12 Cosgrave Bldg. Tenders received by Owner. Two storeys, 26 x 40, brick and steel construction, brick foundation, felt and gravel roofing.

Church, cor. Fulton and Carlaw Ave., contemplated for Roman Catholic Denomination. Site purchased, 178 x 200. New parish formed. Parish priest not yet appointed. Further information from Archbishop McNeil, Wellesley Place.

Walkerville, Ont.
Incinerator contemplated by Town Council. Mayor, R. H. Revell. By-law passed Sept. 6th, cost $16,234.

CONTRACTS AWARDED

Belleville, Ont.
Dormitory building planned by Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Parliament Bldgs., Toronto. General contractors, Thos. Manley & Son.

Brockville, Ont.
Nurses home, cost $65,000, for Ontario Govt., Toronto. Sec., H. F. McNaughton, Parliament Bldgs., Toronto. General contractor, W. P. Driscoll Two and three storeys.

Hamilton, Ont.
Repairs to House of Refuge. Mayor, C. M. R. Graham. General contractor, George E. Mills, 614 King St. E.

Laundry and heating plant for hospital. Architects, Stewart & Witton, H. P. & L. Bldg. Masonry, A. H. Yeates, 74 Leeming street. Carpentry, James Huckson, 147 Belview ave. Painting, A. Kemp, 36 Fairholt Rd. Roofing, Dennis & Jocelyn, Walnut street north. Plumbing, Drake & Avery, 22 John St. S. Plastering, Arnold Clapham, 142 Duke Street. Iron Work, Hamilton Bridge Works Co., Barton and Bay streets. Stokers, Murphy Iron Works Company.

Kingston, Ont.
School addition, Victoria, planned by Board of Education. Masonry, H. W. Watts. Carpenter, Hunter & Harold. Heating and plumbing, McKelvey and Birch. Painting, T. Milo. Electric, H. W. Newman Co. Iron stairs, Toronto

Ornamental Iron Co., 25 Agnes street, Toronto. Vacuum cleaner, Hutton and Crumley. Excavating done.

Kemptville, Ont.

Armories, cost $11,500, Main, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Benj. Dillon, Brockville. Mason, W. Sherman, New Dublin. Two stys. Excavating done.

Macleod, Alta.

School, cost $5,000. Sec.-Treas., E. F. Brown. General contractor, J. S. Lambert. Architect, Mr. Whiddington, Lethbridge. Two stys., 33 x 34, brick construction. Seating tenders being received by Clerk. Foundations in.

Moncton, N.B.

Machine shops for Dom. Govt. Dept of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Rhodes Curry Co., Amherst, N.S. Roofing, Jno. E. Wilson Co., Ltd., Sydney St., St. John, N.B., $7,500.

Montreal, Que.

School planned by School Commrs., Longueuil. Architect, A. Prefontaine, Montreal. General contractors, Guertin & Bouchard, 414 Parthenais St., Montreal. Steel, MacKinnon, Holmes & Co., Sherbrooke.

School, cost $196,000, for R. C. School Commrs., Longue Pointe (Lavaltree), c/o U. Lafontaine, 85 St. Catherine W. Architect, Z. Trudel, 238 St. Andre. General contractor, H. Demers, 47 Labelle. W. A. Wood, 246 Pine Ave. W., contractor for driving 900 piles for foundation, spruce or red pine.

Church, cost $150,000, for Stanley Presbyterian Church, Westmount. Pastor, Rev. W. D. Reid, 21 Lincoln Apts., Montreal. Architects, Hutchison, Wood & Miller, 50 Royal Ins. Bldg., Montreal. Painting and glazing, R. E. Jones, 69a McGill College Ave. Heating and plumbing, J. A. Gordon, 301 St. Antoine. Foundations in.

Fire and police station, cost $93,000, Longue Pointe (Notre Dame E.). Architect, Alp. Piche, 52 Victoria Sq., Montreal. General contractor, mason and carpenter, L. Langevin, 225 Parc Lafontaine. Steel, Structural Steel Co., New Birks Bldg. Plastering, Pascal Larocque, 341 De Lanaudière. Painting, Chas. Larin, 468 Parc Lafontaine. Heating and plumbing, P. Page, 58 Amherst. Electric, Mr. Rochon. Roofing, Lariviere & Paquette, 112 Montcalm. Two storeys, 77 x 120.

Moose Jaw, Sask.

Elevator for Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa. General contractors, Barnet McQueen Co., Minneapolis, U. S. A. Capacity of 3 million bushels.

Saskatoon, Sask.

Elevator planned by Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa. General contractors, Barnet McQueen Co., Minneapolis, U. S. A. Capacity of 3 million bushels.

Toronto, Ont.

Theatre, cost $15,000, Queen and Bertmont, for Hutchinson & Webb, 1 Grenadier Rd. Architect, A. J. Rattray, 123 Bay street. Masonry, R. H. Harman & Son, 156 Dupont street. One storey, 26 x 110.

Theatre, cost $12,000, Roncesvalles, for Gowland & Burns. Architect, G. D. Redmon, Dineen Bldg. General contractor, H. J. Turner, 103 Roncesvalles avenue. Two storeys, brick construction, shingle roofing. Seating, galvanized iron.

School, Homewood Ave., for Board of Education. Sec.-Treas., W. C. Wilkinson. Mason, Jas. A. Wickett, 28 Toronto St. Carpenter, Frank Armstrong, 89 Oak St. Terra cotta, Geo. T. Gayton, 2 Wayland St. Plasterer, Beaver & Sons, 62 Winchester St.

Church, Franklin Ave., for Greek Ruthenians, Rev. Jos. Boyarczuk, 374 Sorauren Ave. Architect, J. P. Hynes, 199 Yonge St. Mason, Venn Bros., 776 Crawford St. Carpenter, S. Hogg, 242 Markham St. Brick construction, cement foundation, shingle roofing. Foundations in.

Winnipeg, Man.

Rifle range, cost $19,500, for Dom. Govt. Dept. of Militia & Defence. Minister, Eugene Fiset, Ottawa. General contractors, Jackson & Goldie, 66 Scott Bldg.

Church (Qu'Appelle ave.) for Knox Presbyterian congregation. Pastor, Rev. F. P. DuVal. Architect, J. H. G. Russell, 1110 McArthur Bldg. General contractors, McDiarmid & Co., Canada Bldg. Only excavating will be finished this year. New plans being prepared which will be ready in a month.

Business Buildings and Industrial Plants

Calgary, Alta.

Garage, cost $5,000, for A. J. Hay, 1936 11th St. W. Plans ready.

Hamilton, Ont.

Plant contemplated for Manistee Iron Works, Manistee, Mich. Negotiations in progress with Industrial Commissioner Marsh.

Hotel, cost $200,000, James and Stuart Sts., contemplated. Interested, A. M. Lewis, of Lewis & Arrell, and Mr. Morris Levy. Site purchased, plans will be prepared.

Montreal, Que.

Alterations and addition to store, cost $7,000, 173 Laurier ave. west, for Stuart Co., Inc., 173 Laurier Ave. W. Architect, L. R. Mont Briant, 230 St. Andre St., will receive tenders in one week. 50 ft. addition and new storey, concrete foundation, pressed brick construction, felt and gravel roofing. Plans drawn.

Office and warehouse, cost $10,000, 18 St. Helen, for H. Joseph & Co., 16 St. Sacrament. Architects, Phoenix Ass. Co., Ltd., 100 St. Francois Xavier street. Owner receiving tenders.

Garage and boathouse, cost $5,000, for J. L. Decarie, Que. Bank Bldg. Architect, Dalbe Viau, 76 St. Gabriel street. Plans in progress.

Regina, Sask.

Warehouse contemplated for Trussed Wall & Block Co., Saskatoon, who have applied to city for lots. Plans will be prepared.

Addition to hotel, cost, $30,000, contemplated by A. G. Cook, Empire Hotel, 5 Railway St. 25 bedrooms will be added. Plans in progress.

Extensions to store, cost $5,000, S. Railway St., for Regina Trading Co., Ltd. Plans will be prepared.

St. Mary's, Ont.

Flour mill contemplated by Carter Milling Co. By-law to guarantee bonds. $50,000 to be voted on Sept. 27th. Capacity 600 bbls. per day.

Saskatoon, Sask.

Abattoir, cost $50,000, contemplated by the Saskatchewan Abattoirs, Ltd. Plans will be prepared.

Smithville, Ont.

R. J. Goring, general merchant, contemplates putting in new store front, building deeper show windows, re-arranging interior, installing new fixtures and clothes presses, plate glass required. Plans will be prepared.

Toronto, Ont.

Factory, cost $10,000, Noble St., planned for H. L. Wood Co., 421 Queen St. W. Tenders received by Owner for all trades. Two storeys, 42 x 60, brick construction, concrete foundation.

Warehouse addition, cost $3,500, 1528 Queen St. W., for Rumsly & Co., 1528 Queen St. W. Tenders received by Architect, C. M. Willmot, 436 Yonge St. Three storeys, 16 x 30, steel and brick construction, brick foundation, felt and gravel roofing.

One pair stores and residences, cost $6,000, St. Clair, for R. T. Robinson, 1310 Lansdowne Ave. Owner sublets. Two storeys, 38 x 50, brick construction, concrete foundation. Excavating started.

Four stores and residences, Bathurst street, near St. Clair, for C. C. Allen, 7 Callender St., who is receiving tenders for excavating, other trades called later, brick construction.

Factory, cost $250,000, Dupont and Christie, contemplated for Ford Motor Car Co., Richmond W. Site purchased, 200 x 206. Reinforced concrete buildings. Plans will be prepared.

Strathmore Press, 206 Simcoe St., will receive tenders for 3-storey addition and alterations, brick construction and foundation, steam heating, plate glass, felt and gravel roofing. Plans with Owner.

Weston, Ont.

Alterations and addition to bank building planned for Bank of British North America. Architects, Lindsay & Brydon, 65 Victoria St., Toronto. Tenders received by Architects until Sept. 30th. Bulk and separate tenders.

Winnipeg, Man.

Two stores, cost $5,000, for A. Beck, 515 Selkirk Ave. Architect, E. W. Craipton, 572 Ross Ave. One storey and basement, brick and steel construction, stone foundation, felt and gravel roofing. Plans in progress.

CONTRACTS AWARDED

Calgary, Alta.

Garage, cost $4,000, for Robertson & Carile, Dominion Bank Bldg. General contractor, R. W. Peach, 124 Premier Way W. One storey, 50 x 50, Excavating done.

Store and rooms, cost $5,000, 17th Ave. E., for J. Nevlin, 234 4th Ave., N.E. General contractor, W. Bloor, 617 4th Ave. N.E. Excavating done.

Store and offices, cost $18,000, for A. F. H. Mills, McDougal Block. Architects, Lang & Major, Board of Trade Bldg. General contractor, G. J. Davis, 2426 1st St. E. Two storeys, 25 x 120, brick construction, tapestry front, concrete foundation. Leaded lights, art glass, galvanized iron. Excavating done.

Alterations to factory, cost $8,000, 7th Ave. E. Owners and general contractors, Hudson's Bay Co., 7th Ave. Two storeys, 30 x 95, felt and gravel roofing. Excavating started.

Warehouse, cost $5,000, for W. R. Hull, Grain Exchange Bldg. General contractors, Fyshe, McNeile, Martin & Trainer, Dominion Bank Bldg. One storey.

Warehouse, cost $150,000, 11th Ave. E., for Pilkington Bros. Architects, Hodgson, Bates & Beattie, Grain Exchange. General contractors, Carter, Halls & Aldinger, Burns Block. Reinforced concrete construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, concrete floors, wire glass, 1 passenger and 1 freight elevator, galvanized iron, fire escapes. Excavating done.

Edmonton, Alta.

Stores and offices, cost $60,000, Jasper Ave. Owner and general contractor, G. D. Scott, 772 21st St. Architect, E. Underwood, c/o Owner. Three stys., 51 x 118, brick construction, concrete foundation. Excavating done.

Stores and hall, cost $15,000, for E. S. McQuaid, 506 Stephens Ave. Architect, W. D. Cromarty, 21 Dominion Block. General contractors, McSporrin & Co., 715 2nd St. Three storeys, 60 x 60, frame construction, concrete foundation. Excavating done.

Granton, Ont.

General store, cost $7,000, for Rowcliffe & Hodgson, Granton. General contractor, A. Finch, St. Mary's. Two storeys, white brick construction. Excavating done.

Montreal, Que.

Store repairs, cost $6,500, St. Peter St., for Estate Caverhill, St. Peter St., c/o Agents, Lewis & Badgley, Merchants Bank Bldg. General contractors, Agents, day labor. Four storeys, 30 x 120, stone foundation, felt and gravel roofing.

Offices, Beaver Hall Hill, for Guarantee Co., of North America, 57 Beaver Hall Hill. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractor, Geo. A. Fuller, 210 Reed Bldg. Painting and glazing, C. A. Sharpe, 234 Craig E.

Store alterations, cost $4,000, St. Catherine W., for Estate G. W. Stephens, c/o Jno. Hyde, Merchants Bank Bldg. Architect, H. C. Stone, 84 St. Francois Xavier. General contractor, Jno. Wighton, 73 Fort street. Dividing large store into two. Two storeys, 25 x 30, stone foundation, terra cotta construction, felt and gravel roofing.

16 stall stable, cost $8,000, for W. Bastien, 125 Manufacturers. General contractor, Henri Hogue, 2835 Park Ave. Two storeys, 50 x 40, brick construction, felt and gravel roofing, concrete floors. Foundations in.

Brewery, cost $100,000, for Molson's Brewery, 906 Notre Dame E. Architect, M. Hetlinger, Boston, Mass., U. S. A., c/o S. W. Molson, Montreal. General contractor, E. G. M. Cape, New Birks Bldg. Steel, Dom. Bridge Co., Dom. Express Bldg. Brewery machinery required later. Four storeys, 150 x 200, concrete foundation, brick construction, felt and gravel roofing.

Store, cost $9,000, Mt. Royal, for O. Gratton, 323 Stuart St., Outremont. Architects, Gauthier & Daoust, 180 St. James St. General contractor, mason and carpenter, Owner. Plastering, A. Murray, 2404 Boyer. Painting and glazing, Owner, by day labor.

Woodworking factory, cost $6,000, Larin Ave., for Malone Moulding & Framing Co., 48 Beaver Hall Hill. General contractors, Anglins, Ltd., 65 Victoria St. Electric, Spencer & Aspinall, New Birks Bldg.

Greenhouse, cost $4,300, Westmount. Manager, G. W. Thompson. General contractors, Robertson Bros., Chestnut Ave., doing all the work. Foundations in.

Stable and coach house, cost $7,000, Westmount (Aberdeen Ave.)., for R. C. Patton, Quebec Bank Bldg. Builder, D. M. Long, rear 39 Windsor St., Montreal. Two storeys, 25 x 45, brick construction. Foundations in.

Three stores and flats, Outremont (Bernard). Architect and general contractor, Wilfrid Bessette, 97 St. James, or 258 Bloomfield Ave., will receive tenders for all trades shortly. Three stys., 60 x 75, concrete foundation, steel and brick construction, felt and gravel roofing.

Printing house alterations, cost $5,000, St. James, for La Presse, St. James St. General contractor, plastering and carpenter, Owner, by day labor. Painting, A. Boop, 287 St. George. Marble, Robt. Ball & Co., 174 Mountain.

Pattern shop, for National Bridge Co. Architect, Company's Engineer. General contractors, A. F. Byers & Co., 340 University. Roofing, Campbell, Gilday & Co., 663 St. Paul St. Brick construction, felt and gravel roofing. Foundations in.

Stable and coach house, cost $7,000, Westmount (Aberdeen), for R. C. Patton, Quebec Bank Bldg. General contractor, mason and carpenter, D. M. Long, rear 39 Windsor St., Montreal. Roofing, Richardson, Simard & Co., 745 Clarke. Painting, W. J. Chapman, 4151 St. Catherine W. Heating and plumbin, J. A. Gordon, 301 St. Antoine. Electric, Spence & Aspinall. Two storeys, 25 x 45.

Alterations to Excelsior and Box factory, cost $6,000, planned for Sauguenay Mills, Ltd., 223 St. Ambroise. Premises purchased near present buildings, being altered to suit. Owners doing the work.

Mount Hamilton, Ont.

Grocery store for Luke Copple, 449 McNab St. N., Hamilton. Architect & general contractor, Louis Blatz, Alexander street, Hamilton. One storey, 22 x 28, frame construction, concrete foundation. Excavating done.

North Battleford, Sask.

Bank and offices, cost $25,000, King St. and 1st Ave., for Royal Bank of Canada. Architect, K. G. Rae, 54a Beaver Hall Hill, Montreal. General contractors, Purdy & Henderson, Ltd., 470 Granville St., Vancouver, and New Birks Bldg., Montreal. Two storeys, 36 x 54, brick and stone construction, cement foundation, marble, terrazo and oak floors, felt and gravel roofing.

Ottawa, Ont.

Factory, cost $20,000, Nelson, for Crown Lithographing Co., Wellington street. General contractor, A. Toms, Arlington street. Plumbing, M. M. O'Connell, Gloucester. Other contracts not let. Excavating done.

Factory, cost $14,000, Beech street, for M. J. O'Brien, Raglan Place, Renfrew. General contractor, A. E. Spooner, Windsor House, Ottawa. Solid brick construction, concrete foundation. Excavating done.

Garage, cost $3,000, Stewart, for Mrs. W. D. Erwin, Stewart St. Architect, C. J. Burritt, 193 Sparks St. General contractor, W. J. Hamilton, Westboro. 22 x 29, concrete foundation, concrete and stucco construction, felt and gravel roofing. Excavating done.

Business block, cost $100,000, Bank, for F. W. Carling, Metropolitan Building. Architect, C. P. Meredith, 126 Sparks St. Carpenter, Alex. Christie, Elgin St.

Port Arthur, Ont.

Addition to store, cost $25,000, Cumberland, for I. L. Matthews & Co. Architect, Fred Urry, 237 Arthur St. General contractors, Cox & Jones. Heating and plumbing, Marshall & Co. Electrical, Mahon Bros. 65 x 110, red clay construction, 1 freight elevator, store fronts and fixtures.

Petrolia, Ont.

Business block, cost $10,000, for Bruce & Hartley, Main & Bedford streets. General contractor, H. Clark. Two storeys, brick construction. Excavating done.

Preston, Ont.

Factory planned for Preston Chair Co. General contractor, James Eagle. Masonry, Wirsching Bros. Three storeys, 48 x 112, brick construction. Excavating done.

Quebec, Que.

Confectionery store and shop, cost $8,000, for W. McWilliams, 136 John St. Architects, Staveley & Staveley, 92 St. Peter St. General contractor, C. A. Vezina, 61 Desprairies. Show cases, etc. Beaver board for walls. Pastry and candy making machinery required.

Confectionery store and shop, cost $8,000, Joseph, for W. McWilliams, 136 John St. General contractor, carpenter and interior fittings, C. A. Vezina, 61 Desprairies. Mason and plastering, Ed. Belanger, Beauport. Steel, Eastern Canada Steel & Iron Works, St. Malo. Roofing, Nap. Barbeau, 36 Bridge St. Painting, Marier & Tremblay, Bridge St. Heating, plumbing and electric, Alex. Forest, 36 Garden St. Three storeys, 40 x 62, stone foundation, steel, red and Scotch brick construction.

Swift Current, Sask.

Store, cost $4,400, for Dr. W. H. Field, McGinty ave. Architect and general contractors, Francis & Wheat, 13th ave.

St. John, N.B.

Grain elevator for C. P. R. Co. General manager, F. R. Hodge, Montreal. General contractors, Jno. S. Metcalf Co., Montreal.

Bank building, Main St., for Royal

Bank of Canada. Manager, T. B. Blair, King St. Architect, K. G. Rea, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Carpenter, Ernest Green, Tisdale House, St. John, N.B.

Stratford, Ont.
Factory, cost $35,000, Douro, for Farquharson-Gifford Co., Douro St. Architect, J. S. Russell, Downie St., Stratford. Roofing, Philip Carey Co., 77 Front St. E., Toronto. Plumbing, Peter & Sylvester, Stratford.

Thorold, Ont.
Alterations to bank building, cost $5,000, Main St., for The Royal Bank of Canada. Architect, A. E. Nicholson, St. Catharine. Mason and roofing, John J. Nichols & Sons, St. Catharine. Carpenter, Thos. J. Joyce, Thorold. Painting and glazing, Leach & Jones, St. Catharines. Plumbing and heating, John Peart, St. Catharines. Electric work, Sandham & Roberts, St. Catharines. Two storeys, 35 x 50, new brick and cut stone front construction, stone foundation, felt and gravel roofing.

Toronto, Ont.
Store and residence, cost $5,000, Roncesvalles near Howard Park. Owner and general contractor, E. E. Rutherford, 279 St. George street. Architect, J. G. Hedges, 210 Clinton street. Plastering, Sparks & Son, 188 Sorauren Ave. Three storeys, 20 x 55, brick construction and foundation, felt and gravel roofing.

Drug store, cost $4,000, for T. W. Hutchison, 11th and Cheadle. Architect, Mr. Ferris. General contractors, Francis & Wheat, 13th Ave.

Warehouse, planned for Moose Grocery. General contractors, Western Constr. Co. Work will be started soon.

Bank, cost $1,000,000, King and Yonge, for Dominion Bank, 59 Yonge St. Architects, Darling & Pearson, 2 Leader Lane. General contractors, Can. Stewart Co., C. P. R. Bldg. Heating and plumbing, W. J. McGuire, Ltd., 86 King W. General contractors will do all work except heating and plumbing. Steel work started.

One pair stores and residences, cost $5,700, Davenport Road. Owner and general contractor, I. F. Schooley, 283 Concord Ave. Two storeys, 40 x 56, steel and brick construction, concrete foundation, felt and gravel roofing. Excavating done.

One pair stores and residences, cost $7,000, Royce Ave. Owner and general contractor, M. Yetman, 997 Dufferin St. Two storeys, 38 x 48, brick construction, stone foundation, felt and gravel roofing. Excavating done.

Warehouse, cost $60,000, Radenhurst, for Labatt Brewing Co. Architect, C. F. Wagner, 15 Toronto St. Mason, Teagle & Son, 55 Boswell Ave. Carpenter, S. T. Avent, 56 Conduit St. Metal windows, Trussed Concrete Steel Co., 23 Jordan St. Steel, Hepburn & Disher, 18 Van Horne St. Painting, Robt. Dale, 440 Shaw St. Plumbing, Fiddes & Hogarth, 122 King E. Galvanized iron, A. Matthews, 256 Adelaide W. Excavating done.

Biscuit factory, cost $200,000, King E., for Christie Brown Co., 43 Duke street. Architects, Sproatt & Rolph, 36 North St. General contractors, Jennings & Ross, King and Spadina. Steel, ornamental iron and stair cases, McGregor & McIntyre, Pearl St. Electric wiring and telephone, E. F. W. Salisbury, 18 Fenwick Ave. Heating and plumbing, Robt. Long & Sons, Richmond St. E.

Winnipeg, Man.
Two stores, cost $6,000, for A. Beck, 515 Selkirk Ave. Architect, E. W. Crompton, 572 Ross Ave. General contractors, Blow Bros., Furby St.

Garage, cost $22,000, Hargrave street, for T. Eaton & Co., Ltd. Carpenter and general contractors, Carter, Halls & Aldinger, Union Bank Bldg. Steel, Vulcan Iron Works, Winnipeg. Owners are doing painting, heating, plumbing and electric. One storey, 100 x 120, brick and steel construction, concrete foundation, corrugated iron roofing. Excavating done.

Residences

Calgary, Alta.
Residence, 18th Ave. W., for Catholic Diocese. Architect, Mr. Haroigan, Alberta Block. Two storeys, 80 x 100, frame, concrete foundation. Plans ready.

Residences, cost $10,000, for Parish of St. Annes, E. Calgary. Architect, Mr. Corin. Two storeys, 40 x 34, brick construction. Plans ready.

Ford City, Ont.
Residence, cost $5,000, Sandwich St., for Theo. Pratt. Ohio brick construction, cement and brick foundation. Plans in progress.

London, Ont.
Two residences, cost $10,000, Waterloo, for R. Ross, cor. York and Thames Sts. Two storeys, white brick construction, concrete and stone foundation. Plans drawn.

Apartment house, cost $15,000, Horton, contemplated by A. Hartmann, 300 Dundas St. Architect to be chosen. Three storeys, 50 x 80, white brick construction, stone and concrete foundation, tin or felt and gravel roofing. Plans will be prepared.

Residence, cost $7,000, contemplated for Major Beattie, 514 Dundas St. Architect to be chosen. Red pressed brick construction, stone and concrete foundation, slate roofing.

Montreal, Que.
Three pair semi-detached residences, cost $25,000, Westmount, contemplated for J. H. Norris, 122 Arlington Ave. Work will be started this fall if possible.

Ottawa, Ont.
Residence, cost $3,500, Arthur, for J. E. Wilson, 793 Somerset St. Two stys., brick veneer construction, stone foundation. Plans in progress.

Residences, cost $6,000, 4th Ave., for Geo. Johnston, 14 Chamberlain. Stone foundation, brick veneer construction. Plans in progress.

Regina, Sask.
Residence, cost $10,000, Albert street. Architects, Clemesha & Portnall, 1721 Scarth. Brick and stone construction, brick and concrete foundation. Plans in progress.

St. Marys, Ont.
Residences, cost $15,000, for Thos. Russell, c/o Weir & Weir. Architect to be selected. White brick construction, Stone foundation. Plans will be prepared.

Toronto, Ont.
One detached residence, cost $3,500, Walmsley Blvd., for Canadian Investments, Ltd., 708 C. P. R. Bldg. Architect, J. M. Jeffreys, 708 C. P. R. Bldg. Bldg. Supt., A. W. Adams, 55 West Lodge Ave. Owner employs regular staff. 2½-storeys, 22 x 34, brick construction, stone foundation. Plans drawn.

One detached residence, cost $5,000, Rowanwood, for J. McLean, 120 King St. W. Architect, C. E. Tyler, 85 Cumberland St. Contracts not yet awarded. 2½-storeys, 22 x 38, brick construction, stone foundation.

Windsor, Ont.
Residence, cost $2,800, Gladstone Ave., for Dan McKenzie, Hall Ave. Tenders received by Owner until Sept. 20th. Two storeys, 28 x 32, Canton brick construction, cement block foundation.

Winnipeg, Man.
Residence, cost $4,000, McDermot, for A. Dunlop, 875 Bannatyne ave. Two storeys, 22 x 30, frame construction, stone foundation. Plans ready.

Residence, cost $3,000, Rosedale Ave., for C. G. Johnson & Co., 26 Canada Life Bldg. Two storeys, 22 x 26, frame construction, stone foundation. Plans ready.

CONTRACTS AWARDED

Calgary, Alta.
Residence, cost $5,000, Sunalta, for G. H. Webster, 911 15th Ave. W. General contractor, R. N. Bolton, 2328 1a St. E. Two storeys, 28 x 36, frame construction, concrete foundation. Excavating done.

Residence, cost $5,000. Architects and general contractors, Alberta Investment and Insurance Brokers, 514 New Burns Block. Two storeys, 30 x 32, frame construction, concrete foundation. Excavating done.

Residence, cost $5,000. Architect and general contractor, J. W. Knoepfli, 504 Maclean Block. One storey, 32 x 36, frame construction. Foundations in.

Residence, cost $5,000, Broadview. Owners and general contractors, Barnes Bros., 1166 Boulevard N.W. Two stys., 19 x 44, frame construction, concrete foundation. Foundations in.

Edmonton, Alta.
Residence, cost $5,000, for G. H. McDonald, King's Drive. Architects, Magoon & MacDonald, Tegler Block. General contractor, L. F. Kelsey, General Delivery. Two storeys, 25 x 34, brick and frame construction, concrete foundation. Excavating done.

Residence, cost $7,000, Grierson St., for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, A. M. Calderon, 259 Jasper Ave. W. General contractor, W. C. McArthur, 523 Sinclair St. Two storeys, 32 x 42, brick and frame construction, concrete foundation. Excavation done.

Residence, cost $5,000. Architect and general contractor, C. R. Horne, 24 Muskoka St. Two storeys, 24 x 30, frame construction, concrete foundation. Excavating done.

Ford City, Ont.
Double residence, cost $5,000, Sandwich

St. E., for Fred White, Jeweler, Walkerville. Architect, general contractor and builder, Peter Blonde, Walkerville. Canton brick construction, cement and brick foundation, plumbing. Excavating started.

Hamilton, Ont.

Residence, cost $4,000, Herkimer St., for Miss Gillespie, Hess & Herkimer Sts. General contractor, W. A. Smith, Sherman Ave. S. Brick construction. Permit granted.

Two residences, cost $2,600 each, for Henry Smith, 74 Wentworth St. S. General contractors, Hobbs & Son, 313 Emerald St. N. Brick construction, concrete foundation.

Melfort, Sask.

Six residences for Terminal Cities Land Co., Farmer Bldg., Winnipeg. Manager, J. F. Hauson. General contractor, Melfort Planing Mill. Frame construction, concrete foundation. Excavating done.

Mt. Hamilton, Ont.

Six residences, cost $3,000 each, Coral ave. Architect and general contractor, Chas. H. Brayley, 195 Gibson ave., Hamilton. Contracts for brick, carpentry, etc., to be awarded separately. 25 x 38, brick construction. Georgia pine finish. Foundations in.

Montreal, Que.

Eighteen flats, cost $11,000, Chapleau, Owner and builder, S. Christin, 185 Poupart. Three storeys, 15 x 48, concrete foundation, brick construction, felt and gravel roofing.

Residence, cost $6,000, Old Orchard ave. Owner and builder, Louis C. Tarlton, 393 Wiseman ave. Two storeys and basement, 21 x 50, cement foundation, brick construction.

Flats, cost $5,000, Verdun, for Mr. Lalonde, c/o Mr. D. Lanthier, 1332 Wellington. Architect and general contractor, D. Lanthier, who will receive tenders. Work to start about Oct. 1st. Concrete foundation, brick construction, felt and gravel roofing.

Apartment house, Lorne Crescent. Owners and general contractors, Hand & Pick, 609 Belmont Ave., Westmount. Architect, D. J. Crighton, Jacobs Bldg. Steel, MacKinnon, Holmes & Co., Sherbrooke.

Two flats, cost $4,000, Notre Dame W. Owner and general contractor, Jos. Rozon, 99 Delisle. Three storeys, 20 x 55, brick construction, felt and gravel roofing. Foundations in.

Alterations to flats, cost $10,000, for A. Hamilton Gault, 595 Sherbrooke W. General contractors, Anglins, Ltd., 65 Victoria St. Tiling, Mosaic & Tile Co., rear 483 Bleury St.

Two flats, cost $4,000, Notre Dame W., for E. & H. Madore, 2560 Notre Dame W. Three storeys, 20 x 55, brick construction, felt and gravel roofing. Work is being done by day labor.

Two flats, cost $9,000, Westmount (York Ave). Builder and general contractor, J. B. Scott, 30 Springfield Ave. Two storeys, 25 x 50, cement foundation, reinforced concrete construction.

Swift Current, Sask.

Residence, cost $5,000, for D. A. Small, hardware merchant. Architect and general contractor, L. G. Linton, 12th ave.

Toronto, Ont.

Two pair residences, cost $12,000, Alberta St. Owners and general contractors, Anglin's Ltd., 507 Lumsden Bldg. Work done by day labor. 2½ storeys, 36 x 42, brick construction and foundation.

Four residences, cost $20,000, Highview Crescent. Owner and general contractor, Mr. Goodyear, 51 Highview Crescent. Mason, A. E. Brobyn, 153 Campbell Ave. Ready to receive tenders for wiring, heating, plumbing, painting, plastering and roofing. 2½-storeys. Two roofed, 2 walls going up.

One detached residence, cost $4,800, Oakwood. Owners and general contractors, Shaw Bros., 501 Manning Ave. 2½-storeys, 24 x 36, brick construction, stone foundation.

One pair residences, cost $5,000, Armstrong Ave., for Jas. Murray, 12 Olive Ave. General contractor, F. Clegg, 509 Manning Ave., will sublet. Two stys., 34 x 42, brick construction, stone foundation. Excavating done.

Two residences, cost $10,000, Rosemount. Owners and general contractors, Anglin's Ltd., Lumsden Bldg. Work day labor. One residence walls going up, 1 residence foundation in. 2½-stys., brick construction.

One detached residence, cost $4,500, Gothic. Owner and general contractor, S. Stewart, 16 Thorold, will sublet. 2½-storeys, 23 x 36, brick construction, stone foundation, lime and sand plastering.

Eight residences, cost $4,000 each, Pembroke St. Owners and general contractors, A. E. McTaggert & Sons, 268 Dovercourt Road. Work day labor. Four residences plastering, balance not started. Two storeys, 17 x 45, brick construction and foundation.

Welland, Ont.

Residence, cost $4,500, Griffith St., for W. A. McKenney. General contractor, Leslie Smith. Work day labor. 2½-stys., 25 x 38, brick veneer construction, cement foundation, shingle and asbestos roofing.

Winnipeg, Man.

Double residence, cost $18,000. Owner and general contractor, A. Macaw, 804 Trust & Loan Bldg. Two storeys, 31 x 63, red brick construction, stone foundation. Excavating done.

Residence, cost $4,450, Machray, for Heinitz Investment Co., builders, 457 Pacific. Two storeys, 26 x 28, frame construction, stone foundation, oak and maple floors. Excavating done.

Power Plants, Electricity and Telephones

Aurora, Ont.

Electrical apparatus required by Town Council. Mayor, W. J. Baldwin. Tenders received by Clerk until Sept. 24th, for the supply of fire pumps, motors, auxiliaries, etc. Plans, etc., at office of Clerk, S. H. Lundy.

Brampton, Ont.

Hydro-electric extension planned. Clerk, W. H. McFadden. By-law passed by Council to raise $15,000, by issue of debenture.

Montreal, Que.

Extension to power house at Lachine. Sec.-Treas., Hector Charette. Plans in progress.

Ottawa, Ont.

Underground services, cost $11,995, in House of Commons, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Chief Electrician, James Johnson. General contractor, A. G. Marshall, 3 O'Connor St.

Owen Sound, Ont.

Hydro power contemplated for the town. Clerk, Chas. Gordon. Power to be developed at Eugenia Falls on Beaver River by Provincial Commission. Transmission line about 30 miles.

Prince Albert, Sask.

Steam power house and plant, cost $275,000, planned by City Council. Clerk, O. Davidson. By-law passed Sept. 6th.

Regina, Sask.

Gas plant contemplated by C. E. McQuaid, 1930 Retallach St., Regina, acting for an American Company who are entering into negotiations with Regina City Council for the purpose of securing a franchise to put in a gas plant.

St. Catharines, Ont.

Power plant planned by City Council. Clerk, J. A. Pay. Estimate received from Hydro-electric Commission. Plant to cost $90,000, street lighting system, $26,000. Council approves. Ratepayers to vote.

St. John, N.B.

Power house for St. John Rly. Co. Manager, H. M. Hopper, Dock street. General contractors, A. R. C. Clark & Son, 51 Water St.

Sault Ste. Marie, Ont.

Deepening power canal, cost $300,000, for Lake Superior Power Co. General contractors, Soo Dredging & Construction Co.

Souris, Man.

Lighting system planned. Clerk, W. J. Breaky. By-law voted on Sept. 2nd was passed. Council will call for tenders immediately for poles, wires, etc.

Winnipeg, Man.

Tenders received by Board of Control till Sept. 18th for erection of ornamental poles on Osborne street from River Ave. to Corydon Ave.; Hargrave St., Portage Ave., Assiniboine Ave., Main St., Sutherland ave., N. City limits. Specifications at Office of Engineer, J. G. Glassco, 54 King St. Secretary, M. Peterson.

Business Notes

Campbellton, N.B.

Foundry owned by McLennan Foundry & Machine Co., Ltd., burned. (W. F. MacNaught). Loss covered by insurance.

Deux Rivieres, Ont.

Warehouse and office, east of North Bay, of Hawkesbury Lumber Co., burned. Also hotel, owned by M. Cottenham; post office, owned by Dom. Govt.; residence, owned by Postmaster Jardine; station buildings, owned by C. P. R.; residence of J. R. Bowles.

Kincardine, Ont.

Grist mill, owned by J. W. Rea, burned. Three storey building. Loss $12,000. Insurance $6,500.

Tenders and For Sale Department

TOWN OF WALKERVILLE

Tenders for Pavements and Sewers

Sealed tenders will be received by registered post, addressed to the undersigned, up to **Tuesday, the 23rd day of September, 1913, at noon,** for the construction of pavements and sewers in the following streets and alleys in the Town of Walkerville.

1. Pavement in Alley between Walker Road and Monmouth, from Niagara to Huron.
2. Re-paving portion of Victoria Road from Wyandotte Street to Assumption Street, and portion of Sandwich Street from Victoria Road to West Town limit, and portion of Walker Road from Ontario Street to Ottawa Street—in the Town of Walkerville.
3. Extension of West Main Sewer and Relief Main Sewer in said Town of Walkerville.

Plans and specifications may be seen on application to Owen McKay, C.E., Walkerville.

Tenders must be accompanied by a marked cheque payable to the Town Treasurer, equal to 2½ per cent. of the amount thereof. Should any party whose tender is accepted, fail to execute the necessary contract and bond for the due fulfilment of the same, his deposit will be forfeited to the Town.

Deposits of unsuccessful tenderers will be returned.

The lowest tender not necessarily accepted.

The names of two responsible persons, willing to act as sureties must accompany each tender.

CECIL H. ROBINSON,
Town Clerk.

Walkerville, Sept. 11, 1913. 38

Department of Militia and Defence

Extension to Stables, Tete-de-Pont Barracks, Kingston, Ont.

Notice to Contractors

Sealed tenders, marked on the envelope "Tender for Construction of extension to stables, Tete-de-Pont Barracks, Kingston," and addressed to the Director of Contracts, Department of Militia and Defence, Ottawa, will be received until noon, **September 30th instant**, for the construction of an extension to the stables at Tete-de-Pont Barracks, Kingston, Ont.

Specifications may be seen and full particulars obtained at the offices of the Officer Commanding the 3rd Division, Kingston, Ont., and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on the form supplied by the Department of Militia and Defence, and accompanied by an accepted cheque on a Canadian Chartered Bank, for ten per cent. (10 p.c.) of the amount of the tender, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into or fails to complete the contract in accordance with his tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET,
Deputy Minister.

Ottawa, September 2, 1913.

Newspapers will not be paid if this advertisement is inserted without authority from the Department.—47356. 38-39
H.Q. No. 44-7-73.

Tenders for Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by A. B. Coutts, Esq., Clerk, Township of Vespra, up to noon of **Saturday, September 27th, 1913**, for the construction of a reinforced concrete beam bridge over Willow Creek, Lot 13, Con. IV., Township of Vespra, at or near Midhurst, known as Findley's Bridge.

Plans, specifications and all necessary information may be obtained at the office of A. B. Coutts, Esq., Twp. Clerk, Barrie, Ont., or at the office of the undersigned, 57 Adelaide St. East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER, Engineer.

Toronto, Sept. 16, 1913. 38

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, September 23rd, 1913,** for the construction of the following sewers:—

Earlscourt Drainage System, No. 3 Outlet;
Dufferin St., 500 ft. north of St. Clair Ave. to 90 ft. north of Morrison Ave.;
Beaver Ave., Lightbourne Ave. to 431 ft. west;
Brandon Ave., Primrose Ave. to Dufferin St.;
Lane 1st W. Christie St., Garnet Ave. to Yarmouth Ave.;
Lane 1st E. Parliament St., Spruce St. to Carlton St.;
Lane 1st W. Spadina Ave., Oxford Ave. to north end;
Lane 2nd N. Bloor St., Symington Ave. to Perth Ave.;
Lane 1st N. Bloor St., Bartlett Ave. to Gladstone Ave.;
Elmer Ave., Queen St. to Norway Place;
Ashdale Ave., Queen St. to Applegrove Ave.;
Wilton Ave., Storm Overflow Sewer Sec. No. 3;
Danforth Ave., Storm Overflow Sewer Sec. No. 1;
Bloor St., Keele St. to E. limit of former West Toronto;
Morrison Ave., Dufferin St. to Harvie Ave.;
Lane 1st N. Queen St., Fuller St. to West End.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, September 11, 1913. 38-38

ARCHITECT

For an experienced, up-to-date architect, an excellent proposition is offered, by an established Consulting Engineering & Architectural Corporation, based on a co-operative plan, offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man who is thoroughly capable of handling an architectural department independently, both inside and outside work. Highest references and $1,500 stock investment required. Contract with salary, commission and interest in business guaranteed. Answer, "Architect," Contract Record, Toronto. 38

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, September 26th, 1913

for the several trades required in the erection of

New School Building, Regal Road, and Enlargement of Building, Kimberley Avenue

ALSO

Plumbing, Heating and Electric Wiring at Balmy Beach School, Pape Avenue School and McMurrich School.

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer, at his office in the City Hall not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON, Sec.-Treasurer.

W. O. McTAGGART,
Chairman of Committee.

38

MacLean Daily Reports
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The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

AGENTS WANTED

High Class Artificial Stone Company requires agents in every city to sell building stone, ornamental work, pipes, roof and floor tiles, etc. Liberal commission allowed. Address C. P. c/o "Contract Record," Toronto.

36-37-38

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs.

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

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Board of Trade Building, MONTREAL

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Bell and Spigot - Flexible Joint
Flange Pipe - Plain End Pipe
Standard Fittings - Special Castings

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ORPEN CONDUIT MANUFACTURING Co. OF CANADA
MANUFACTURERS OF XCELADUCT AND ORPENITE CONDUITS
HEAD OFFICE TORONTO ONTARIO

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"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

"Orpenite" Enameled Conduit—Easy Bending Spellarized Steel Tube; protected against rust by coatings of special enamel not affected by temperature conditions, smooth interior.

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TORONTO, CANADA Montreal, Quebec

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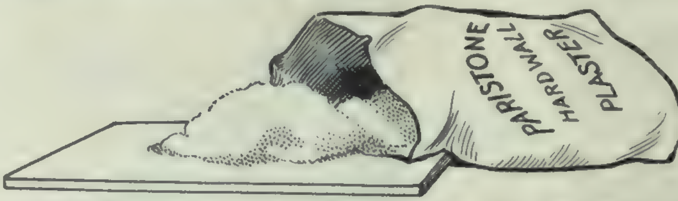

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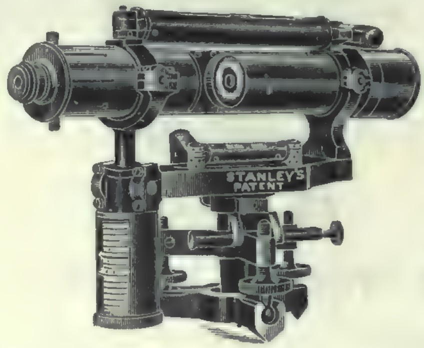

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Alphabetical Index of Advertisers
Page 16

Vol. 27 **September 24, 1913** **No. 39**

Vancouver Joins Cities of Notorious Administration

SOME time ago it was erroneously reported that Mr. F. L. Fellowes, City Engineer of Vancouver, had been asked to terminate his agreement with the city owing to loss sustained through defective water pipes that had been approved by his department. The fact was that at that time an investigation (concluded on September 12) was in progress and that the council had decided to cancel the present agreement with Mr. Fellowes, which calls for six months' notice, and to enter into new arrangements.

City Engineer Fellowes has been referred to not infrequently as "the highest paid municipal engineer in the Dominion." By the same token he is the most harassed official between the Atlantic and the Pacific. Mr. Fellowes has been dragged into a tiresome controversy over the acceptance of steel pipe supplied by a Pittsburg firm, the National Tube Company. The pipe is of the company's usual standard, but the water superintendent of Vancouver, who is supposed to receive his instruction from the city engineer, condemned it severely, without going through the formality of an inspection. Needless to say that after making such a report the worthy superintendent soon had a good-sized following in the council and that by the pulling of a string here and the exercising of a little political influence there the city engineer's position was speedily made uncomfortably warm.

Were we to attempt to recite the various details of the investigation—details which have provided the local press with columns and columns of wasted effort—our task would be overwhelming. We gladly pass over the senseless quibblings with which the Vancouver public have been regaled and record the fact that the investigation has been wound up with the acceptance of terms drawn up by the National Tube Company and that the stand made throughout by the city engineer has been completely vindicated. More, City Engineer Fellowes has shown up the unsatisfactory methods of inspection laid down by the council and their unfair and unpractical interpretation of specifications.

The city of Vancouver, or rather the persons to whom the administration of the city of Vancouver is entrusted, seem to have no appreciation of the fact that the strictest fair play is due to a man who has been taken at the zenith of his professional career from a growing city where he was not only making good but distinguishing himself. The ignorant and irresponsible men who criticised Mr. Fellowes at the Vancouver investigation as "not big enough"* for his position and "not commanding the confidence of the citizens"* are surely not competent from their narrow viewpoint and limited experience to criticise one who has been associated with some of the most important and interesting developments in the country.

Looking back over Mr. Fellowes' record we find that he has been identified with dozens of important works and that his name has been associated with some of the leading practitioners of the country. With Mr. Janin and Mr. Chipman a few years back he represented the Federal Government upon a commission which reported on the best system of drainage for the west end of the city of Montreal and adjoining municipalities. He investigated the various systems of lighting, filtration and incineration in leading cities of Canada and the United States, and on his report the plants now in operation at Westmount were established.

The work carried out last year in the city of Vancouver under the supervision of Mr. Fellowes was phenomenal—the largest in local history, in fact larger than the sum total of the preceding nine years' work, equalling, if not exceeding, the records of the big eastern cities.

It would seem that Mr. Fellowes had been unfortunate in taking over the engineering development of a city strong enough to pay a large salary and weak enough to engage a man upon whom the responsibility of all engineering undertakings would devolve but who was not to be supported as the supreme head of his department. Further, it would seem that the administration of the city of Vancouver had been weakened by the system of ward representation.

The investigation, as we have followed it, discloses a lamentable lack of well-balanced men in the Vancouver council. Vancouver, like many of our eastern cities, is suffering from the effects of electing to the council men who have not yet developed the ability to shoulder the responsibility of their own statements, let alone the important work of a city peopled by hundreds of thousands. Higher standards in every department of our administration would produce correspondingly higher results in executive branches. It is the universal cry of a higher standard of representation in which Vancouver is silently joining.

It is possible that the city of Vancouver, which—thanks largely to the able work of City Engineer Fellowes and his predecessors in office—has made great strides in recent years, is becoming over-confident. At any rate, the swaggering assertions of its aldermen as reported in the local press would incline one to that belief. We are not vindictive, but we do hope that if ever Vancouver is at its wits' ends to induce another self-respecting member of the profession to become city engineer, the trouble will be shared by the swaggering individuals responsible for the recent rumpus.

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* For the origin of these phrases see the proceedings of Toronto's first city council.

Triumph for Canadian Shipbuilding Industry

AN impetus to the ship-building trade which will undoubtedly have its effect upon the constructional world generally will be given by the new Government regulations which provide that all vessels built for the Canadian Government must be constructed in the Dominion. In effect this means a new industry for Canada, for of the Dominion Government vessels built in recent years probably seventy-five per cent. have been constructed in Great Britain. The regulations enact that all vessels built for the Government must be constructed wholly of British materials.

Canadian ship-builders have been working towards this goal for a number of years and they are to be congratulated upon having attained it. The consummation of the enactment, however, places upon them a heavy responsibility. The development of such industries on efficient and successful lines requires an aggressive, far-seeing policy, and the problems of finance are not inconsiderable. However, in other fields we have many great institutions which attest the soundness of our judgment and the aggressiveness of our policy and there is no reason to suppose that we shall not rise to the occasion in this case, for it is an occasion worthy of great enterprise.

It is of interest to record that the first vessel to be constructed under the new regulations is to be built in Toronto by the Polson Iron Works.

The Peterborough Disaster

ENQUIRY on our part has revealed nothing but reticence in connection with the collapse of the Turnbull Building at Peterborough, which resulted in the loss of five lives. The jury brought in their verdict last week, but the evidence was not sufficient either to determine the cause of the collapse or to fix the blame.

Possibly, the scanty information may be traced to the fact that a number of law-suits are pending; possibly this is only one of a number of considerations.

Reticence to a certain degree is proper. A man is not called upon to take the responsibility of statements which may or may not be founded on fact. At the same time the community at large, and particularly the constructional interests, are entitled to have timely information on such matters. All that we are told one month after the disaster is that the jury were unable to arrive at any conclusions owing to the insufficiency of the evidence and that they recommend the appointment of a building inspector whose duties would include the supervision of structures undergoing alterations.

We can make certain deductions from the evidence given by the architect appointed to examine the premises on behalf of the Attorney-General's department. This gentleman found serious defects in the construction of the basement wall upon which the supporting pillars were erected. The wall was under strength, the bricks were soft and the mortar was poor. Scanty as these details are they show the importance of adequate inspection in every branch of constructional work and point the moral that where human lives are a consideration the question of economy is criminal.

It is to be hoped that more definite information will be forthcoming from the authorities and that further details will not be withheld until such time as public interest has waned to a point where it is a negligible factor.

The Passing of a Great Contracting Firm

MOST of us who have heard of the late Sir John Aird find some interest in the statement that his firm will soon pass out of existence. The history of Sir John Aird & Company has been wrapped up with the growth and development not only of the British Empire but of nearly every country in the world during the last eighty years. The name of Aird is the most widely known in the contracting world to-day.

Sir John Aird, Bart., the founder of the firm, died in 1911, and it appears that the present baronet, finding himself face to face with more strenuous competition, is not desirous of continuing the business. He is a wealthy man, and is not willing, perhaps, to take the risks involved in the great contracting operations for which his firm competes. Moreover the firm has been involved in several big legal disputes and it is quite possible that the present head is tiring of the law's vexations.

Recently the firm was concerned in one of the most famous law cases of all time—that of Messrs. Aird versus the Tanjong Pagar Dock board, or really the Straits Settlement government. This trial was easily the most expensive of its kind, and though the verdict was eminently satisfactory to the contracting firm, there is reason to believe that the settlement was disappointing.

The disappearance of this firm marks a landmark in the world's contracting history. It may give some idea of the extent of their business when it is mentioned that for many years their outgoings were $50,000 a day.

Under the terms of the proposed new building code for New York City, when an architect, builder, or owner desires a modification of any provision in the building ordinance, or a ruling on any matter not covered by it, he must make written application therefore with the reasons for his request. The building superintendent must give his decision, with reasons, in writing; the same is to be published in the official "City Record" within two weeks and filed, properly indexed, in the permanent records of the building department. These records, to which the public shall have free access, may be cited as precedents.

Quebec Water Supplies Discussed at Montreal Convention

MEMBERS of the Sanitary Services of the Province of Quebec last week held their fifth annual convention in Laval University, Montreal. Most of the papers read and the subjects discussed related to the purely medical side of civic administration, including infant mortality, medical inspection of schools, meat inspection, etc.

The question of water supplies in the province of Quebec was dealt with by Mr. Mac. H. McCrady, of the Provincial Board of Health. He stated that about 41 per cent. of the population obtained water from rivers and streams, which was a rather big figure to be dependent on such sources. This was due largely to the fact that towns were found most thickly clustered together on the river banks. Some rivers had water which was colored, but that was no real criterion. The more serious question was that of pollution from sewage. This might be found in an apparently clear water. An examination of water courses showed that 30 per cent. of streams only were satisfactory from the drinking standpoint. Of springs 80 per cent. were good, but of wells only 25 per cent. were satisfactory.

It would be beneficial, said Mr. McCrady, to inaugurate an educational campaign for the purpose of teaching rural and small town communities to protect their underground water supplies. Only one per cent. of the population was supplied with water from the lakes, which was the more astonishing as lakes were an ideal supply. This meant that great opportunities were being missed by certain communities. The supplies were found to be divided up thus: 41 per cent. from streams, one per cent. from lakes, and 58 per cent. from underground springs or wells.

In touching on purification, Mr. McCrady blamed municipalities for their laxity in this respect, and said in some cases where plants had been installed, they were entirely ineffective. "On the whole," he said, "with the exception of Montreal and suburbs, water purification systems in this province are not satisfactory. The general disregard of the need of purification is difficult to understand." Thirty per cent. of the population of the province had purification to some extent; 12 per cent. excellent river water, and one per cent. good lake water. It was expected that within the next five years every district would be provided with chemical filters with hyperchlorate.

Mr. James O. Meadows, in discussing the paper, pointed out that the initial cost of drawing supplies from lakes was such as to account for their small use. There were several large towns in the province, he said, which were using water from surface supplies of very doubtful quality.

The system of sewers in the province of Quebec was discussed in a paper by Mr. Theo. Lafreniere, C.E., in the course of which he described the various systems in use.

The report of the committee on the protection of water courses was made by Mr. Meadows. It was to the effect that the committee had drafted a bill by which certain powers would be conferred on the provincial board of health in regard to dealing with impure water systems and sewage purification. This bill had been sent to the Provincial Secretary last year, but no result had followed. Mr. Meadows urged that some government department should be empowered to superintend the installation of water purification plants, as much money had been frittered away on inadequate plants. It was agreed that the bill should again be pushed by officers of the convention.

Co-ordination of Engineering Research

TO get rid of unnecessary duplication of effort is one of the first objects of the efficiency expert in every field of human industry. In the pursuit of this ideal the division of labor has been carried to extraordinary lengths and specialization has attained a development never before equalled, says The Engineering Record. Close observers of industrial progress are beginning to realize, however, that specialization is in the last analysis a rather arbitrary matter, and that an interdependence exists between the various practical arts which demands anything but narrow knowledge of simple specialties for the most enduring success. It is increasingly essential for the expert in any one field to keep in touch with progress in even distantly related lines of work, and in the engineering profession in particular the catholicity of its interests, its uncounted points of contact with the business and scientific worlds, and the overlapping of its equipment and methods in different branches exact devotion to the broad outlook no less than faithful attention to details from the successful practitioner. It is this situation which commends to the attention of the engineer every carefully considered suggestion aimed to facilitate his knowledge of significant progress in the domain of physical science, and in this connection a paper on "Engineering Research and Its Co-ordination," read by Mr. G. H. Roberts at the July meeting of the Institution of Mechanical Engineers at Cambridge, England, is of special interest.

The author points out that no definite and generally recognized system has been formulated for making known to the profession the results of numerous private researches and experiments constantly in progress and emphasizes the need of a sort of world-wide docket of engineering research which will constitute a clearing house of information as to the kind of investigations in hand, the objects sought, and the results attained. The desirability of accomplishing this end needs little argument, for if it could be brought about it would undoubtedly save a great deal of time and money and vastly enhance the efficiency with which engineering research is conducted in different parts of the world. The day is certainly far distant when all duplication of research will be a things of the past—for the conditions surrounding investigations will always be enormously varied, and the personal equations and laboratory equipment of the investigators will often demand independent observation; but the fundamental point is to acquaint the profession as a whole with the research activities of individuals and organizations, and once this is done the saving in effort will repay the cost.

To specify in detail how this problem can best be solved is not feasible at the present moment, but the matter can be discussed to great advantage by engineers and should receive the best thought of many minds before any elaborate scheme is attempted. Mr. Roberts suggests that the Institution of Mechanical Engineers may be the proper clearing house of data and touches upon the possibilities of ultimately guiding research by the committee method. To make his proposals definite he presents as a nucleus about a dozen pages of tests made at the Woolwich Arsenal upon the mechanical properties of some 75 varieties of woods and 23 alloys; reviews the recommendations of the Standards Committee in regard to the proportions of test pieces, and briefly discusses the unification of methods of reporting. In view of the magnitude of the subject, however, and particularly because of the overwhelming mass of data in process of accumulation throughout the engineering world, it is open to debate whether the best way to start this campaign is not by the preparation of an index bibliography of current research, perhaps subdivided among the national engineering societies or else compiled in a central bureau reporting back to the great engineering organizations supporting it and contributing to its accumulations. There are, of course, many researches which those who meet their cost legitimately prefer to keep in private hands; but there is a huge volume of investigation under way to which restrictions upon publicity do not apply, and if the results of such work can be disseminated through an efficient organization a great advance will be made in the methods and spirit of modern engineering research.

Highway Bridge Design—Cross Sections of Bridges

Part II[*]

Specially contributed by F. Tissington[†]

IN Fig. 1 there is illustrated the usual arrangement of parts for Warren Poney Truss spans, particularly those having comparatively shallow trusses, say up to about 8 ft. 6 in. centres of gravity of top and bottom chords. A four-inch timber floor is used which is spiked to the nailing pieces on the I-beam stringers. This cross-section shows the vertical posts at the panel points. It will be noted that the angles composing these are arranged to lap over the chord angles. This feature, together with the knee brace angle secured to the floor beam, constitutes all the support the top chord obtains, but owing to the particular style adopted this arrangement has been found perfectly satisfactory. A further point to be noted is the connection of the handrailing to the truss; the cleats forming a support for the posts as well.

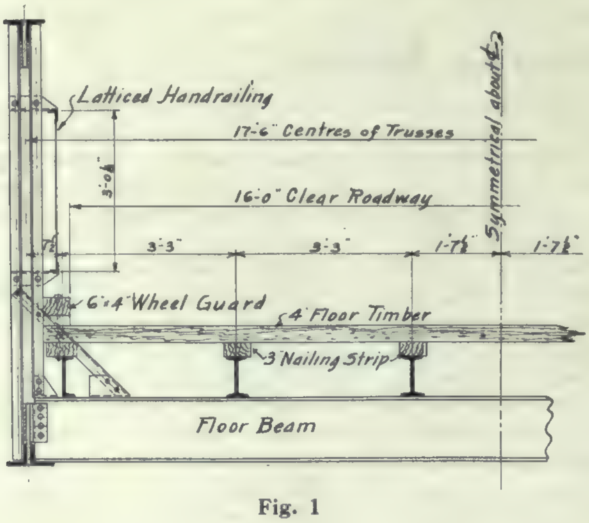

Fig. 1

The outside line of stringers are of channel section as they only have to support half the load of the other stringers.

Fig. 2 is a typical cross-section for a bridge with concrete floor, the truss also being of the Warren Poney type. It will be noticed that the posts are shown with outside stays, which is the usual type adopted for trusses that are more than 8 ft. 6 in. deep.

The stringers are packed up towards the centre of the floor beam, which gives a camber to the flooring and allows the rain water to run away easily.

Fig. 3 shows a cross-section of a Pratt through truss with a vertical clearance of 13 ft. underneath the overhead brace frames. The latter occur at the posts only. The floor stringers are in this case shown rivetted to the web of the floor beam, a course usually adopted for the larger spans owing to the additional stiffness given to the lower framing of the structure.

Fig 4 indicates a similar cross-section to the one just described with concrete floor and modifications to the sway frame arrangement.

This type of sway frame should only be used for comparatively short spans where the depth of truss prevents the use of the one shown in Fig. 3.

Trusses

The general outline of the trusses has been discussed in a previous article so that nothing further need be said on this point.

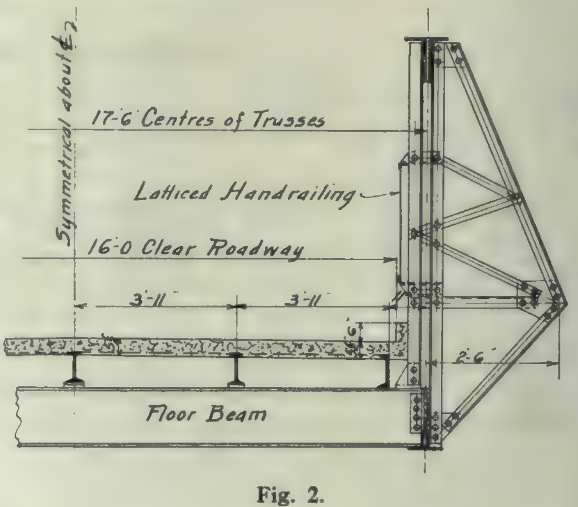

Fig. 2.

The selection of the various sections comprising the truss is a matter of some moment and the following considerations should be borne in mind.

(1) That the proposed sections should be readily obtainable from the rolling mills. All odd sizes being left out of consideration.

(2) Thin sections to be used in preference to thick, it being noted that not less than five-sixteenths of an inch is allowable.

Generally, the adoption of thin sections results in a smaller proportion of material being taken out of a tie by the rivet holes, whilst for struts a greater value of radius of gyration is obtainable for a given weight of material per foot run.

[†] Chief Draughtsman, MacKinnon Holmes & Co., Sherbrooke, Que.

[*] Part 1 was published in the Contract Record of Sept. 3, 1913.

(3) For the smaller spans it will be found economical to make the diagonals near the centre to the same templates, as in a number of cases the minimum size of angle (2½ x 2½ x 5-16) will fill the bill for at least two sets of diagonals on each side of the centre line of the truss, and a rivet or two extra will be more than compensated for by savings effected in template making, marking and assembling.

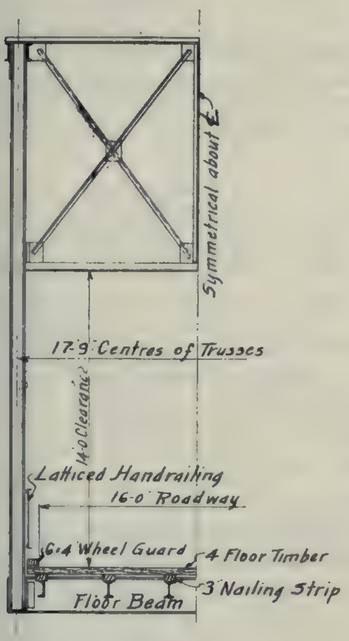

Fig. 3

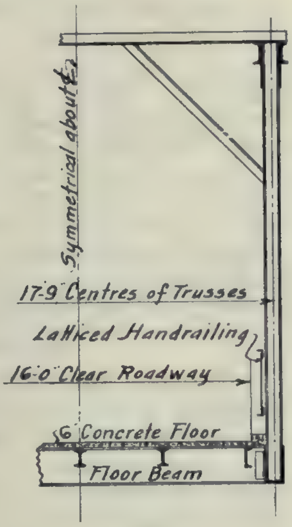

Fig. 4

(4) For light struts and diagonals with a reversal of stress the writer has adopted a section of two angles placed in the form of a cross, see Fig. 5. For comparatively long struts with light loading which necessitates the use of a large-sized angle when placed in the ordinary way (see Fig. 6) in order to obtain a ratio of length to radius of gyration that is permissable (maximum value not to exceed 120 times that of l/r), the former arrangement will be found much more economical even taking into account the additional batten plates required.

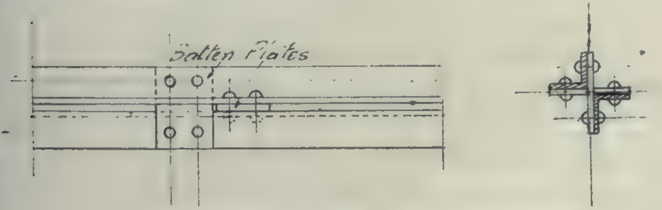

Fig. 5

This applies practically to all cases where the ratio of l/r governs the section to be used rather than the area required to carry the total stress.

(5) For trusses where it is necessary to use a box section, composed of two channels placed some distance apart, it will in the majority of cases pay to use a smaller size channel with a cover plate on the top, owing to the lacing being expensive to manufacture and also because it cannot be counted as part of the sectional area of the number to resist direct stress.

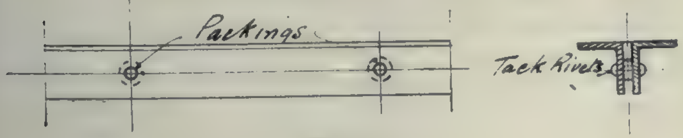

Fig. 6

(6) For through Pratt trusses the posts should be of H section wherever possible, i.e., Bethlehem column or girder sections, broad flange beams, etc. The use of the above eliminates a large amount of detail work as they will usually replace a post composed of two channels laced.

(7) In similar trusses to those mentioned in item (6) the substitution of one or two channels (in the latter case placed back to back) or H sections for two or four angles either battened or laced will produce a small economy for the same reasons given previously.

It should be noted however that these are general terms and may not apply to every individual case.

(8) For Warren Poney Trusses the use of gusset plates approximately thick enough to develop the full double shear value of the rivets in bearing also is good practice as this eliminates a good many field rivets which are always expensive to drive.

(9) Further, small types of trusses, the joints should preferably be made on the far side of a panel point looking from the centre of the truss for the reason that it is then only necessary to provide sufficient rivets in the joint to transmit the lower stress of the two members in the chords connected together (see Fig. 7).

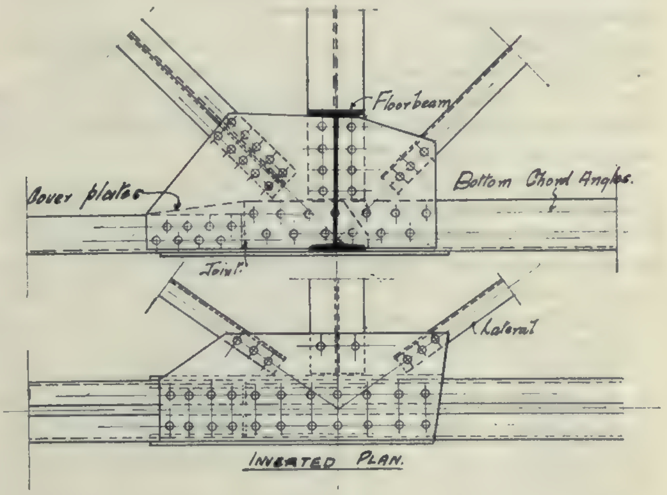

Fig. 7

(10) When sidewalks are added to one side of the bridge only throwing an additional load on one truss, it will be found that a saving in manufacture will result if the additional sectional area required to carry the heavier load is provided by increasing the thickness of the sections used on the other truss, as the same templates may then be used.

Seasoning of timbers, 8 x 16 inches in cross-section, should extend through two entire summers to reach a thoroughly air-dry condition. If seasoning is started in the hot summer months the loss of moisture is at first very rapid, and checking is invariably induced. The best results are obtained when the air seasoning is started in the late fall or early winter months. The effect of shrinking in redwood timbers is not very noticeable, although it contains much moisture when cut. It can, therefore, be seasoned readily without serious checking.

The Waterproofing of Concrete Surfaces*

THE work of the committee was found to be divided naturally into three branches:—(1) Causes of permeability, and methods of avoiding them; (2) Waterproofing by the addition of other substances; (3) Subsequent treatment of exposed surfaces.

In the laboratory and under test conditions using properly graded and sized coarse and fine aggregates, in mixtures ranging from 1 cement, 2 sand and 4 stone to 1 cement, 3 sand and 6 stone, impermeable concrete can invariably be produced. But the fact remains, nevertheless, that the reverse often obtains in actual construction, permeable concretes being found even with 1 cement, 2 sand and 4 stone mixtures and are of frequent occurrence where the quantity of the aggregate is increased. This the committee attributes to:

(a) Defective workmanship, resulting from improper proportioning, lack of thorough mixing, separation of the coarse aggregate from the fine aggregate and cement in transporting and placing the mixed concrete, lack of density through insufficient tamping or spading, and improper bonding of work joints, etc.

(b) The use of imperfectly sized and properly graded aggregates.

(c) The use of excessive water, causing shrinkage cracks and formation of laitance seams.

(d) The lack of proper provision to take care of expansion and contraction, causing subsequent cracking.

Properly graded sands and coarse aggregates are rarely, if ever, found in nature in sufficient quantities to be available for large construction, and the effect of poorly graded aggregates in producing permeable concrete is aggravated by poor and inefficient field work. Even if the added expense could be afforded of screening and remixing the aggregates so as to secure proper granulometric composition to give the density required to make untreated concretes impermeable, it is seemingly a commercial impossibility on large construction to obtain workmanship even approximating that found in laboratory work.

The committee finds that in consequence of these conditions substances calculated to make the concrete more impermeable—either incorporated in the cement or added to the concrete during mixing—are often used.

Value of Waterproofing Compounds

While it has been impossible for the committee to test all of the special waterproofing compounds on the market, it has investigated a sufficient number of these, as well as the use of certain very finely divided mineral products, to form a general idea of the value of the different types. The committee finds:

(a) That the majority of patented and proprietary integral compounds tested have little or no immediate or permanent effect on the permeability of concrete and that some of these even have an injurious effect on the strength of mortar and concrete in which they are incorporated.

(b) That the permanent effect of such integral waterproofing additions, if dependent on the action of organic compounds, is very doubtful.

(c) That in view of their possible effect, not only upon the early strength, but also upon the durability of concrete after considerable periods, no integral waterproofing material should be used unless it has been subjected to long-time practical tests under proper observation to demonstrate its value, and unless its ingredients and the proportion in which they are present are known.

(d) That in general more desirable results are obtainable from inert compounds acting mechanically than from active compounds whose efficiency depends on change of form through chemical action after addition to the concrete.

(e) That, assuming average quality as to size of aggregates and reasonably good workmanship in the mixing and placing of the concretes, the addition of from 10 to 20 per cent. of very finely divided void-filling mineral substances may be expected to result in the production of concrete which under ordinary conditions of exposure will be found impermeable, provided the work joints are properly bonded and cracks do not develop on drying, or through change in volume due to atmospheric changes, or by settlement.

Surface Treatment

While external treatment of concrete would not be necessary if the concrete itself, either naturally or by the addition of waterproofing material, was impermeable, it has been found in practice that in large construction, no matter how carefully the concrete itself has been made, cracks are apt to develop, due to shrinkage in drying out, expansion and contraction under change of temperature and moisture content and through settlement.

It is, therefore, often advisable on important construction to anticipate and provide for the possible occurrence of such cracks by external treatment with protective coatings. Such coating must be sufficiently elastic and cohesive to prevent the cracks extending through the coating itself. The application of merely penetrative void-filling liquid washes will not prevent the passage of water due to cracking of the concrete. The committee has, therefore, divided surface treatment into two hands:

(a) Penetrative void-filling liquid washes.

(b) Protective coatings, including all surface applications intended to prevent water coming in contact with the concrete.

While some penetrative washes may be efficient in rendering concrete waterproof for limited periods, their efficiency may decrease with time and it may be necessary to repeat such treatment. The committee, therefore, believes that the first effort should be made to secure a concrete that is impermeable in itself and that penetrative, void-filling washes should only be resorted to as a corrective measure.

While protective extraneous bituminous or asphaltic coatings are unnecessary, so far as the major portion of the concrete surface is concerned, provided the concrete is impermeable, they are valuable as a protection where cracks develop in a structure. It is therefore recommended that combination of inert void-filling substances and extraneous waterproofing be adopted in especially difficult or important work of any nature.

Considering the use of bituminous or asphaltic coatings, the committee finds:

(a) That such protective coatings are often subject to more or less deterioration with time, and may be attacked by injurious vapors or deleterious substances in solution in the water coming in contact with them.

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* Conclusions reached by the Committee on Waterproofing Materials of the American Society of Testing Materials.

(b) That the most effective method for applying such protection is either the setting of a course of impervious brick dipped in bituminous material into a solid bed of bituminous material or the application of a sufficient number of layers of satisfactory membranous material cemented together with hot bitumen.

(c) That their durability and efficiency are very largely dependent on the care with which they are applied.

Such care refers particularly to proper cleaning and preparation of the concrete to insure as dry a surface as possible before application of the protective covering, the lapping of all joints of the membranous layers, and their thorough coating with the protective material. The use of this method of protection is further desirable because proper bituminous coverings offer resistance to stray electrical currents.

In conclusion, the committee points out that no addition of waterproofing compounds or substances can be relied upon to counteract completely the effect of bad workmanship, and that the production of impermeable concrete can only be hoped for where there is determined insistence at all times on good workmanship on all structures.

Influence of Painting on the Rusting of Iron

WHILE the ultimate nature of the rusting of iron is being contested strenuously says a technical writer in Engineering, the question of the protection of iron by the aid of suitable coatings has advanced little of late. Most scientists probably incline to an electrolytic theory of rusting; some dispute it.

Nobody denies that there is a danger of rusting wherever local potential differences exist in or on the iron. To insist or to deny that the ultimate cause of rusting must be electrolytic is perhaps going ultra vires. But we may assert that local potential differences are a very common, possibly an essential, symptom accompanying rusting processes. We galvanize iron with zinc, and not with copper, because we know that the zinc is more liable to corrosion in the combination of iron and zinc, and the iron more liable to corrode in the combination of iron and copper; and we find that potential determinations would induce us to galvanize iron with some less noble metal if that process were unknown. But we are apt to overlook that local potential differences are also set up whenever the iron surface is not perfectly clean and free, and when any coating, an oxide graphite, a point or simply moisture, is present.

Many people would probably say that good painting should afford an efficient protection against rusting, provided the paint be itself non-corrosive, uniform, impermeable to moisture, and non-porous. That was substantially the conclusion at which Messrs. William H. Walker and Warren K. Lewis—men well known in this field of research—arrived, at the Massachusetts Institute of Technology when investigating, in 1909, a peculiar case of failure of preserved-fruit tin cans which had been varnished inside. The remedy seemed to be: if one coat of varnish or paint is not sufficent because of the pores, apply two or several coats.

Effect of Several Coats

But now comes Messrs. Erig Liebreich and Fritz Spitzer, of Berlin, with the statement that one coat of varnish or paint may protect the iron, but that the application of several coats will actually promote rusting.

Liebreich and Spitzer had been experimenting with various iron varnishes, and they had painted numbers of symbols on the coatings. Upon removing the coating afterwards they could always read the characters on the iron surface, which was most corroded in those spots, and they found that this was so also with painted sign-boards which they examined. According to their experience, the rule should therefore be: use a good, non-corrosive iron paint, but do not apply more than one coating. The research is not yet completed, but the subject is worth looking into.

We will first refer to the experiments of Walker and Lewis. As some acid fruit preserves attack tins, some tins were carefully varnished inside with a high-grade copal-linseed oil varnish; but some of these tins were eaten through in six weeks, and they all corroded rapidly. The lacquer had been baked at 140 deg. C., and had appeared to form a perfect coating of the sheet metal. In making the can, however, the film had probably been ruptured by the dye, the burning, etc., and "when the fruit was introduced the depolarizing action of the lacquer, coupled with that of the little air left in the can, threw the protected areas into a cathodic state, concentrating the solution of the metal at the exposed points, so that both tin and iron were dissolved."

Corrosion Electrolytic

The explanation is thus suggested that the corrosion was electrolytic (i.e., made the iron more liable to oxidation), because the lacquer contained unsaturated compounds which acted as depolarizers on nascent hydrogen. This explanation is not easy to follow; but the fact remains that the unlacquered tins held out longer than the lacquered ones.

Liebreich and Spitzer coated highly polished sheet-iron with various paints, consisting of linseed oil and some oxide (lead, zinc, iron), sometimes further mixed with carbon; the addition of carbon made no difference in their behavior. The sheets were suspended over boiling water for four days and nights. Half the surface of the iron was then bared of its coating with the aid of toulene, and the bare surface covered with vaseline to prevent any further rusting.

In all cases (except one presently to be mentioned) the iron had remained bright when one coat had been applied, but had rusted under two coats, and distinctly rusted still more under three and four coats of the same paint. Some commercial paints gave the same results. Potential differences were observed between iron wires coated with the paints in question and the bare iron wire, when both wires were dipped into salt solution. In a paper read before the Schiffbautechnische Gesellschaft in 1905, Ragg had already demonstrated that all paints show a potential difference against iron.

These potential differences would account for some corrosion, and the fact that linseed oil while being dried slowly oxidizes, and continually liberates both water and carbon, would provide the favorable conditions for some electrolytic action. But one does not see why several coats of paint should afford a poorer protection against rusting than one coat. In fact, were it not that there was protection in the first instance with one coating, one might think that the method of testing was altogether unsuitable. The steam might creep in from the edges, between the iron and the film of paint, and cause corrosion in that way.

Liebreich and Spitzer are not yet in a position to offer any explanation, though they throw out a few hints. We venture to suggest that adhesion might enter into the problem. One thin coat of varnish or paint may adhere better to the iron surface than several coats united to a thick skin; the second film might tend to pull the first off the iron. That would depend upon the nature of the films.

We mentioned that one paint behaved exceptionally; this paint always afforded protection, whether applied in one or in several coatings. The article quoted does not explain the nature of this paint, merely designating it by reference to a German patent specification. The paint in question is prepared by Liebreich by mixing white lead and linseed oil in the proportion 25:6, and by adding a small quantity of solid potassium sulphide or cyanide to the cold stirred solution. The preparation, it is said, liberates free alkali when in contact with water, and the alkali is to prevent the rusting. As a rule, only one coat of this paint would be applied, and a covering consisting of the same paint without the sulphide then put on.

New Cyclopean Masonry Dam at Pittsburg

By Hiram A. Miller, Consulting Engineer, Boston

THE new Farnham dam which has been built to furnish an additional water supply to Pittsfield, Mass., has a gravity section of cyclopean masonry, about 600 ft. in length, with core walls at each end, making the total length of the dam about 900 ft. It is divided by expansion joints with inspection wells passing down through the joints, near the upstream side, to the bottom of the dam. These inspection wells are connected at the bottom by cast-iron drainage pipes, with a pipe leading from the bottom of the deepest well to the westerly side of the lower end of the spillway.

The gate well is on the upstream side of the dam outside the regular section, and is about 10 ft. square.

The expansion joints are 80 ft. apart, having 6-in. vertical offsets, 8 ft. apart through the dam. There is a copper strip across the joints on the upstream side of the inspection well similar to the one designed by the engineers of the Board of Water Supply of New York City for the Kensico dam. One side of the expansion joint is constructed of concrete blocks; on the other side the concrete of the cyclopean masonry is permitted to come to the joint. Before laying the concrete the side of the joint first constructed was coated with hot tar pitch, then a sheet of roofing paper was applied to the hot pitch, and the roofing paper was again coated with hot pitch.

During the last of February of the present year, after the coldest spell of the winter, when the reservoir was full, the total leakage through the joints measured at the end of the drainage pipe was at the rate of 18,000 gal. per day, which had decreased during the present summer to 200 gal. per day when the reservoir was drawn down 11 or 12 ft. Moisture appears on the downstream side of the dam to the extent that a large proportion of the area appears wet on a damp morning, but in the sunshiny afternoon the surface is mainly dry.

In the revised pressure diagram, made since the completion of the dam, the weight of the masonry is taken as 157 lb. per cubic foot, the volume of the inspection wells being included in the volume of the dam, the weight of the quartzite being 169 lb., and the weight of the schist 174 lb. The weight of the concrete was averaged at 151.2 lb. Ice pressure was taken at 10,000 lb. per linear foot at the surface of the water. It was assumed that the upward pressure of water under the dam would be equal to the full pressure of the water at the upstream side, and that it would be nothing at three-quarters of the distance from the upstream side to the downstream side, either at the bottom of the dam or at any horizontal section of the masonry. When the reservoir is empty the pressure line passes about 3 in. outside of the middle third, but if the deduction for the inspection wells had been taken out of the vertical longitudinal section in which they are, instead of being distributed through the total volume of the dam, and if the lesser weight of the masonry near the upstream face of the dam, being all concrete, had been taken into account, this pressure line would not have passed outside the middle third. The pressure will keep within the middle third, in accordance with the above assumptions, when the reservoir is full to the elevation of the spillway. It will also keep within the middle third with the water 5 ft. higher, provided there is no ice pressure. Consequently flashboards 5 ft. high can be safely placed across the spillways, provided they are removed before ice forms on the surface of the reservoir to any great thickness; and provided also that there is no depth of water passing over the spillway.

The use of concrete is not a new thing; it is as old almost as the world. The Romans used it as a method of construction and also as a fill, with the permanent forms of brick veneer or stone. The Spaniards and Italians both used it and the Mexicans also. The principal types of architecture developed along these lines of construction are those of Spain and Italy particularly, and the best modern expression of this type of construction in America is to be found in Carrere and Hastings' Ponce De Leon and Alcazar hotels in Florida. These buildings are of concrete with terra-cotta and brick trimmings around the openings, and with Spanish tile roof with necessary overhang. The colour contrast gives the plain wall surface additional value. This type or similar architecture must be used in order to get value and beauty from the simplicity of a straightforward monolithic concrete wall. Classic or Renaissance forms in cast concrete are at best poor imitations of the genuine living styles; so that the sooner we realize the value of concrete beams and corbels carrying a red tile overhanging cornice instead of a classic imitation, just so much the sooner shall we arrive at the solution of our problems, for construction dominates and determines style.

Protecting Buildings Against Lightning

Important Questions and Answers on the Placing and Value of Rods — Danger in Cities Relatively Small*

IN looking over recent articles dealing with lightning and lightning protection one is struck by the prominence given to protection of electric transmission lines and electric apparatus generally, while practically no contributions have been made to the subject of protection of buildings since the famous work by Sir Oliver Lodge years ago. Yet the protection of buildings unquestionably is as important as the protection of transmission lines and there are thousands of people interested in protecting their homes to every one interested in a transmission line.

To people living in cities the subject is, however, of little or no interest. Experience has shown that the extensive networks of wires, metal roofs, etc., are usually ample for protection. The man living in the country, however, is very much concerned, as experience has shown that in certain localities at least it is indeed tempting providence not to have some lightning rod scheme.

In a paper presented before the Illinois State Electric Association and condensed in Engineering News, Mr. Berg discusses the laws represented in, and the electric characteristics of lightning discharges, and, in conclusion, answers a series of questions, given here in part, on the best method of affording protection.

"Is there any real advantage in the installation of lightning rods or do they draw lightning and thereby add to the danger?" Experience seems to have settled beyond reasonable doubt that if properly installed, lightning rods afford considerable protection. Any lightning rod "draws" lightning if by that expression is meant that it prepares, under certain conditions, an easier path for the lightning discharge than would be the case if it were not there. The conducting streamers issuing from the rod tend to equalize the potential between earth and cloud and thus diminish the severity of a stroke and possibly prevent it altogether. Yet it may also be argued that unless there are many such streamers the rod cannot always cope with the situation and a stroke may result from them. This feature is dealt with later under another heading.

"Can a building be perfectly protected from lightning?" The answer must be no, except perhaps in the case of a thoroughly grounded all-metal building.

"How much protection does a lightning rod afford?" Unquestionably some if properly installed, but it may make matters worse in some cases. Assume for instance that a large building is equipped with a high, but broken, rod or a rod having poor joints or a high resistance to ground, say several hundred ohms, which undoubtedly sometimes is the case. Such a rod could serve the function of equalizing the potential between cloud and earth almost as effectively as a good rod, and were there only a sufficient number of them it is conceivable that the neutralization of potential would be so complete as to make a flash discharge practically impossible. A building having one rod only, however, is considered at present. The rod is assumed as projecting considerably above the building. If the electric tension is great, unquestionably streamers are emitted, the air above the rod is made fairly conductive and thus the discharge is invited.

The question is then: "How can such a rod take care of a discharge " The discharge current frequently is very large and while the ohmic resistance of the rod is practically immaterial as long as it is at all reasonable, it must not approach or exceed the normal value of the impedance. In a rod, say, 30 feet long, the ohmic resistance of even the smallest practical iron conductor is a fraction of an ohm only and the impedance is perhaps 30 to 75 ohms, depending upon the height and frequency of the discharge. It is easily seen that a poor joint may have many times this resistance; therefore, when the discharge encouraged by the streamers from the defective rod strikes the building it finds the rod entirely inadequate to cope with the situation. The voltage drop in the rod is so great that it is far easier for the current to split up in a number of paths and enter through the building than to confine itself to the rod.

"How many rods should be used?" The answer is, the more the better. The protection afforded ought to be, roughly speaking, proportional to the number of earthed rods. Half a dozen ground connections to a house 100 feet by 50 feet seems nothing out of the way.

How should they be placed? They should always be placed outside of the building and it is indeed a question whether the vertical part of the system, that is, the rod proper, should not be some little distance from the wall and possibly even insulated therefrom. The rods should be a considerable distance from gas pipes, stove pipes, water pipes and balconies or places where persons might be during a storm.

A small house might be protected as shown in Fig. 1. There are five or six ground connections, one at each corner and one or two from the chimney. A horizontal rod follows the ridge of the roof and is connected to earth by the several ground connections.

Heated gases coming from a chimney are apparently themeslves good conductors, or more probable are instrumental in collecting and forming a path of charged particles constituting good conductor for lightning discharges. It seems conservative, therefore, to have a metal conductor crossing over the chimney opening. Such a conductor should be made of copper on account of the chemical effect of fuel gases on iron.

Two small spires each having many points are shown. These are unquestionably of some advantage in that through them there is a continuous equalization of the potential between cloud and earth. It seems, however, as if their height should be conservative. A projection of a few feet seems quite enough. To be effective in their office these spires should have several points; but the expense of using platinum or something similar seems hardly warranted, because the amount of current radiated from the points is significant before the "brush discharge" begins, and when such discharge takes place it matters little whether the points are rough or sharp.

Each tower or other projection of a building should have direct ground connection, though connected with the other lightning-rod system.

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* By Ernest J. Berg in the Engineering News.

In Fig. 2 is shown an unsatisfactory arrangement of rods. A small dormer is supposedly protected by an independent short rod connected by a long wire to the main system. It seems unlikely that the discharge would travel many feet to reach the main rod when by striking through the building it can reach ground in most cases with greater ease. The attic room, supposedly protected, is endangered by the rod. Protection would, however, result if the dormer rod were directly grounded.

Metal gutters should be connected to the lightning-rod system and should be connected at their lower extreme to ground.

A high factory or power-plant chimney needs good protection; two or three rods do not seem too many and the opening of the chimney should be crowned by some simple copper-rod construction.

"What kind of material should be used?" In cities, where after all the damage by lightning is small, there is always more or less fuel gas and soot in the air and copper seems best. But there is no electrical advantage in having a stranded cable—a solid rock is as efficient. There is a very slight advantage in a flat ribbon, but the advantage is very small and the mechanical difficulties with a ribbon are greater than with a rod.

In the country, galvanized-iron rods seem best for two reasons: (1) They are cheaper; (2) their electrical constants are, if anything, better than those of copper.

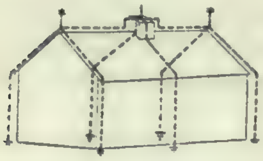


Fig. 1—Satisfactory.

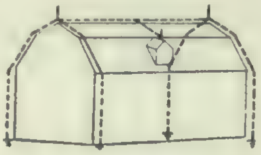


Fig. 2—Undesirable.

The old idea that the rod carries the electric charge to earth and that that is the end of it is fallacious. The earth is one plate of the condenser, the cloud the other, and whatever energy is stored between them has to be consumed in some way. It is done by heating the rod and by sending out electric radiations. The higher the resistance of the rod the greater is the energy converted to heat, and thus the smaller the number of oscillations of the discharge current necessary to dissipate the energy. Iron has considerably higher effective resistance than copper, and thus has an advantage.

Lodge's experiments and theory show conclusively that there is no advantage in copper over iron. Copper may have mechanical advantages under certain conditions, for instance in cities where the atmosphere is charged with soot and a variety of fumes. Galvanized iron has the advantage of cheapness, with a possible electrical superiority.

"What should be the shape and size of the rods?" While flat conductors have a very slight advantage, it appears too small to be considered seriously. A round wire or a pipe can conveniently be handled and seems therefore preferable. In the installation of the rods, sharp bends should be avoided as much as possible. There is little or no advantage in using large expensive copper conductors or cables. A size mechanically satisfactory is likely to serve all electrical purposes. Expensive sharp points offer little advantage over ordinary rather blunt points. The rods may advantageously terminate in a number a points projecting only a short distance above the part to be protected.

"How should ground connections be made?" They should be of low resistance, and therefore the rods should preferably terminate in moist soil. "Salting" the ground may be an advantage, but the experience with such grounds is not sufficient to warrant its adoption unless an occasional inspection is made. In many cases excellent connection can be made by driving a galvanized gas pipe a few feet in the ground.

"Should water, steam and gas pipes in the building be connected to the rods and grounded?" This is debatable. On the whole it would seem most conservative to leave them alone, especially the gas pipes. The water pipes, which are always grounded, may, however, advantageously be connected to the lightning-rod system under ground.

"Is it dangerous to stand in a draft during a thunder-storm?" A building having its windows and doors open certainly affords a chance for the entrance of air, perhaps ionized air made conducting by a previous discharge. It is, therefore, safer to keep the house closed during a violent storm.

"Is it safe to stand near a lightning rod?" From the preceding discussion this seems hardly safe. It is well to keep away not only from the rod, but from chimney, kitchen ranges, metal pipes, etc.

It is finally of interest to draw attention to the fact that the damage by lightning in cities is relatively small and that so far the modern sky scraper with its vast amount of steel appears to be lightning proof.

Surface-Oiled Roads in the Phillippines

THE use of a surface treatment of oil on the macadam roads of the Philippines is reported in the "Quarterly Bulletin" of the Bureau of Public Works as proving satisfactory even under comparatively heavy automobile traffic where proper attention has been given to the methods of application of the oil. Experiments have been conducted on small areas for some time and a study of the results of previous practice has led to several changes. Oil was applied to about 4½ miles of the Manila-South Road last January. Preparatory to the surface treatment of oil the road was broomed, but only the finer portion of the material was removed. No water was applied, as was done before, and the oil, spread in quantities approximately ½ gal. per square yard, was allowed to stand from thirty to seventy-two hours, until the surface was dry, before being covered with dredge-run gravel. Previous practice had been to cover it with sand from three to five hours after the oil application, and in this way much of the binder was absorbed by the sand covering and thorough penetration of the road base was prevented.

It has not been found necessary to use road rollers after the gravel has been spread, as the local traffic seems to consolidate thoroughly the binder and the surfacing. Previously the asphalt-like surface was oftentimes too thin to stand the traffic and would break through after a few months of use. Now there is no dust raised by the fastest moving automobile.

The Canadian Pacific Railway have completed their high-level bridge across the Saskatchewan River, from Strathcona to Edmonton, at a cost of slightly over $1,000,000.

The Layout, Design and Equipment of Industrial Works

By A. Home Morton

INDUSTRIAL works design is a special branch of applied engineering. It is not merely the design of the structure, of the power plant, or of the works equipment; it is all of these and more. It is the correct correlation of the human, mechanical and financial equipment of an industrial undertaking, and involves consideration of every problem which may arise from the conception to the realization of the scheme. No one is better fitted to study these than the engineer. A sound technical training combined with a keen insight into international industrial movements and the faculty of observation, are his basic qualifications.

Industrial engineers may be either professional designers, serving directly the interests of their clients, the principals in the scheme, or manufacturing designers selling their experience and manufactures to those principals. In either case the energies of the engineer-designer are essential to the birth of every industry, and his services to its continued progress. It is but reasonable, then, to expect that the creation of a new industry, or the organization of one already existing, ought to be first of all committed to the experience of an engineer-designer, either professional or manufacturing, and certain that command of this experience, when available prior to the inauguration of the industry, is of value infinitely beyond its cost. It is beyond doubt, also that these services must be paid for whether obtained from a manufacturing designer, or from a professional designer.

GENERAL CONSIDERATIONS

The stress of competition in modern industry demands efficiency with economy in every department. Industrial engineer-designers are, in consequence, frequently called upon to supplement estimates of the capital cost of a projected undertaking with estimates of the working costs, maintenance, and even of profits.

These demands in proprietors' interests, are, under certain conditions, legitimate and desirable, and the engineer-designer must be able to satisfy the proprietor with such estimates, accurate to within a moderate percentage. Careless estimating ought to be inconsistent with professional honor.

No practice is more to be condemned than that of encouraging proprietors to launch a scheme upon ill-considered and illusive estimates. An industrial undertaking is essentially an investment in which it is proposed to sink capital, perhaps the savings of private individuals, or, it may be, public moneys. Nothing then, ought to be permitted, either in the initial financial arrangements, or in the design of the scheme, which may, in the slightest degree, handicap its future chances of success.

Marketing a Profitable Output.—The first consideration should not be what capital can be secured, but what immediate output can be profitably marketed. This having been determined, the data ought to pass into the engineer-designer's hands to be worked up, and, in due course, be presented as a completely designed scheme for consideration by proprietors and their managers. From this design, embodying the works buildings, the works equipment, the power plant, and the area of site necessary, the several sectional costs and the probable total capital cost, can be determined to within a small percentage of probable error.

From these preliminary figures, the capital sum to be set aside for the works site can be estimated and available sites considered. Rough block plans of the works should be laid down upon the plans of the likely sites, and their merits and demerits should form the subject of a preliminary report, with special reference in each case as to:—

(1)—Labor, raw materials, and accessibility to markets.

(2)—Water, fuel, and other supplies.

(3)—Areas for storage, refuse dumping, and particularly extension.

(4)—Probable ground charges, rates and taxes.

To overlook any of these factors may prove a serious handicap to the future of the industry.

From these considerations it should be possible to fix upon the most convenient site, and immediately thereafter to form a close estimate of all costs, and draw up a complete general arrangement plan of the future works. This general arrangement may later be modified in detail, but it ought to be so complete and so carefully prepared that proprietors and their officials will be clear as to their liabilities and the works arrangement before anything has been spent on permanent works.

LABOR AND LABOR CONDITIONS

Due consideration of and for the worker is now being accepted as a sound business policy rather than as a mere economic idea or fad. The law of the land is becoming more stringent in its demands for the health and convenience of the workers. There is a tendency towards improved labor conditions and the reduction of physical drudgery by the introduction of aids to labor.

It must be clear that in order to secure not only quantity but quality of output, the interest and skill of the worker and the perfection of equipment must be alike maintained unimpaired. In engineering works, where modern methods hold, experts are employed who devote their energies to the regulation of the feed and speed of the high-class tools now generally in use, yet there is far too frequently in parallel with these efforts a marked lack of attention to the conditions of labor. Apathy among a body of workers, whether due to physical or mental depression, in consequence of unsatisfactory conditions, or discontent from any cause, may easily prove a far more serious loss to the management than even inefficient mechanism. Industrial efficiency cannot be expected unless the human and mechanical factors in the works equipment have both their maximum value. It is most important, therefore, that the labor conditions should receive attention equal at least to that bestowed upon plant and equipment. Consideration for the workers does not involve extravagance either in design or equipment, and, when judiciously carried out, yields a fair return.

If an industrial undertaking is to take its proper place in the international competition of to-day, it must be the subject of careful preliminary consideration, so that it may finally take shape as a well-designed and well-equipped works, complete with all necessary plant and fittings, properly situated in regard to its raw material and market, having a sound commercial organization and management, and provision for the health, comfort, content, and even education of its workers. Under these conditions it may be expected that there will be willing co-operation between employer and employee, and, if the existence of the industry can be justified at all, financial success.

GENERAL ARRANGEMENT

Successful general arrangement of industrial works presupposes practical acquaintance with the manufacturing process, and with the works plant. With this knowledge and his own special training, the engineer-designer should be able to build the works on paper and to see them in his mind's eye with every stage of the process in operation before the ground is broken.

It is also essential that the design of the buildings, the steel structure, the power plant and transmission, and the arrangement of the process plant should proceed simultaneously. Indeed, in the case of the two latter sections, it is essential that they should be considered in parallel. It is quite a common practice to have these separate sections designed by separate people and assembled under the supervision of the principals and their officials, but it seems almost needless to urge the advantage which must accrue if these can all be carried through under the direct supervision of one individual.

Influences Affecting Works' General Arrangement.—A works' general arrangement must be considered, first, with reference to the character and quantity of the output, and the limitations and disabilities of the site. Actual works designed to produce the same commodity on sites of varying form are found on examination to have similar essential areas, even although they may differ somewhat in arrangement. A relationship obtains between floor area and output which holds for average conditions over a considerable range in magnitude. To illustrate, the average percentage floor space in each department of four engineering works producing a similar commodity and in approximately equal quantities was noted to vary between ¼ per cent. and 3 per cent. as between the maximum and minimum percentages for each department. This gives to the designer what may be called an approximate formula for departmental areas in such works. In a similar manner, areas for yards, storage and refuse, can each be reduced to fairly correct relative values. These areas should, of course, be ratios of the total site, although only that portion of these areas required for the immediate output should form the works proper initially, the remaining area being left for extension. A well-arranged scheme of extension should form part of every original design.

The first essential to a general arrangement design is the "process diagram" and the second the "routine diagram."

The Process Diagram.—This is simply the enumeration in tabular form, or the graphical presentment of the several works processes. For example, in paper mills, the several processes are: sorting and cutting, dusting, washing, breaking, bleaching, beating, coloring, paper-making, drying, sizing, and glazing. When to a graphical diagram of a process of manufacture is added a complete schedule of the areas required to house the machines necessary to produce a given output, then a complete "process diagram" is the result.

From the process diagram and the basic areas already mentioned, the engineer-designer, with an intimate knowledge of the whole process of manufacture, and of the machines necessary to accomplish the process in each particular section, may proceed to prepare the "routine diagram."

The Routine Diagram represents graphically the flow of work in process. In preparing this, the following axioms should be kept clearly in view. Works should be so arranged that the material dealt with and manufactured shall flow through them in an orderly manner, in one direction, as far as may be, and without waste of time, energy or material.

The routine diagram is probably the most difficult part of works design. It involves the sequential arrangement of the machines within each department, and there after the laying out of the departments relative to each other. To carry this out successfully requires great skill and care, and probably much tactful discussion with the proprietors, managers, and foremen of the proposed works. From the detail data available, however, suitable approximate linear dimensions and heights for buildings may be fixed, and thereafter the manipulation of these blocks may proceed until the most satisfactory relative positions of departments are secured.

The routine diagram is complete when the several departments are arranged on paper, and the flow of work in progress through the departments is as nearly as possible perfect. The first design is rarely final. A large number of block plans, each having advantages, may require to be prepared before even a measure of satisfaction is reached, and the final plan is usually an amalgam of the leading features of several of the draft plans.

It may be said that this work could be done by the works proprietors or managers. Experience shows, however, that a good manager is not necessarily a good designer of works, even for his own trade. Every man works most efficiently when on the work for which he has been trained. Better then for the manager to take time from his own work only to point out briefly his requirements and the peculiarities of the trade or process to the engineer, leaving him to meet the requirements and solve the problems. There can be no doubt that an engineer-designer, skilled in this particular class of design, can, with very beneficial results, bring a fresh mind to problems, the solution of which may have become stereotyped, and import useful ideas from other trades which have come under his wider range of practice.

Power Transmission.—The transmission of power, like a great arterial system, conveying life to every department, is an integral part of the whole scheme, and it must be considered from that standpoint. If this be not done, then it may be that, instead of being so compactly arranged as to permit of direct driving by means of a single steam or gas engine, the works arrangement may be such that only electrical transmission (frequently misused to cover bad design) can be satisfactorily applied. The requirements of the power transmission system may sometimes modify the general arrangement, but in most cases, the method of power transmission will be fixed by the requirements of the general arrangement.

Transportation.—Other important factors bearing upon the general arrangement of a works or factory are railway communication lines, internal transport of materials, and general auxiliary equipment. The railway communication lines should be simple and economical in arrangement and at the same time adequately serve each department, provide suitable sidings, package, and storage lines, and yet maintain adequate through communication to all departments.

Entrance siding lines should, wherever possible, permit of the passage of a main-line freight locomotive to the more important section of the works, and where this is impracticable ordinary car sidings, served by a dummy engine, having a short wheel-base may be accepted. The means of internal transport may be by travelling cranes, power runways, hand runways, or bogie trucks, with or without tracks. All have their particular spheres of usefulness, and care bestowed upon their selection and installation is of value, since they are among the more important labor-saving appliances within a works. External transport, other than by railway lines, may be by overhead travelling cranes upon gantries, by travelling gantry cranes upon railway tracks, by locomotive jib cranes, by power runways or by cableways.

Auxiliary Equipment.—In addition there is a large assortment of what may be termed "auxiliary equipment" to be considered in parallel with the works' arrangement, such as water supply from bore well, river or local system, with probable treatment plant and filtration for works and boiler service and for drinking purposes; fire service, usually an independent ring water service, probably interconnected with some fire appliance of the sprinkler type; drainage divided into two sections, foul drainage direct to the local sewage system or to an independent treatment plant, and surface water, if pure, directly connected with the condensing plant and cooling pond; lighting, by electricity, high-pressure gas or oil gas; repair shops and tool rooms, stores, offices, and men's rooms, and many other minor departments.

POWER GENERATION AND TRANSMISSION

The subject of power generation and transmission in industrial works has been frequently and exhaustively treated in recent years. Tests have been made and comparisons drawn to prove the superior economy of practically every type of power plant and every transmission system, and it is true that after a full and impartial consideration of the relative merits of the three more important transmission systems, with reference to a particular works, it may be necessary to admit that each of them has some superior merits.

An interesting side issue bearing directly upon this question may be noted. The shop costs in a number of manufacturing establishments in the engineering and allied industries have been analyzed, with the result that the cost for power is shown to be only from 2 per cent. to 5 per cent. of the total cost of manufacture. This is a most important point. In other industries the ratio of the cost of power may be much greater or even less, but, in certain manufacturing establishments, a quite legitimate conclusion may be that the influence of power costs upon manufacturing costs is so stifling as to be nearly negligible. The narrow margin may on the other hand mean all that there is between profit and loss to the manufacturer. These facts lend weight to the statement so frequently made, that reliability, flexibility, and adaptability to the needs of the worker are more to be sought after in a transmission system than simply economy of operation. It is certainly true that a very modest reduction in the labor costs in most works, due to increased manufacturing facilities, may represent a handsome percentage, if not the whole, of the cost for power. The expansion which has taken place in the applications of electricity in industrial works has further proved that this aspect of the case exercises an important influence on the minds of manufacturers.

The following general statements are subject to modification under particular circumstances.

Each system of power generation and transmission has its particular advantages and superior economy, and maximum economy in works driving in a particular case may be obtained by a combination of two or more systems. The difficulty is usually not so much the selection of the system as the determination of the extent to which it should be utilized.

Dealing first with transmission systems. Where the plant is compact and conveniently arranged within a radius of, say, 100 or 150 ft. from the central power plant, mechanical transmission is most economical, while, with an increased radius, gas or electrical transmission has advantages, the former being the most enticing system from the point of view of thermal efficiency, but meantime having a more limited application. Where tools are set widely apart, electrical transmission with independent motors is economical, although where it is possible to have a group of tools in a works, an independent gas engine or electric motor driving these through gearing is more economical than independent motors.

Where the amount of power required for individual machines is small, it is almost always advisable to group them. By examining the published descriptions of the electrification of several large engineering and shipbuilding establishments, it will be found that the average size of motor is steadily rising.

The question of reliability and consequent need for stand-by plant is also important. Practically any one of the systems, if properly installed, can be regarded as reliable, but the subdivision secured by the use of motors or small gas engines has advantages.

The chief advantages of the electrical transmission system are its adaptability and the ease with which it can be extended, and its chief drawback is its cost, a part of which, at least is due to the refinements which have been introduced into electrical controlling and operating mechanism.

The question of transmission, depends for its solution upon the conditions of service. Where the power demand is very intermittent, purchased electrical energy has advantages over all other systems, although for dock pumping, slipway haulage, and other heavy intermittent loads, gas engines, using city gas, are very economical in use. For a moderately steady demand up to about 100 to 150 B.H.P., the suction gas engine has no rival. Above this load it is possible to purchase steam plants using highly superheated steam, which can generate one I.H.P. per hour, at a fuel cost of little over 1 lb., and a steam cost of approximately 8½ lb.

Where an electrical transmission system has been decided upon, the purchase of current demands first and most careful consideration. If a private plant is decided upon, then the generators may be either steam or gas-engine-driven. The units, in the case of gas-engine-driven generators, may be of practically any size desired, while steam-engine-driven units may be reciprocating engines up to 750 kilowatts, and steam turbines thereafter. Interesting results can be got from the combination of reciprocating engines with steam turbines, a combination of this character giving a wide range of economical load at a modest capital cost, this advantage being obtained by cutting out the turbine from the lower loads and exhausting direct from the reciprocating sets to the condensers.

The sphere of usefulness of the large power gas engine is confined mainly to situations where so-called waste gas can be obtained, as at coke ovens and blast furnaces, or where chemical plant already is installed. Where waste gas is available, the large-power gas engine is in many ways desirable.

DESIGN AND CONSTRUCTION OF THE WORKS STRUCTURE

It might be argued that the design of the works structure—that is, of the buildings and sheds, should be left in the hands of an architect. Works buildings, however, are designed in the first place to withstand the special stresses to which they may be subjected in service, and effectively and economically house the machinery and power transmission plant. Detail consideration of these matters does not enter into the architect's training. For this reason the design of industrial works and factories, in all its details, ought to be left to the engineer-designer with the proviso that he is not at liberty to perpetrate an offence to the public eye.

The essential feature of all industrial design should be simplicity, utility, and efficiency, combined with low first cost and durability. These features should be apparent, whether in the design of the power plant, of the electrical installation, or of the structure. The simplest manufactured details readily procurable from stock ought to be used for all details, unless these are quite unsuited to the purpose of the designer. Steel structural work, even more than builders' work, ought to be characterized by simplicity and well-placed material. Artistic or eye-pleasing effect can always be obtained by correct design, carried out in suitable materials on well-balanced and simple lines, carefully arranged and well-proportioned, without useless and meaningless ornamentation. Nothing can be truly artistic or eye-pleasing which violates the principles of design, or misuses material.

Formerly, works had massive stone walls and timber roofs. To-day the steel structure has displaced the older materials almost completely. In factory construction, reinforced concrete is coming more into use, and some very beautiful structures have been erected in reinforced concrete with brick filling; this class of construction, especially where brickwork is also reinforced, is particularly satisfactory.

The question of economy in first cost may have greater influence on the class of construction than is warranted, and may lead to the adoption of timber. The cost of maintenance and the fire risk with the ordinary form of timber construction, combined with the relatively shorter life, are strong influences against its adoption. Granting, however, that an all-timber, or brick and timber structure is lowest in first cost, then an all-steel construction, with corrugated iron sheeting, is next in order of economy, while brick and steel construction is usually rather more expensive.

For a permanent factory or works, however, where a manufacturing process is to be carried on under shelter, a steel structure with brick walls, either built or filled, is almost universally adopted where the manufacturing process is of such a nature that absolute protection from wind and weather is not of first importance.

Stresses on Buildings.—With travelling cranes and shafting, the consideration of internal stresses is important, because any excessive movement in the structure will bring about shafting troubles, and any lack of rigidity may quite easily have a serious effect upon the operation of travelling cranes. The stresses due to the stopping, starting, and running of high-speed travelling cranes are very considerable. A point frequently neglected, in designing sheds where cranes are in use, is effective diagonal bracing of the structure to prevent racking, through end-travelling on the one hand and cross-travelling on the other.

The external forces to which an industrial structure may be subjected are wind and snow loading. Generally speaking, if a structure is designed to resist the side and roof stresses from wind loading, and to have a fair margin of safety, any snow loading which may arise can be neglected. A very great deal of work is being put up, even to-day, which can only be said to withstand the wind stresses to which it is subjected by courtesy of an indulgent Providence, and, on the other hand, there is a large amount of work being made of an unduly extravagant character. A well-designed roof-truss, having its ends thoroughly connected to the roof girders, having good spreading plates, moderate purlins, and a corrugated sheet roof well and properly laid, must by itself, by virtue of the continuity of the roofing, be a reasonably well-braced structure. The value of a roof, whether of timber or of corrugated iron, as what might be termed wind bracing, is considerable, and given sound end connections it is somewhat difficult to see the reason for the adoption of an elaborate system of longitudinal or diagonal wind ties across the lower members of the roof frames.

In buildings in which there are cranes, the area between the main pillars and under the crane beams may be left quite clear, since if the pillars are stiff enough, and their strength is carried through on the top of the crane beams, and if, in addition, a moderate amount of diagonal bracing is introduced above the crane rail level, then the upper part of the structure between the crane and roof girders virtually becomes a deep lattice, having the crane girder as its lower member, the roof girder as its upper member, and the continuation of the pillars carried up to take the roof as its end members, the lattice bracing filling the intervening space. With such a structure, the resistance to the heavy stresses set up by the travelling cranes is usually well provided for.

In general with long spans, if bracing is carried down in a vertical plane from the lower member of the roof tie to the roof pillar, and sideways in a horizontal plane from the same lower member to the roof girder, these diagonal connections tune up the whole structure in a reliable manner.

Under the industrial conditions which hold to-day and are becoming increasingly stringent, no manufacturer building or reconstructing works or mills can afford to neglect the technical skill which is at his disposal, quite irrespective of cost. It may be argued that a works manager or proprietor knows most about his business and its needs. But it can quite legitimately be argued that the proprietor's business may be the mining of coal, the manufacture of iron or steel, of ships, of chemicals or of textiles. In that sphere he works at his best, his efficiency is a maximum. In the design of buildings, the selection of power plant, or even the economical arrangement and correlation of these, he is at a disadvantage.

Whether this disadvantage is serious or may only involve a permanent tax upon his business, when accepted, must be left to his own judgment. The author merely calls attention to the fact that those industries which hold a world-wide reputation in America, in Germany, and even in Great Britain, have in every instance had the advantage of being originally designed or reconstructed at some point in their recent history by experts in collaboration with engineering skill either manufacturing or professional. As already pointed out, the skill and energies of the engineer are essential to the birth and growth of every modern manufacturing industry.

Painting Cement

THE painter of modern times, when called upon to paint a cement building, naturally stops to give the matter his most serious thought, taking into consideration the various factors which would have some effect upon the life of his work. The porous property of the cement makes it a material which absorbs water readily, and in a rainstorm the walls of cement buildings soak up large quantities of water which sometimes makes the buildings very damp and unhealthy. This trouble, of course, will be overcome if the paint used is a good one, and is properly brushed on. If the foundations of the building are of cement they have probably been waterproofed on the outside (below ground) with hot coal tar of gas pitch swabbed on in thick layers between alternate layers of tar paper, or with some specially prepared waterproofing solution. This waterproofing of the under structure is generally done by the cement masons, and if properly carried out will give assurance to the painter that the walls above ground will not be troubled with any water, which might, under a head of pressure, push through untreated side walls and work up into the exposed part of the building.

Style of Finish Must Be Considered

The style of exterior finish of the building to be painted is also a factor which demands the painter's special attention. Some of the finishes used today are termed rough sand finish, floated surface, smooth trowelled surface, and pebble dash. These different finishes absorb different amounts of paint, and the painter must, in making his estimate of cost, make a test to determine the spreading capacity of the paint that has been selected for the job. This can be done upon a small area of the building ten feet square (100 square feet). The amount of paint required to cover such an area, either one, two or three-coat work, can then be used in calculating the amount of paint required for the whole surface of the building, the area of which should be carefully measured.

The time required to paint the 100 square feet of the test area should also be taken, as the painting of cement requires a much longer time than the painting of wood. This is due to the porous nature of the cement, every little surface pocket of which should be filled with the paint. With the information gained from such a test, the painter can make a safe estimate of the cost of the work. The painter who considers it unnecessary to make such a test and who bases the cost of painting cement entirely on guesswork or upon assumption that it is the same as painting wood, is apt to find himself doing the work below cost.

Cement buildings which are allowed to remain unpainted for a year or so. present the most satisfactory surfaces, as the action of the weather upon the cement makes it thoroughly hard and practically free from salts, which might prove destructive to oil paints. Sometimes, however, the painter is called upon to paint cement buildings right after the cement is set up and in a green condition, even before it has had a chance to become thoroughly hardened. In such cases the application of paint is apt to turn out badly, as the alkaline salts in the cement will be carried out by the water present, to the very surface upon which the paint is applied. The paint may then become streaked and scale off. These conditions were described by Charles McNichol, a painter who read a paper on the subject before the International Association of Master House Painters. He stated that the use of a twenty-five per cent. solution of zinc sulphate could be brushed on a damp wall of fresh cement, and that this treatment will entirely neutralize the alkaline salts and put the surface of the cement in excellent condition to be immediately painted with a good paint. This method has been worked successfully on many buildings, and its author is to be complimented upon having given his brother painters the benefit of his knowledge and practice.

Effect of Alkaline Salts

Walls or surfaces of new cement buildings often show white patches where the alkali salts are concentrated. It is over such spots that the fading of cement paints is first shown, and the safest way to prevent such trouble when new cement walls are painted, is to treat the whole wall previous to painting, by the above described process or some similar process which has been carefully tested.

Heavy varnish should not be used as a size for damp cement walls, as it makes a thick film that will not let the water out, and peeling in whole sheets would probably follow such a method. This leads to a feature of the subject which is most important. A cement paint to be efficient must provide for the escape of any water or moisture in the cement, otherwise the water will be drawn out when the cement becomes warmed by the sun and the paint will blister and peel. A dull finish paint such as the painter would produce by thinning a good cement paint with turpentine or naphtha, is generally preferred on cement walls. Such a paint would make the surface sufficiently moisture-proof and would not form a coating that would prevent the exit of moisture from cement. Although white paint is mostly used upon cement, any good permanent color may be used, especially if the surface is first washed, as previously described.

Lime-proof colors are now used for coloring the best grades of cement paints, thus making the paints unfading, even when painted upon cement walls containing lime.

Fire Hazard of Floor Openings

The fire hazard of floor openings to accommodate belt or rope drives has not been as fully appreciated as the safeguarding of vertical openings through floors at stairs and elevators by placing them in towers well cut off from the remainder of the building. The protection of belt openings has been handicapped by the lack of a construction suitable for use in mill buildings where the belt or rope towers were not provided for in the original design. Partitions of expanded metal and cement construction, 2 inches or more in thickness, have been found well adapted for the inclosure of such main drives in existing buildings. These cement partitions, it is said, can be installed at a cost not greatly in excess of combustible forms of construction.

The Decorative Value of Tile Flooring

Opportunities Afforded the Designer and Setter—Possibilities of Variety in Pattern and Elaboration—Importance of Joints

By A. B. LeBoutillier

TILE floors have a practical value; they also have great decorative value, and it is with the latter that we are at present concerned. Owing to the peculiar limitations of the material and the methods of manufacture, tiles are necessarily small units. To cover a large surface with these units, obviously requires numerous joints. Therefore, the joints, as well as the tiles, should be given importance in the design. From a designer's point of view, the limitations of a material are its greatest asset, each material requiring its own peculiar treatment.

Not many years ago, all the tiles that were available for floors were of the machine-made variety, so perfect in workmanship that they could be laid in a floor with joints of a hair's breadth. These tiles were made in a variety of shapes and colours, but it was useless to lay out a pattern in one colour, because the pattern of the joints could not be discovered without close inspection. If pattern was to count, it was necessary to use colour, and the effect was generally hard, dry, and uninteresting. Conditions have since changed, and we have come to realize the value of the joints. It is seldom necessary to lay a floor of plain tiles with joints less than one-quarter of an inch in width. Whether these joints are left the natural colour of cement, or are coloured, they will always count in the design, and the slight unnevenness of the tiles themselves will give a texture that is not as hard and uninteresting as the floors of mechanical perfection.

The character of the building and the location of furniture and rugs affect the design of the floor. If the floor is in an important room of a monumental building and is free from large pieces of furniture, it may well be treated so as to be in accord with the architectural treatment of the walls, but if there is to be much furniture and many rugs on the floor, it is better treated as a whole. This is a point that is often lost sight of in railway waiting rooms and restaurants.

Church floors afford as great an opportunity for tile work as the windows do for stained glass. Much could be said on this subject alone, but it is sufficient here to make the following observation: The nave aisles should be simple, the choir somewhat more elaborate, and the sanctuary very rich in pattern, symbols, and colour. In short, the elaboration increases as the altar is aproached.

It is not necessary to use large tiles in a large room to get scale, as the tiles can be arranged so that the unit is composed of several small tiles, and the scale of the pattern increased or reduced at will.

It is not essential that all the tiles laid in a floor come from one factory. Herein has the tile setter great advantage, especially in coloured tiles. In the matter of shapes and designs, clay is so easily moulded that there is almost no limit to the variety that the smallest factory can produce. It is in the matter of glazes and quality that manufacturers differ.

There are many patterns that have been common property ever since the beginning of tile making, and are to be found, with slight variations, in many tile manufacturers' lists. New designs can be readily produced and old ones revived; the process is simply a model in clay or wax, from which a plaster mould is made, then the clay pressed in by hand, removed from the mould, dried and baked; a simple primitive process, to which tiles owe much of their charm. The difficulties are in composition of the clay and glazes; these, of course, it is assumed, have been overcome by the manufacturer.

The ideal method of designing a floor is to arrange a general scheme and then lay out the details on the job, changing and rearranging details as occasion arises. This, of course, requires an artist as a workman—and there are such—or constant supervision. This is not always possible, but when it is done, the result is spontaneous, and free from the mechanical look that might come from a hard and fast plan laid out on the drawing board.

By the use of colour in pattern, and pattern in individual tiles, there is almost no limit to the richness and elaboration possible for tile floors, but on the other hand, it is also possible to make an interesting floor of plain tiles in one colour by taking advantage of the joints.

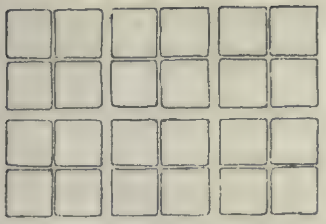
The diagrams will serve as reminders that the joints are of equal importance with the tiles.

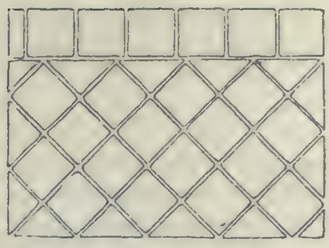
Excavation Under Water

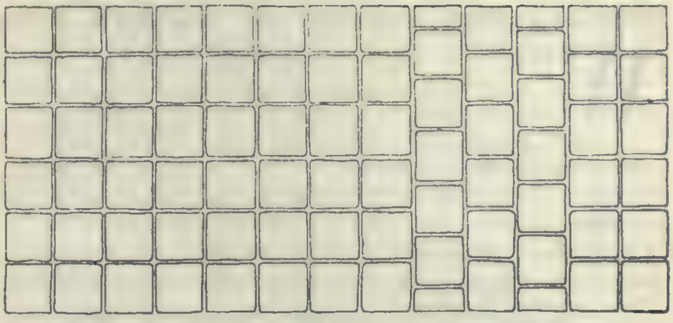
Heavy submarine excavation will be required for the Government dock at Vancouver, B.C., for which appropriations sufficient to cover the first year's construction have already been allocated. The new dock is to cost between $1,500,000 and $1,750,000 and is to be completed within two years. It will be 800 ft. long and 300 ft. wide, and the berthing slips on each side will be 140 ft. wide, dredged to a depth of 36 ft. at the lowest water. It will be necessary to excavate about 125,000 cu. yd. of material below low water before actual construction can start. Solid rock in excess of 100,000 cu. yd. will have to be drilled and blasted under water, it is said, in depths varying from 5 to 36 ft. When the excavation is complete twenty-three large timber cribs are to be built in drydock, sunk at the required points and then filled with broken rock. On top of these cribs a sawn-timber foundation requiring 11,000,000 ft. b. m. is to be laid and topped off with a layer of concrete. Upon this composite foundation a retaining wall is to be constructed.

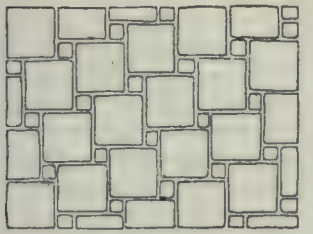
Architects Commend Brick

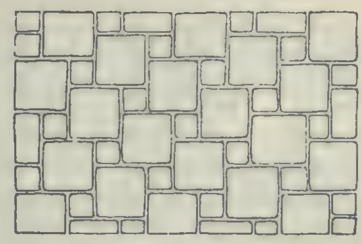
After exhaustive research and thorough investigation including the severest fire and water tests that could be applied to building construction, we do not hestitate to say that brick work far surpasses any other form of construction work known to science. Either structural steel or concrete measures up to commercial tests, or originally known, but where these materials have been subjected to extreme heat and streams of water have been applied to buildings constructed of these materials, under these conditions, the results have been disastrous.—Year Book, American Society of Architects.

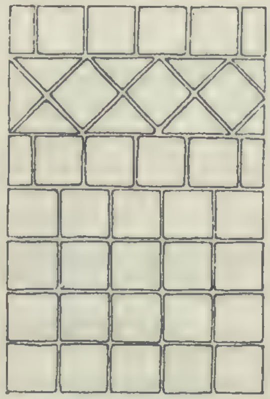

By groups of four squares as a unit separated by wider joints, the scale is increased.

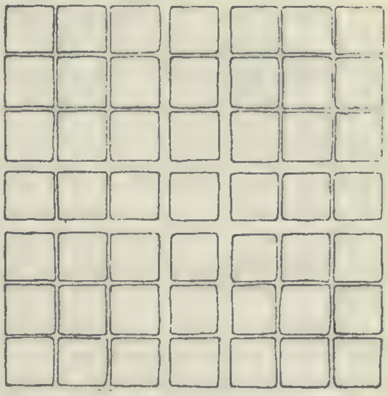

A diagonal pattern of square tiles is emphasized by a border.

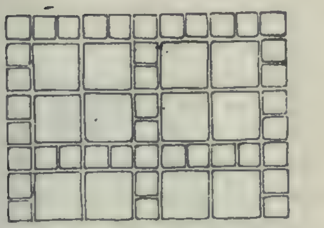

By a few rows of broken joints, an effect of border is produced in a field of square tiles.

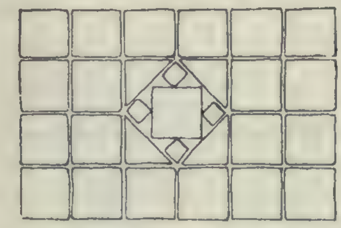

When the small squares are less than one-quarter of the area of the large squares, the pattern runs off at the side.

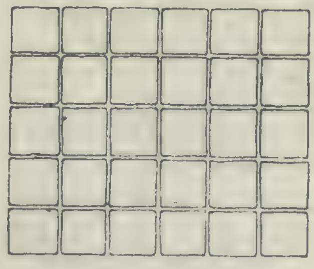

When the small squares are one quarter of the area of the large squares, the pattern has more repose.

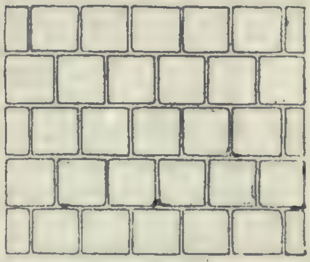

By breaking joints in one course, the border is made wide.

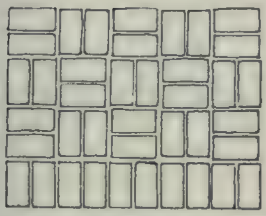

An arrangement adapted to large rooms.

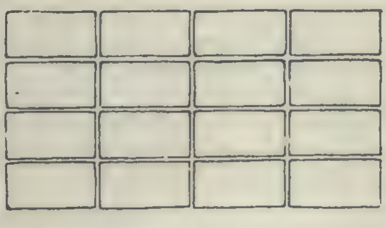

Another way to increase the scale with small tiles.

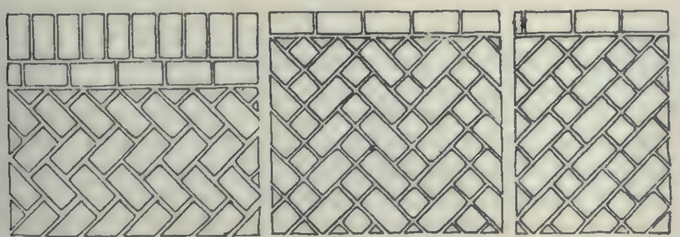

A decorative pattern that can be made on the job.

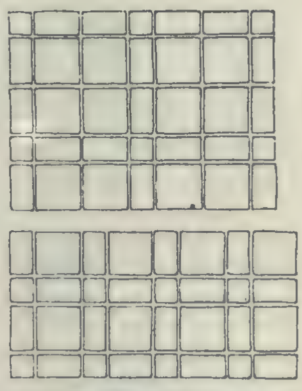

The simplest floor of square tiles is interesting if the joints are in scale.

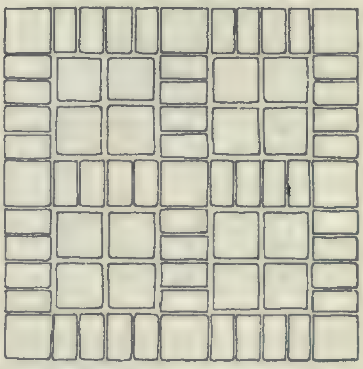

When square tiles are laid with broken joints, long lines in one direction are the result.


When double squares are laid "basket pattern," the necessary allowance for joints adds interest.


A good pattern for corridors.


Varieties of "herringbone."


Two combinations suggesting plaids.


A simple device for a panel or a floor for a large room.

THE DECORATIVE VALUE OF TILE FLOORING

Standard Specifications for Building Brick

With the time approaching for the annual meetings of the various clayworking associations in Canada, it is timely perhaps to present the following report which was submitted recently at the annual convention of the American Society for Testing Materials and held for further consideration:

At the twelfth annual meeting of the Society in 1909 this Committee, designated at that time as Committee D, submitted a report including some suggested specifications, which were offered for use but not intended, at that time, for adoption. The lack of accurate knowledge regarding the properties of brick, the methods of testing them, the relations existing between the properties which could be measured and their influence in the finished structure, compelled the Committee to refrain from any definite recommendations. This condition has continued during the succeeding years and little progress has been made. In 1911 the Committee was considerably enlarged and organized into two sub-committees, one on building brick, the other on paving brick. A program outlining a series of investigations was formulated and has through the co-operation of some of the manufacturers and testing laboratories progressed sufficiently to yield some reliable results. It is hoped that during the coming years a greater number of laboratories may become interested and assist in the collection of much needed data.

The University engineering laboratories and the laboratories of large companies have during the past twenty years devoted a large amount of energy and money to the investigation of steel and steel products; the new and attractive alloys; cement and cement products; and built-up members involving these materials in their construction.

Brick, the most extensively used structural material in the country, and ceramic materials, such as hollow tile, terra cotta, fireproofing and the mortars used with them, forms one of the most fertile fields for engineering investigation.

Building Brick

In the preparation of the following suggested specifications the Committee has felt that its chief aim should be to provide methods for contractual testing.

The numerical requirements included in the suggested specifications are therefore limited to those properties upon which the Committee has at the present time sufficient information to enable it to indicate reasonable values. The transverse test and the numerical values for the compressive strength after freezing and thawing have been omitted for the lack of sufficient data. The Committee recognizes the value of these tests and expects to obtain information on them during the next year. As a comparative test between different kinds of brick the transverse test may be considered as a modified tensile test to determine the cohesion of the materials and to form a valuable estimate of their relative resistance to transverse action in a structure when subject to uneven bearing, settling and temperature changes. It also assists in the determination of the effect of various kinds of lamination.

For the purpose of making comparative tests and for the proposed investigations of the Committee, the following methods are suggested:

Transverse Test

At least five brick shall be tested, laid flatwise with a span of seven inches, and with the load applied at midspan. The knife edges shall be slightly curved in the direction of their length. Steel bearing plates, about ¼ inch thick by 1½ inch wide, may be placed between the knife edges and the brick. The use of a wooden base block, slightly rounded transversely across its top, upon which to rest the lower knife edges is recommended. The modulus of rupture shall be obtained by the following formula:

$R = \frac{3 W e}{2 b d^2}$, in which e is the distance between supports in inches, b is the breadth and d the depth of the brick in inches, and W is the load in pounds at which the brick failed.

There can be no question of the far-reaching value of the freezing test since information of this nature referring to all of stone-like building materials is urgently needed. If the freezing test is desired, the Committee suggests the following method:

Freezing Test

At least five brick shall be dried as specified under "Sampling" below, weighed and immersed in water which shall be raised to boiling in not less than 30 minutes, boiled for 30 minutes and then allowed to cool between 60 deg. F. and 80 deg. F. The specimens shall be immersed in water below 40 deg. F. for not less than one hour, then transferred to the refrigerator and supported in such a manner that all be exposed. They shall be subjected to a temperature not above 20 deg. F. for at least four hours, then removed and placed in water at a temperature between 60 deg. F. and 80 deg. F. and raised to boiling. The freezing and thawing operation shall be repeated twenty (20) times, after which the brick shall be dried as before and weighed. The condition of the bricks shall be noted before and during the test and all visible changes recorded. If it is desired to express the loss of weight in percentage, it shall be computed upon the dry weight.

Classification

In attempting to establish values in the "Requirements," the Committee has been confronted with the difficulty of not only having to meet the numerous uses of brick but the wide divergence in various parts of the country on account of the different natural materials available for manufacture. The difficulty has been overcome by forming a classification which, it is believed, will meet these conditions.

SUGGESTED SPECIFICATIONS

Sampling

For the purpose of tests, brick shall be selected to represent the commercial product by an experienced person agreed upon by the parties to the contract. All brick shall be carefully examined and their condition noted before being subjected to any kind of test.

For the purpose of tests ten (10) brick will be required, which shall be thoroughly dried to constant weight in a suitable oven at a temperature of from 225 deg. F. (107 deg. C.) to 250 deg. F. (121 deg. C.).

Compression Test

Compression tests shall be made on at least five (5) half brick, each taken from a different brick. The half brick shall be prepared either by sawing or by breaking upon yielding bed with a sharp mason's chisel which shall be the full width of the brick. To secure a uniform bearing in the testing machine they shall be bedded in a thin coat of plaster of Paris, spread upon a plate glass surface coated with a thin layer of oil. The brick shall be pressed firmly upon the surface, making the layer as thin as possible, and remain undisturbed until set. Before applying the plaster of Paris, the bearing surface of the brick shall receive a coat of shellac. Recessed or paneled brick should be brought to full bearing surface by filling the depression with neat Portland cement mortar, which shall stand at least 24 hours before the plaster of Paris is applied.

The machine used for the compression test shall be equipped with a spherical bearing block kept thoroughly lubricated to insure accurate adjustment, and the adjustment should be made by hand under a small initial load. During the test the beam of the testing machine must be kept constantly in a floating position. The breaking load shall be divided by the area in compression and the results reported in pounds per square inch.

Absorption

At least five dry brick shall be weighed and completely submerged in water at a temperature between 60 deg. F. and 80 deg. F., the water heated to boiling within one hour, boiled continuously for four (4) hours, then allowed to cool in the water to a temperature between 60 deg. F. and 80 deg. F. They should then be removed, the surface water wiped off with a cloth and the brick quickly weighed. The percentage of absorption shall be computed on the dry weight.

Requirements

Class A.—Vitrified Brick. Average compressive strength, not less than 5,000 lbs. per sq. in.; minimum comp. strength of any specimen in test, not less than 4,500 lbs. per sq. in.; average absorption, not more than 5 per cent.

Class B.—Hard Burned Brick. Average compressive strength, not less than 3,500 lbs. per sq. in.; minimum comp. strength of any specimen in the test, not less than 3,000 lbs. per sq. in.; average absorption, not more than 12 per cent.

If subjected to the freezing test, they shall not show cracking or serious spalling in any of the bricks tested or serious disintegration of the material.

Class C.—Common Brick, First. Average compressive strength, not less than 2,000 lbs. per sq. in.; minimum comp. strength of any specimen in the test, not less than 1,800 lbs. per sq. in.; average absorption, not more than 18 per cent.

If subjected to the freezing test, they shall not show cracking or serious spalling in any of the bricks tested or serious disintegration of the material.

Class D.—Common, Second. (These bricks to be used only for backing up and for interior walls involving small loads.) Average compressive strength, not less than 1,500 lbs. per sq. in.; minimum comp. strength of any specimen in the test, not less than 1,200 lbs. per sq. in.

Miscellaneous

Any brick other than clay brick may be included in Classes A, B and C, provided they meet the specified requirements and when the freezing test is required, it shall not show cracking or serious spalling in any of the bricks tested or serious disintegration of the material.

Standards with Reference to Sewage Treatment*

By T. Aird Murray, M. Can. Soc. C. E.

WITHIN the last two or three years there has developed in Canada a strong desire to conserve the purity of inland waters by preventing the discharge of raw sewage effluents. Several provincial governments have enacted legislation making it imperative that any scheme for the sewerage of an urban district shall be accompanied by a scheme for the satisfactory treatment of the resultant sewage.

The engineer when called upon to make surveys and plans for a system of sewers finds that it is no longer the simple question of providing underground channels with suitable grades and a final effluent point into some stream, ditch or sheet of water forming the natural drainage level of the district, but that he has also to design some form of works or plant which will have the effect of so changing the character of the raw sewage that it will at least meet the requirements of a Provincial Health Department. Naturally the engineer before he commences to make plans for any particular design of sewage disposal works is inclined to ask the provincial authority to state what it expects and will insist upon with reference to degree of purification and manner of sewage treatment. The engineer is anxious to know that his efforts in preparing plans are based upon what may be accepted lines and that his scheme when submitted will not be rejected for non-compliance with certain standards of required efficiency.

The engineer is generally somewhat surprised to find that these provincial health authorities have no hard and fast rules with reference to any fixed standards applying to the question of degrees of purity of sewage effluents, but that the golden rule appears to be that there is no rule.

There appears to be sufficient evidence connected with the history of sewage disposal methods and administration to warrant the conclusion that it is impossible to adopt any general standard of required degree of purity, and that each case under consideration requires separate adjustment with reference to local conditions and requirements. The importance of the consideration of local conditions cannot be exaggerated, especially with reference to this country where we have certain conditions which are peculiarly inherent, and are not found to the same extent in most other countries where sewage disposal methods are in vogue.

The fact that certain methods and principles have been more or less adopted in Great Britain, Europe and the United States and found more or less successful, allows of no definite conclusion that such methods and principles will be equally successful in Canada. To take an example,—we find in Great Britain that the underlying principle which demands sewage disposal is entirely apart from any pathogenic consideration whatsoever. Methods of sewage disposal in Great Britain do not include any claim for the elimination of, say, typhoid infection or protecting sources of domestic water supply. Apart from the city of London no other large British city depends upon its water supply from sources open to or subject to sewage pollution. Sewage disposal, or sewage treatment, is not enacted in order that the rivers and streams may be less dangerous from a pathogenic point of view, but merely that their aesthetic value be maintained and fish protected by conserving the oxygen supply natural to the waters. Since the question of sewage disposal has been agitated in Canada it can be safely stated that medical men connected with public health questions have shown greater practical interest in the subject than all others put together. Generally, engineers have been apathetic and have shown little desire to trouble with a subject presenting many disputed and unknown factors. Politicians have fought shy of the question, and have not been sure of it as a vote-getting machine. Those responsible for municipal administration have not been enamoured with the idea of spending sums of money with no direct prospect of profit, and in simply doing something for the benefit of the other fellow further down the stream. Now it cannot be said that the medical health official has been actuated by his interests in fish life or to any great extent by the preservation of aesthetic values, but on the other hand he is directly interested in the reduction of mortality rates and the elimination of zymotic diseases. Dr. Chas. Hodgetts and others, over and over again, in referring to the necessity of legislation to prevent sewage pollution of inland waters have referred to the high typhoid mortality rate in Canada as compared with Great Britain and other countries.

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*Paper read before The Canadian Public Health Association, Regina, Sept., 19, 1913.

In approaching this question of sewage disposal, the point of view of the medical man appears to be generally accepted by the Canadian public. It appears reasonable to assume at the present time, that, if the public were told that efforts towards sewage disposal were not calculated to guard the purity of sources of domestic water supply, were not calculated to eliminate or decrease chances of disease infection, but were merely to provide against aesthetic nuisance, it would then be very difficult indeed to obtain the passing of a by-law in favor of any expenditure in this direction.

Yet, this medical point of view with reference to sewage disposal has met with no consideration in Great Britain, with only a little consideration in Germany, but with perhaps a fair amount of consideration in the United States.

In discussing any possible standards relative to purity of sewage effluents, we must first determine exactly why we are treating the sewage and what particular interests we are guarding in preventing raw sewage from entering any body of water.

Again, as an example of peculiar local conditions, we have our prolonged winters during which oxygination of inland waters practically ceases and fermentative and putrefactive processes become dormant. It does appear that in approaching this question of standards we must be careful to give full weight to general Canadian and local conditions as compared with those of other countries where certain basic and working principles have found particular favor.

Conclusions of Royal Commission

The conclusions of the Fifth Report of the Royal Commission on Sewage Disposal (Great Britain) par. 355 headed "Tests for Sewage Effluents in Relation to Standards," state in part, "According to our present knowledge, an effluent can best be judged by ascertaining, first, the amount of suspended solids which it contains, and, second, the rate at which the effluent, after the removal of the suspended solids, takes up oxygen from water."

"For the guidance of local authorities we may provisionally state that an effluent would generally be satisfactory if it complied with the following conditions:—

"(1) That it should not contain more than 3 parts per 100,000 of suspended matter; and

"(2) That, after being filtered through filter paper, it should not absorb more than:

"(a) 5 parts by weight per 100,000 of dissolved or atmospheric oxygen in twenty-four hours.

"(b) 1.0 part by weight per 100,000 of dissolved or atmospheric oxygen in forty-eight hours, or

"(c) 1.5 parts by weight per 100,000 of dissolved or atmospheric oxygen in five days."

Here we have a provisional general standard advised which takes cognizance only of the amount of suspended matter intercepted, and the stability of the organic content relative to its affinity for oxygen. The aesthetic nuisance is guarded against by the interception of solids and fish life is preserved by ensuring a chemically stable effluent.

Par. 304 of the above Report states:—

"We observe that previous commissions have reported that, of all the processes which were proposed for the purification of sewage, or of water polluted by excrementitious matter, there is not one which is sufficiently effective to warrant the use, for dietetic purposes, of water which has been so contaminated, and the 1868 commission stated that, in their opinion, 'rivers which had received sewage, even if that sewage had been purified before its discharge were not safe sources of potable water.' We, therefore, conclude that the framers of the Rivers Pollution Prevention Act, 1876, did not contemplate that local authorities should be required so to deal with their sewage that the rivers into which the purified sewage flowed might be regarded as safe sources of water supply, in cases in which the water was not to be filtered before distribution."

Par. 305 states,—"In our opinion much the same position must be taken up today. Although the methods available for the purification of sewage are more numerous than when the 1868 commission reported, our examination of a very large number of effluents from sewage farms, and from artificial filters of various kinds shows that although such effluents may be very good as judged by chemical and physical tests, they are generally liable to contain large numbers of micro-organisms of intestinal derivation, and that if such organisms are to be destroyed, or eliminated, the effluents must be subjected to some treatment additional to that which is ordinarily employed." Again, par. 309 states, "We are satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly to purify the water before distributing it to their customers. Par. 310 goes on to state further, "Apart from the question of drinking waters we find no evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of knowledge, we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

It must be perfectly clear and apparent that if British standards are to be accepted as applicable to Canadian conditions, that there is no necessity to demand any more efficient standard of purification than may be obtained by mere screening in discharging raw sewage into the great lakes. The ratio of fresh water to sewage is so great that dilution will prevent any nuisance either of a chemical or physical nature. Again, British standards if applied to our larger rivers will make sewage disposal a comparatively simple and easy matter to deal with.

Referring to Professor Dr. Dunbar of the Hamburg State Hygienic Institute (Principles of Sewage Treatment, page 239) "In the case of rivers which serve as sources of water supply, attempts should be made to restrict the infection to a minimum. In the case of rivers which are not used as sources of water supply, bathing places will have to receive consideration, as well as the river population, and the fact that the water of such rivers may come into contact with food destined for human consumption, as in washing of milk pails, the rinsing of vegetables, etc. In all cases where it is a question of discharging sewage into a river, the possibility of spreading infectious diseases must be considered. In certain circumstances it will be necessary to adopt measures for the separation or destruction of the infectious germs either permanently or temporarily." This view as expressed by Dunbar appears fairly to represent the medical health point of view in Canada. Is it the correct view? Are our conditions here in Canada of a nature that they demand an entirely different general standard of purification from that accepted in Great Britain? The author of this paper has always shared this view, which he takes the liberty of calling the "Canadian Public Health View."

George W. Fuller in a recent publication "Sewage Disposal," states, page 213, "Theoretically the treatment of sewage should not be made so complete that the sanitary benefit derived therefrom is incommensurate with the cost involved. Fortunately there is now available by the hypochlorite method a reliable means of disinfecting sewage or water at a small cost. The full significance of this is not yet fully appreciated. It has much bearing on the question of sewage disposal in general and on the dilution method in particular."

Disinfection of Sewage Effluents

Until recently, methods of disinfection of sewage effluents have been considered prohibitive with reference to cost, and it has been very generally agreed that it is cheaper and more effective to purify a water supply than attempt to remove the pathogenic impurities from sewage. After extensive experimental work, Prof. Phelps has been able to some extent to crystallize this subject and show that practically efficient disinfection of sewage effluents is economically possible. He has shown that practical disinfection may be obtained by the use of an average of eight parts per million of available chlorine with settled sewage, 13 parts with septic effluents and 3½ parts with sprinkling filter effluents. Chloride of lime in large orders costs about 1.5 cents per pound. The lime contains on an average about one-third of available chlorine. Thus one million gallons of settled sewage requires about 240 lbs. of chloride of lime, a septic effluent 390 lbs. and a sprinkling filter effluent about 105 lbs. Where average domestic sewage is treated fresh, septic conditions avoided, and the rate of filtration on sprinkling filters is about 2½ million gallons of sewage per day per acre of filter and six feet four inches in depth and the after humus is settled out, the author has data evidence that practical disinfection can be obtained by the use of 60 lbs. of chloride of lime per 1,000,000 gallons of sewage treated. The annual cost in the above case for lime would be $800 per annum.

It would appear then that other things being equal there is no economic objection to the Canadian Public Health point of view, that a standard of sewage effluent purification should insist upon disinfection where the effluent enters a domestic source of water supply or a water source which comes in contact with boatmen, bathers, and others.

This question in relation to standards, viz., the requirement of a chemically stable effluent or a disinfected effluent is likely to form one of the main points in any discussion between this country and the United States in relation to the pollution of boundary waters. It is, therefore, reasonable that our position be clearly defined in relation to our own local conditions.

There is an evident tendency in some quarters to accept the British point of view, and throw the whole responsibility of pure water supply upon those delivering the water and ask for only partial or physical treatment of sewage. The argument in favor of the British point of view appears to assume that a condition of water supply will eventually prevail by which every drop of suspicious water used for domestic supply will be efficiently purified. Such an ideal condition would certainly be welcomed, but is it possible to attain? The argument is also used that by disinfecting sewage effluents, you create a false impression of security, as there are uncontrollable sources of pollution apart from sewage discharge, and that municipalities relying upon the effect of disinfection of sewage may delay or refuse to purify water supplies. The author's opinion is, that in the light of modern economic methods of sewage disinfection, both methods of precaution should be taken wherever practicable. It is not a question of the one method of precaution as against the other. Large towns and cities can afford to install water purification plants. Small towns, villages, summer residences by lake or river shores, individual farmers, boatmen, bathers, etc., may not be in the position to take efficient measures to counteract the sewage infection of their only available source of water supply.

The use of the term uncontrollable infection or pollution is to some extent misleading and much that is looked upon as uncontrollable can by legislation be efficiently controlled. Refuse and sewage matters from ships may be here included. Storm water discharges from streets and inhabited areas may be collected in stand-by tanks and disinfected. What may remain as uncontrollable pollution is an extremely small factor as compared with the millions of gallons of sewage containing millions of intestinal bacteria which are constantly being discharged into our sources of water supply. The argument, that because 100 per cent. efficiency cannot be obtained, we should not attempt a ratio of efficiency, is an argument which if applied to other matters would cause all endeavor to cease.

Canadian Conditions Dissimilar from British

Conditions in Great Britain do not appear to demand the same standard of sewage treatment efficiency as they do in Canada. Great Britain owing to a comparatively equable climate, and a high rate of rain precipitation is able to collect and store its rain fall in districts which are free from chance of sewage pollution. That country is not dependent on its rivers and waterways for domestic water supply. On the other hand Canada has a comparatively low rate of rain precipitation demanding large catchment areas and storage of water subject in the summer months to hot and continued sunshine productive of algae and other vegetable growths, in the winter time to a thick ice covering cutting off the supply of atmospheric oxygen and retaining the gases and products due to vegetable decay. Canada has many fresh water ways, great lakes and rivers which form and must continue to form the main sources of domestic water supply. Can this country afford to allow the Great Lakes, the waterways and rivers to become so bacteriologically impure that it is absolutely necessary that every drop of water be treated and sterilized before being used for dietetic purposes? In Great Britain and in most parts of the United States the rivers have become so hopelessly impure that the destruction of the sewage bacteria would probably make very little difference one way or another. In Canada this hopeless condition of things has not yet occurred, and it appears that we have an opportunity now of checking any such possibility by adopting such standard with reference to sewage effluents which best fit our local conditions.

In this province we have two large rivers, the North and South Saskatchewans, other streams are small and to an extent present very little and at times no flow in the summer. The two large rivers will probably in the future form the chief source of available domestic water supply. The creeks and smaller streams will probably be dammed so as to conserve as much of the spring run-off as possible and will be used for both cattle and domestic water supply. Several cities and towns throughout the province have adopted systems of sewage treatment and in every case where the effluents discharge either into the large rivers or the smaller creeks, the system of sewage treatment has been directed so as to obtain a practically sterile effluent. In the case of the smaller creeks stable chemical effluents followed by disinfection have constituted the accepted standard, in the case of the two large rivers, well settled non-septic effluents followed by disinfection have been, generally, admitted as sufficient. In the latter connection, however, it is sometimes well to consider the comparative capitalized cost of filters as against the extra chlorine required for a merely settled effluent.

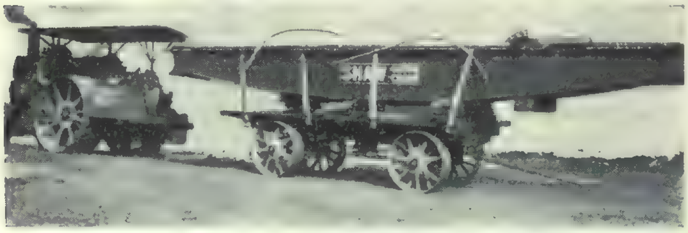
In connection with the city of Lethbridge the author had occasion to go into the question of the cost of filters as against the extra cost of chlorine for treating a merely settled effluent. Works were planned for 20,000 population producing a daily discharge of about 2,500,000 gallons per day. It was found that in order to obtain a fair percentage of disinfection 10 parts of available chlorine per million were required for fresh sewage liquid after 65 per cent. of the solids were removed by two hours precipitation. At 1.5 cents per lb. the annual cost of the lime came to $4,000. After the settled sewage had been passed through a trickling filter of broken stone at the rate of 150 gallons per cubic yard of stone per day, and the resultant humus settled out, efficient disinfection was obtained by the use of 2 parts per million of chlorine, costing $800 per annum for lime. The difference in annual cost for lime represented at 5 per cent. a capital sum of $64,000. Filters were put in and completed at a cost of $30,000, producing a capital saving of $34,000 by adopting disinfection after filtration.

While the author does not think it expedient or even possible to lay down any defined standards with reference to degrees of purity of sewage effluents, and considers that each case must be considered on its merits, he is, however, convinced, with the evidence that he has at present before him, that the generally accepted standard of purity should include the removal of intestinal germs whenever the sewage has finally to pass into any water source which may by any chance be used for domestic purposes.

Haulage Outfit in Transporting a Big Electric Crane

This road freight car, built by the Buffalo Pitts Company, Buffalo, N.Y., is one of their standard 20-ton capacity cars used by many contractors in haulage work. The car is built with wooden frame, with steel facings and steel braces. The axles are 3½-inch solid steel, and the steel wheels are 48 inches high, having a 14-inch tire face. The car is equipped with patent reversible gear that makes every wheel track perfectly and enables steering a number of these cars in train either front or back with perfect ease. The tractor, also, is of Buffalo Pitts Company make.

Contractors are using haulage outfits for every conceivable kind of work outside their regular field of application. The Buffalo Pitts Company build many types of special cars on order and furnish their different types of standard cars in 5-ton, 10-ton and 20-ton capacity with patent reversible gears so that they may be coupled in one train.



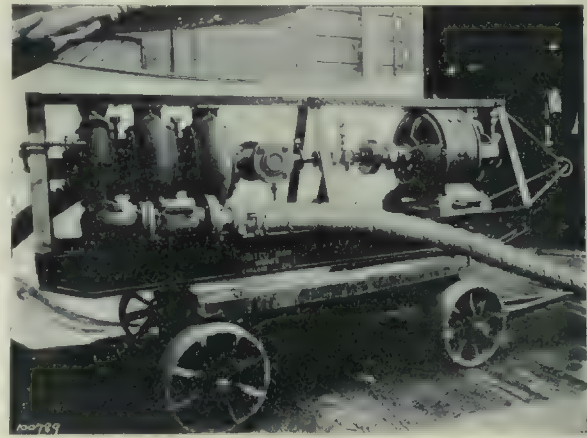
Standard 20-ton car.—Buffalo Pitts Company.

The new policy of improving the Intercolonial Railway includes the double-tracking of several sections of the road, increasing yard and shop facilities at several points, improved ferry service at the Strait of Canso, installation of a telephone despatching system on the St. John-Moncton section, where the automatic block system will also be introduced, and a general overhauling of station property, as well as the construction of several new and attractive station houses. Mr. F. P. Gutelius, the general manager, announces that a contract has been awarded to Messrs. Soper & McDougall for the double-tracking of eight miles of road from Levis to Chaudiere Junction, while the yards at Levis are also to be extended to about double their present size. Canadian firms have been invited to tender on a second ferry boat for service at Canso. The grade revision of the entire system, as promised when Mr. Gutelius took charge of the road, will be started on the Cape Breton section of the road as soon as authority for the expenditure has been obtained from Parliament.

Motor-Driven Pump for Operation on Inclines

The accompanying illustration shows an interesting application of a motor-driven pump. It is designed for mine drainage and is to be used on inclines up to forty-five degrees from the horizontal.

The pump and motor are held together in a steel frame work with an eye at the end to which a cable or rope is attached for lowering the outfit down the incline. The lower part of the framework acts as a skid.



Motor driven pump for mines.

Special arrangements had to be made for oiling the motor. The lubricating device for the lower bearing is seen between the coupling and the bearing housing; it is fed with oil from the upper end by means of a pipe.

The pump is 4-inch, three-stage, and operates at heads up to 250 feet. The motor has a capacity of 30 h.p. and is of Westinghouse manufacture.

To Prevent Car Shortage

The superintendent of car service on the Grand Trunk, Mr. J. E. Duval, has issued a circular asking co-operation to prevent car shortage this fall. In part the circular reads:

"Some consignees find it more convenient to use cars for storage rather than increase their warehouse or handling facilities, car service in their cases being the less expensive. Every such car held deprives some other trader of his car supply and increases the car shortage.

"One important and practical remedy for shortage of cars is very largely in the hands of the users of cars, for if they will provide larger warehouses, adequate facilities, and employ sufficient help so as to give the best possible despatch to the cars handled they will be made quickly available for further use by others who are anxiously waiting for them. In other words, first order only as many cars as can be promptly loaded each day; second, use every effort to load cars quickly and to their full capacity; third, provide adequate facilities and sufficient help to unload cars rapidly.

"It is to be hoped that shippers and consignees will not lose sight of the fact that the car supply question is one in the solving of which they can materially assist railways, and that no satisfactory solution can be effected without their co-operation."

The Constructional Field at the Coast

Building Returns Satisfactory—Optimistic Predictions Concerning Future Business—Good Progress on Larger Work—Many Important Contracts

Office of The Contract Record,
Vancouver, Sept. 17, 1913.

THE total number of building permits issued at Vancouver during August was 174, valued at $874,603. Compared with the corresponding period in 1912 these figures show a slight decrease, the permits taken out in August last year amounting in value to $944,970. For the first eight months of the present year permits to the number of 1,524 with a total valuation of $8,433,942 have been issued, while during the same period in 1912 the number was 2,357, valued at $11,151,702, the decrease during this year approximating $2,700,000. Despite this falling off, conditions in the building and constructional field at the coast continues fairly satisfactory, and contractors express optimistic opinions concerning the outlook for the balance of the year.

There is considerably less activity in the construction of dwellings in Vancouver and the adjoining municipalities this year, but in the business sections of the city the volume of building under way at the present time compares favorably with that in evidence during any previous season. It is to be hoped that an early start will be made on the proposed drydock and shipbuilding scheme at North Vancouver, and the government dock on the Vancouver side of Burrard Inlet. These projects will provide employment for a large number of both skilled and unskilled workmen all the year round, and it is felt locally that the inauguration of two such huge undertakings, fathered by the Dominion government, will have a stimulating effect on all branches of industry represented in Vancouver and the nearby coast points.

Important Contracts Described in Detail

Work on the first portion of the new Woodward Department Store, Vancouver, is being rapidly pushed ahead by the contractors, Messrs. Booker, Campbell & Whipple, and by Christmas it is expected that the premises will be ready for occupation. This part of the structure is located on the lane leading off Abbot street behind the present store, and the framework is now completed to the full height of six storeys. The foundations have been constructed strong enough to carry four additional storeys when required. The main store will have a frontage of 152 feet on Hastings street and 132 feet on Abbot, and will be ten storeys in height, The style of architecture is Neo-Grecian and the construction will be steel frame on a concrete foundation, the street elevations to be faced with Haddington Island stone. A granite base will be placed in the space below the show windows. One of the outstanding features of the architecture will be the large Corinthian columns on both street elevations, which extend to a height of 43 feet and are 4½ feet in diameter. A carved band of stone near the top of the building will give a further touch of decoration. Bronze entrance doors will be placed on the facades on Hastings street and Abbot street. Alaska marble will be used for the stairways, which are 20 feet in width. British Columbia fir has been chosen for the interior woodwork throughout. The floor space provided in the building will be 200,000 square feet. The arrangement of the interior will conform with the latest ideas in department store equipment and construction. It is planned to commence operations on the main structure as soon as the addition in the rear will have been completed, and it is thought that the entire contract will not be finished until early in 1915. The total cost of this huge building has been estimated at close on $1,000,000. Mr. W. H. Wenyon is the architect.

The Weart Building

During recent weeks steady progress has been in evidence on the new Weart Building, which is located at the corner of Richards and Hastings streets, Vancouver. The steel skeleton frame has been erected to a height of two storeys and all possible haste will be made by the contractors, the Canadian Ferro Concrete Company, to have this immense framework completed to the full height of fifteen storeys within the shortest possible time. The foundations have been carried to rock for a building measuring 78 x 120 feet, the three lower storeys to be terra cotta with a polished granite base, eight storeys above this are face brick, and the four remaining storeys are finished in marble and bronze. The main entrance corridor is designed in the same architectural style as the exterior; the walls and floors being of marble with bronze trimmings and ceiling of oak beams and panelling. The main floor is so planned that the corner can be occupied by a banking institution with the main entrance directly facing Hastings street. The main corridor is entered off a general vestibule, twenty-five feet wide, which leads to the basement stairs on one side and the bank entrance on the other.

New Woodward Departmental Store, Vancouver.

The typical floor contains thirty offices fitted with all modern equipment. Oak is employed as interior finish throughout. The corridor floors are of Terrazzo tile with marble borders. The fact that the building is fifteen storeys high and that the upper five storeys will never be blocked by other buildings adjoining, gave the architects a chance to treat the four sides of the building in a decorative manner, which presents a tower architecturally finished on all sides; the pinnacles above the fire walls, are equipped with electrical illuminations. In designing the building the architects adopted the style known as Françis I. in which the general effect is based on Gothic traditions, but the details are Renaissance, a blending of classic and Gothic decorative forms. In this style the wide, overhanging cornice is omitted, and the upper portion of the structure recedes somewhat, instead of overhanging, the ornamentation being transferred in a considerable measure from horizontal to vertical lines. The decoration usually employed on a heavy cornice is, in this building, expended on its crowning tracery and pinnacles. An approximate expenditure of $700,000 has been estimated for this building by the architects, Messrs. Russel, Babcock & Rice, Vancouver. The contract for furnishing the complete equipment of tile for the Weart Building has been awarded to the Far West Clay Company, of Vancouver. The order will comprise in the neighborhood of 300,000 tile. The same company has also been given the contract to furnish the tile required in the new six-storey addition to the Woodward Department store building in Vancouver.

A Well-Planned Structure

Construction work has just been completed on this imposing apartment block which enjoys a beautiful situation on the corner of Beach avenue and Nicola streets, Vancouver, overlooking English Bay. The design of the building reveals many useful and artistic features which hitherto have not been embodied in local structures of this class. More especially does this apply to the planning of the interior which has been carried out with a view to providing as many of the advantages with as few of the disadvantages of houses and hotels as possible. The building itself measures 60 x 130 feet, and stands five storeys with full basement. It has a reinforced concrete exterior frame with interlocking hollow tile curtain walls, this method of construction being adopted to accommodate Meduca cement facing and the plastering of the interior, which is done directly on the hollow tile wall. The interior is of mill construction with solid 6-inch floors. The floors of all public hallways are covered wih terrazzo inlaid with marble, while the main stairway is of iron frame with terrazzo tile treads. The walls of the main entrance foyer are of cast and run Meduca cement. The building contains twenty-one suites, each comprising seven rooms and two bathrooms, in addition to suites reserved for the use of janitors. Each apartment has a large reception hall, equipped with an open fireplace, spacious living room with balcony, and dining room, the two latter rooms so arranged that they may be converted into one separate suite. The principal bedroom in each suite is so arranged that the bathroom adjoining may be used as a private one. The service quarters of each apartment, including maids' bedroom and bathroom, kitchen and pantry, are separated from the main portion. The interior finish adopted is worthy of special mention. The typical reception hall has, in addition to a mantel, a plate shelf and alcove, the effect being quite artistic. The dining room is planned on the Colonial style, painted white and panelled from floor to ceiling. All living rooms have beamed ceilings with mahogany doors and the interiors are finished entirely in white. Special attention has been given to the lighting fixtures, and these are of a class generally to be found in the better class of private homes. Semi-indirect lighting has been adopted for the dining-room, while bureau lights are provided in the bedrooms. The equipment of the bathrooms includes pedestal washbasins, and showers, all fixtures being of high grade workmanship. The remaining equipment of this building comprises an elevator, steam heating plant with oil burning apparatus in connection, garbage burners and store rooms for each apartment. Mr. Philip M. Julian, Vancouver, prepared the plans, the general contract being carried out by Messrs. Robertson & Hackett, the owners, who sublet the plumbing, heating, lighting, concrete work, etc. The building was erected at a cost of approximately $125,000.

Exterior and main entrance of new apartment building, corner of Beach Avenue and Nicola Street, Vancouver.

Another large ten-storey office block in Vancouver, due to be completed by July 1 next year, is the Credit Foncier Building, now in course of construction at the corner of Hastings and Hornby streets. This building is of reinforced concrete construction and the exterior will be finished with cut stone and terra cotta surmounted by a copper cornice. In the interior the floors will all be finished with rock maple. Marble wainscotting and terrazzo floors will be placed in the corridors. All the offices with the exception of those to be occupied by the Credit Foncier will be finished in oak. Mahogany will be used in finishing the quarters of the Credit Foncier. The Durham system of plumbing will be installed throughout the entire building. Three passenger elevators will be at the service of the tenants. One of these elevators will be geared to carry 5,000 pounds weight. The plans for this building were prepared by H. L. Stevens & Company, Vancouver, in co-operation with Messrs. Barrott, Blackader & Webster, architects, of Montreal. Construction work is being carried on by H. L. Stevens & Company.

Canadian Fairbanks Building Almost Finished

The new seven-storey warehouse building which is being erected for the Canadian Fairbanks Company, on Beatty street, Vancouver, is nearly completed. The Beatty street frontage of this structure is 268 feet, the C. P. R. track frontage 234 feet and the depth of the building 120 feet, making in all 20,300 square feet of land occupied by the warehouse. The building is of mill construction with exterior facing of pressed brick, trimmed with stone and will cost approximately $150,000. The first floor will contain the offices of the Fairbanks Company and the basement will be used for the heating plant, and also for additional storage space. The remaining floors will have space for the storage of hardware. Mr. W. H. Miller has charge of this contract, plans for which were prepared by Parr, McKenzie & Day.

Immense Powder Factory Proposed

The board of directors, a controlling interest of which is vested in Nobles Explosives, Limited, of Glasgow, Scotland, has appropriated $1,250,000 to erect buildings comprising the works of the new powder factory plant on James Island, near Victoria. The plans call for the erection of about 100 buildings, including cottages for the employees on the eastern part of the island. On the west side will be placed a wharf and other structures for the handling of material, supplies, etc., of a non-explosive nature. The contract has been awarded to Cullinton Bros., of Victoria, for the erection of the west side of the wharf. This is 800 feet long by 20 wide. It will be "T" shaped, and at one end will be placed a warehouse 50 x 400 feet in size. The company is now clearing the sites for the buildings and will immediately undertake the construction of a network of tram lines between the various points. The output of the new plant will be one hundred tons of explosives and black powder daily. Canadian Explosives, Limited, and the Victoria Chemical Company, Limited, of Victoria, represent the western control of the huge plant.

B. C. Telephone Company Expanding

An addition to industrial Vancouver is to be seen now at the corner of Yukon and Front streets, where the new plant and storage headquarters building of the B. C. Telephone Company stands completed. As will be seen from the accompanying view this structure has been erected on most substantial lines, the foundations being of solid concrete, and the upper portion composed of steel and red pressed brick with concrete floors. The building measures 80 x 120 feet and is four storeys with full basement. The basement will be used for the storage of heavy wire and telephone cable, while the portion under the loading platform will answer the purpose of a garage and repair shop and will have a graded runway to the street level. The first floor will consist of general stores and offices of the divisional superintendent of plant; second floor, construction stores and offices of superintendent of construction; third floor, switchboard construction and carpenters' shop, together with offices for same and space for building inspector; fourth floor, offices of general superintendent of plant and engineering department. This floor will also provide room for sundry stores. Railway trackage is provided at the side of the loading platforms. The general contract, valued at approximately $50,000, was carried out by Messrs. Smith & Buckland, New Westminster. Mr. J. Johnston, supervisor of the telephone company's buildings, prepared the plans.

Government Awards Contract for Vancouver Dock

The contract for the proposed government dock at Vancouver on Burrard Inlet, between Salisbury and Commercial Drives, has been awarded by the Dominion Government to the firm of Messrs. Henry, McFee & McDonald, at a figure of $1,250,000. The docks will be 800 feet long and 300 feet wide. A berthing slip 140 feet wide will be provided on each side, dredged out to a depth of 36 feet at the lowest stage of the tide. An appropriation sufficient for the first year's operations has been allocated, and the funds for the completion of the dock and the installation of all the latest contrivances in the way of electric travelling cranes, etc., will be appropriated later. It is expected that the docks will be finished within two years.

A great deal of preliminary work on the government wharf will be necessary. First of all the surface soil will have to be excavated. About 125,000 cubic yards of soil and rock will be removed and the bottom levelled. The solid rock excavation is expected to exceed 100,000 cubic yards, which will have to be drilled and blasted under water in depths varying from five feet to thirty-six feet below tide water. A great deal of this work will have to be done by divers. A foundation of crushed stone will be provided for the cribs, which will be filled with stone ballast, topped off with gravity sections forming a base for a retaining wall, which will extend around the outer edge of the docks.

The cribs will be covered with a layer of solid concrete. On the top of the foundation of crushed rock large sawn timbers will be placed, it being estimated that 1,000,000 feet board measurement, will be necessary for this purpose There will be twenty-three of the large cribs. They will be built in dry docks and sunk and filled solid. The contracting firm, the members of which are said to be Canadians, have established their offices in the Dominion Trust Building, Vancouver.

Floating Drydock and Shipbuilding Plant for Burrard Inlet

Approval has been given by Hon. Robert Rogers, Minister of Public Works, to the proposed drydock scheme and shipbuilding industry for the north shore of Burrard Inlet. The cost is now estimated at $4,000,000 for the two concerns which will be operated in conjunction. The plant will be located in D. L. 265, and will comprise a floating drydock, a shipbuilding works and repairing ways of the most modern and approved type. Officials of the Amalgamated Engineering Company, the firm which has the project in hand, state that work will be started as soon as the necessary arrangements are made with the government.

The original idea of the company was to invest $2,500,000 in the entire scheme, but it was afterwards decided to enlarge the scope of the enterprise. The basin will have a depth of 30 feet at low tide; the drydock will have a lifting capacity of 20,000 tons, and will be much larger than the one at first proposed. It will accommodate the largest vessel in the Pacific trade, according to the plans. Four building berths will be provided, two for 750-foot boats and two for 350-footers. Repair shops, equipped with all the latest electrical appliances, will be attached to the plant.

It is expected that it will take three years to complete the plant and docks. About 2,000 men will be given employment, it is estimated. The plans are now being rushed, and will be despatched to Ottawa so that an order in council may be passed.

The directorate of the company includes many prominent men in Canada and in Great Britain. The managing director will be Mr. C. J. V. Spratt, of Victoria. Identified with the project also are Col. Sir Henry Pellatt, Col. Sir John M. Gibson, Lieutenant-Governor of Ontario; Mr. D. B. Hanna, and Mr. E. J. Palmer, of the Victoria Lumber & Manufacturing Company, Chemainus. The advisory board is composed of prominent Old Country capitalists.

Victoria Architect Gets Important Commission

Mr. Loring P. Rixford, who first came into prominence at the coast as the architect of the Union Club Building in Victoria, was recently awarded the first prize in the competition for the adjudged best plans for the Provincial Royal Jubilee Hospital, to be erected on the site of the present structure in Victoria. Mr. Rixford's plans receive a premium of $1,500. Messrs. Somervel & Putnam of Vancouver were given second place with a prize of $1,000, and Messrs. James & Davidson, of Vancouver, came third, winning a premium of $500. In his report, Mr. J. D. Atchison, of Winnipeg, the advising architect in charge of the competition, commented on the exceptional merit displayed in the preparation of the fifty sets of drawings submitted, each of which showed that the author had made a careful study of this particular problem, as well as the administration and design of hospitals in general. It is understood that the winning plan is the most economical, exhibiting besides the fullest knowledge of the site and its possibilities. Mr. Rixford will now be appointed supervising architect. He has now been in practice since 1907 in San Francisco, and is a graduate of the Ecole des Beau Arts at Paris. He was city architect for some time in San Francisco, and among the important buildings he designed are the Bohemian Club and the San Francisco city and country general hospital. Mr. Rixford has maintained an office in Victoria since he commenced to practice in this province. It has been announced that tenders for this important contract are to be invited forthwith and the project which is expected to involve an expenditure of between $450,000 and $500,000 got under way as soon as possible. It is understood that in all cases local materials and local workmen are to be given the preference.

Coast Miscellanea

All of the exterior work on the new seven-storey addition to the boot and shoe factory of J. Leckie & Company, Cambie street, Vancouver, has been completed, and work on the interior is being rushed ahead as quickly as possible. This building is of mill construction and will cost about $50,000. Messrs. Snider & Brethour have charge of the general contract.

It was announced at the coast recently that the Bank of British North America has purchased a site at the southwest corner of Menzies and Superior streets, Victoria, on which it is intended to erect a branch office building in the near future. The site comprises about 47 x 90 feet, and changed hands for a consideration of $15,000.

Plans were filed recently at the office of the Vancouver building inspector for the proposed immigration shed building, which will be erected in this city by the Dominion government at a cost of about $300,000 at the foot of Victoria Drive. In the basement will be a laundry, fumigation room and cook rooms. On the first floor will be a reception room, waiting, examination, inspectors' and guards' rooms. On the second floor will be men's dormitory for Chinese men and women, recreation room, discharging room, etc. The third floor quarters are intended for immigration officials. The building will measure 64 x 212 feet, and will be of reinforced steel beam construction, four storeys high.

Tenders are now being called for the construction of a first-class fireproof theatre building to be located on Keefer street, near Main street, Vancouver. The specifications provide for a structure of steel and brick, with pressed brick and terra cotta exterior. The dimensions will be 75 x 120 feet, and there will be seating capacity in the interior for approximately 1,700 persons. The stage will measure 32 x 73 feet with full equipment. There will be an exhaust system for both heating and ventilating, concealed or "indirect" lighting on an elaborate scale, ornamental plaster and considerable interior decorating, tile floors in the lobbeys and full modern equipment for an entirely up-to-date theatre building. The contract, for which tenders are desired only from responsible contractors, will cover everything excepting that equipment specially for "theatrical" building accessories. Mr. J. J. Donnellan, 319 Pender street, Vancouver, is the architect.

The contract for erecting the proposed three-storey building for the American Can Company on the C. P. R. reserve, Vancouver, was recently awarded to J. Carver & Sons. This factory building will be of brick and mill construction, and when complete will cost approximately $75,000. The company is backed by large capital and will engage extensively in the manufacture of cans.

In view of the fact that the city of Vancouver has recently disposed of a big block of its bond issues it is the intention of members of the council to have work undertaken without delay on both the proposed Creche and Old Peoples Home buildings. The contract for the Creche, a two-storey fireproof building to cost about $45,000 from plans by Mr. R. T. Williams, architect, is in the hands of Mr. Geo. E. Williamson, contractor, while the Old Peoples Home building is to be a brick structure, to cost about $40,000, from plans by Mr. R. T. Perry, architect, Messrs. Campbell & Wilkie, general contractors. Work on both buildings has been delayed since the contracts were let some weeks ago owing to the fact that the bonds remained unsold.

Tenders will shortly be called by the Burnaby School Board for the construction of an 8-roomed reinforced concrete school building to be erected on Vancouver Heights, an eminence overlooking Burrard Inlet. The cost of the structure has been estimated at approximately $75,000.

Mr. L. Taylor, architect, Vancouver, recently completed plans for the erection of a two and one-half storey and basement residence on Shaughnessy Heights for Dr. M. F. Keely, of this city. The plans provide for a structure measuring 40 x 42 feet, the construction to consist of stone to the first storey and above that, fir and stucco work. On the ground floor there will be a dining room, hall, kitchen, den, reception hall, living room and large porch; on the first floor there are provisions for four bedrooms, bath, balcony, etc., and the attic will contain a large billiard room, servants' quarters, smoking room, etc.

Plans are completed for a splendid residence for Mr. H. Bingham, a local capitalist, on Shaughnessy Heights, Vancouver. The exterior construction will be of hollow tile blocks, with stucco finish. The building will be equipped in a thoroughly modern manner throughout with hot water heat, considerable hardwood finish, etc. It is expected that figures on the general contract will be taken by the architect. Mr. G. B. Kaufman, during the first half of September. The cost of the building will be in the neighborhood of $13,000.

Efforts which have been made for some time past for the creation of a builders' exchange in Vancouver have at last proved successful, the preliminary organization of a builders' exchange for the city and district being now completed. Provisional officers have been appointed and a nominating committee has been named to prepare a list of nominations for officers to be voted on in the near future.

The Pacific Lime Company, of Vancouver, recently closed a contract with the Tacoma Smelting Company, of Tacoma, Wash., for 100,000 tons of limestone to be used for fluxing, delivery to start October 1. The company's plant at Blubber Bay is running at full capacity.

Mr. J. E. Hall, president of the Vancouver Grain Exchange, is authority for the statement that Vancouver people are interested in two proposed grain elevators to be erected on Burrard Inlet. There are no names or further details given out for publication.

Messrs. Perry & Fowler, architects, Vancouver, have been commissioned to prepare plans for the proposed Dominion drill hall, to be erected in Grandview, Vancouver. The building will be of fireproof construction, costing about $200,000. It will be some time before the tenders are wanted.

The contract for the Pitt River dredging recently awarded to the Pacific Dredging Company, Vancouver, calls for the dredging of a channel from the 25-foot contour in the Fraser bed, between Douglas Island and Coquitlam River, 800 feet in length and 300 ft. wide, 25 feet deep, ending in the pool to the north of Douglas Island. Nearly a million yards of material must be removed in dredging the channel. This material will probably be deposited on the lower end of Douglas Island and on the mainland above the mouth of the Pitt.

St. John and New Brunswick

Trade Active and Several Interesting Projects Announced — Shortage of Brick Hampers Operations

Correspondence of the Contract Record

The American Foundry Construction Company have instructed its representative to look over the situation at St. John as a possible site of a branch factory in Canada.

The Canada Cement Company have decided on a site for their new $1,000,000 plant near St. John, N.B. It is about ten miles from the city on the Intercolonial Railway. It is understood that the company will construct a model village there for their workmen.

The new observatory for the Meteorological service at St. John, N.B., the plans and specifications of which were prepared some time ago by Mr. Garnet W. Wilson, is now under construction. The building is to be of pressed brick, with olive sandstone trimmings and copper roofing, with a frontage of 120 feet and a depth of 300 feet.

The brick manufacturers at St. John have been utterly unable to cope with the demand for brick for building purposes this year. The Atlantic Refineries, Limited, have been compelled to order a million and a half brick from Nova Scotia. It is stated that considerably more brick buildings would have been erected in the city this summer but for the scarcity and high prices of material.

The St. John City Council has asked Hon. J. D. Hazen to arrange a conference with the officials of the Grand Trunk Pacific Railway to learn what the intentions of the company are with regard to the port of St. John. No action has yet been taken to provide terminals at St. John, although the company must eventually come to this port, and its line will be in a position to handle traffic within a year.

The St. John Railway Company will at once extend its line from the city along the Marsh Road for one mile, and then across to Kane's Corner at East St. John, returning thence to the city, and completing a circuit and providing a service which will be of the greatest benefit in building up that section of the outskirts of the city. The work will be completed within two months, as the company has all the material at hand and will have no difficulty in securing a large force of workmen.

The St. John and Quebec Railway Company's estimates for work on the St. John Valley Railway for the month of August, as submitted to the meeting of the Provincial Government at St. John recently, amounted to $220,000. It is not now expected that steel will be laid on the entire Fredericton-Woodstock section before next spring, the handicaps from the exceptionally unfavorable weather of the season of 1912 having been too great for it to be possible to catch up this month.

The Norton Griffiths Company have two very powerful dredges on the way out from England to be used in dredging Courtenay Bay at St. John, also two self-propelled hoppers from the Argentine to work with the dredges. Norton Griffiths & Company are considering the question of establishing a plant at St. John where machinery and parts of dredging fleets could be assembled and the work of construction completed, thus avoiding the risk there is in bringing such equipment across the Atlantic.

The Dominion Government has awarded a contract for the erection of grain conveyors at two additional steamship berths at West St. John. The work will cost about $140,000 and will be rushed to completion for use in the coming winter, when the new million-bushel elevator of the C. P. R. will also be in commission. The port of St. John will be in a much better position in the coming winter to handle grain shipments than ever before. By the winter of 1914-15 two more wharves with warehouses and other equipment will be completed, still further enlarging the capacity of the port.

Within the last two months two natural gas wells with a very high pressure have been struck in Albert County, N.B. In the well which is being drilled at Sussex, within forty-five miles of St. John, pockets of gas were struck several times in the first six hundred feet and a large body of gas is expected to be struck at a depth of fifteen hundred feet, which is about the depth of the Albert County wells. The piping of the gas from these wells into the city of Moncton has greatly reduced the cost of heat, light and power, and has proved of immense benefit for domestic as well as industrial purposes, and also in connection with the Intercolonial Railway shops.

Canadian Railroad Development

The announcement was recently made that work on the Dominion Western Railroad, which will run from a point on the international boundary line north of Great Falls, Mont., west into the Crow's Nest country, tapping the coal fields north to Calgary and on into the Peace River country, will be commenced at an early date. British and American capital is financing the undertaking.

According to Mr. J. D. McArthur, of Winnipeg, the contractor who is building the Hudson Bay line from Le Pas to Nelson, 420 miles, by the end of the fall at least 50 per cent. of the grading will be done, and about 125 miles of rails laid from the western end, as the entire road will have to be built from that end. The terminals and the railway are due for completion at about the same time, or say two years from now. Mr. McArthur is also carrying out the construction of the Edmonton, Dunvegan and British Columbia Railway. The contract calls for a line ending at Fort George on the Grand Trunk Pacific in British Columbia, but the present subsidies cover the section from Edmonton, the capital of Alberta, to Athabaska Landing and through the Peace River country, some 400 miles in all. In about five weeks time, Mr. McArthur says, they will have the road steeled to Athabaska Landing, 130 miles from Edmonton, and graded 125 miles beyond.

Double tracking on the main line of the C. P. R. between Mission Junction and Ruby Creek for a distance of nearly forty miles has now been completed. There are more than eighty miles of track parallel on the Cascade subdivision, which extends from Vancouver to North Bend, 29 miles from Vancouver. Regular train service over the newly-completed sections of double track will be started at an early date. The double-tracked portion of the line between Vancouver and Mission Junction has been in operation for some time. In connection with the improvement schemes, bridges have been rebuilt for two sets of metals on the district between Mission and Ruby Creek. With the exception of the bridge over the Harrison river, which is expected to be completed by February, all this work has been finished. The double track operations on the Cascade were started in May last year, and the work has entailed an expenditure of more than two million of dollars. Good progress is being made on the other sub-divisions, and the company is engaged in these operations for a distance of 24 miles west of Revelstoke and 25 miles east and nine miles west of Kamloops.

It has been announced that engineers of the Great Northern have already prepared plans for tapping the coal fields in southern Alberta. The Canadian Northern and the Edmonton, Dunvegan & British Columbia Railway companies are building lines into the northern district. The bonds on both lines are guaranteed by the provincial government of Alberta to the extent $30,000 a mile.

Mainly Constructional

The News in Brief—From Coast to Coast

A contract for a new drill hall at Winnipeg was recently awarded to the Carter-Halls-Aldinger Company of that city for $519,000.

A permit was recently issued to the Canadian Pacific Railway for the erection of a seven-storey office building at King and Simcoe streets, Toronto, to cost $250,000.

Four bank buildings are in course of construction at the present time in Prince Albert, Sask., the total expenditure being in the neighbourhood of $250,000.

Two additional freight sheds will be commenced this year by the Montreal Harbour Board. They will be two storeys high, with concrete piers, and steel superstructure.

Mr. Gosselin, of Levis, P.Q., has been awarded the contract for the construction of the workshops for the Transcontinental Railway at St. Malo. The cost will be $1,500,000.

La Compagnie des Habitation Salubres de Quebec, Limitee, was recently incorporated at Quebec with a capital of $100,000. One of the principal objects of the company is house building.

A remarkable increase is noticeable in the building permits at St. John, N.B., for the first eight months of 1913 as compared with the same period of 1912, the figures being $1,470,545 and $411,700 respectively.

It is expected that the government will award contracts shortly for the international storage elevators at Saskatoon and Moose Jaw. The time for receiving tenders has now expired and the elevators are to be completed by the end of 1914.

The contract for the Dominion Government share of the Toronto harbour improvement was let at a recent Cabinet Council, the successful tenderer being the Canadian Stewart Company, Limited. The contract price is $5,371,732.12, which is about 10½ per cent. under the original rough estimate of six millions.

Mr. T. Aird Murray, Toronto, is to be retained by the Whitby Town Council to advise them and submit plans for a sewerage system and disposal plant. At the present time the town is supplied with filtered Lake Ontario water, and the arrival of two new railway lines, the C. P. R. and the Toronto Eastern, points to great developments.

Three docks instead of one will be constructed by the Winnipeg and St. Boniface Harbour Commission next year. The commission has been promised a grant of $100,000 by the Dominion Government, but the money will not be available until the estimates have been approved at the next session of parliament. It is not expected that the $100,000 will complete the work and a further grant from the government is anticipated.

In connection with the Montreal underground conduit system now being completed on St. Catherine Street, Mr. Parent, civic superintendent of lighting, has prepared a report recommending the controllers to instal a system of arc lighting. It is proposed to erect 142 lamp standards 14 feet high and about 150 feet apart instead of the 350 feet which now separate the arc lights hung from wooden poles. It is also proposed to extend this system to other streets in the downtown district, but cluster lights will probably be employed in the residential sections of the city.

Building permits issued in Toronto in August, 1913, amounted to $3,175,450, as compared with $3,822,975 for 1912. The figures for the first eight months of 1913, however, are $20,832,771, as against $19,317,820 for 1912, an increase of 7 per cent. Corresponding figures in Montreal are:—$2,318,672 for August, 1913; $1,364,833 for August, 1912; $13,816,662 for the first eight months of 1913 and $11,179,376 for the corresponding period last year.

Work at Port Nelson, the terminus of the Hudson Bay Railway, is progressing rapidly and the Department of Railways and Canals has succeeded in placing there enormous stores of equipment and supplies necessary to carry out the plans. These call for a continuation of the work all the winter, so that when the Hudson Bay railway is completed facilities at the terminus will be adequate to care for the immediate traffic. Two hundred men are at work. They are engaged in building quarters, docks, storehouses and railway yards.

The members of the Ontario Highways Commission are at present on a trip of inspection. They will pay particular attention to the great state highways, where the New York road experts are endeavoring to work out a type of roadway best suited for heavy automobile traffic. The county roads of Ontario have been fairly satisfactory as to construction, but in the provincial scheme to be outlined through highways for heavy traffic will form an important part, and the commissioners are especially anxious to study New York State methods of handling that problem. The Quebec system of encouraging construction by giving rural municipalities the free use of road machinery in addition to financial assistance is also to be considered.

The Canadian Pacific Railway recently deposited plans for four additional storeys to the central portion of the Hotel Vancouver, Vancouver, and for the east wing fronting on Granville street, at an estimated cost of $1,100,000. The estimated outlay on the work of reconstructing the central portion of the hotel, calling for twelve storeys, was $800,000, so that with the addition of the work now proposed, the ultimate cost will not be far short of $2,000,000. According to the plans, the central part of the structure will be sixteen storeys in height, and the east wing will be eleven storeys, with the exception of the centre, midway between Georgia street and the Orpheum theatre. Here a large hall will be situated, for banquet purposes. The entrance to this hall will be 87 feet by 59 feet, and will be from Granville street. The whole structure will be of reinforced concrete and steel construction, faced with pressed brick.

Personal Mention

Mr. E. Drinkwater, town engineer of St. Lambert, P.Q., is preparing a report on a trunk sewer scheme for four municipalities on the South shore, opposite Montreal.

Prevost Hubbard, Assoc. Am. Soc. C. E., Lecturer in Highway Engineering Chemistry, Columbia University, and Mr. Arthur H. Blanchard, M. Can. Soc. C. E., Professor in Charge of the Graduate Course in Highway Engineering, Columbia University, have been appointed members of the United States Committee on "Standardization of Nomenclature of Road Materials." This committee is to co-operate with the Engineering Standards Committee of Great Britain.

Hon. W. H. Hearst, Minister of Lands, Forests and Mines for the province of Ontario, returned recently from an extended tour of northern Ontario, where he has been inspecting the road construction carried out during the past season under the supervision of Mr. J. F. Whitson, the government's northern development commissioner. Up to the present time 500 miles of roadway have been covered. $750,000 has been spent and before the end of the season the expenditure on highways in the north through Mr. Whitson's special work will amount to a million.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Blandford Twp., Ont.
Tenders received by Twp. Clerk, Geo. Oliver, Royal Hotel, Woodstock, until September 26th, for 270 ft. of 6-in., 600 ft. of 5-in. and 200 ft. of 3-in. tile drain.

Dundas, Ont.
Cement walks, Mountain, planned by Town Council. Clerk, J. S. Fry. General contractor, John W. Dickson.

Hamilton, Ont.
Asphalt, macadam and wood block pavements, cement curbs and walks, cost $50,033, planned by Council. City Clerk, S. H. Kent. City Engineer, A. F. Macallum.

Metcalfe Twp., Ont.
Tenders received by Twp. Clerk, Richard Ward, Strathroy, until October 3rd, for 600 rods of new open and tile drains.

Montreal, Que.
Concrete sidewalks, cost $21,000. Sec. of Board, L. N. Senecal. Engineer, Supt. Barlow, City Hall. Board of Control asked City Council to vote above amount for new sidewalks, likely to be built this fall.

Trunk sewer, St. Lambert and Longueuil, for South Shore Municipalities. Mayor, St. Mars of Longueuil, 4 St. Lawrence Blvd., Montreal. Engineer, E. Drinkwater, St. Lambert. Mr. Drinkwater is preparing report on large trunk sewer for South Shore.

Ottawa, Ont.
Pavements, cost $30,000. Mayor, J. A. Ellis. City Engineer, Archibald Currie. Tenders received until September 27th for asphalt pavements on Clarence St., King Edward to Chapel; O'Connor St., Queen to Laurier. Plans and specifications at office of engineer.

Winnipeg, Man.
Plank sidewalks on several streets contemplated by Rural Municipality of Kildonan. Sec.-Treas., H. Thompson, 215 Chambers of Commerce, Winnipeg.

Six wells will be installed for Rural Municipality of Kildonan. Sec.-Treas., H. Thompson, 215 Chambers of Commerce, Winnipeg, also sewer on Oakview ave.

Woodstock, Ont.
Cement walk and curb, Victoria St., contemplated by the City Council. City Clerk, John Morrison.

CONTRACTS AWARDED

Windsor, Ont.
Paving Pitt St. planned by City Council. Mayor, Henry Clay. City Engineer, Ed. Brian. General contractor, Thomas Chick. 8,000 sq. yds. asphalt block pavements at $2.79 per sq. yd.

Railroads, Bridges and Wharves

Dand, Man.
Location of Canadian Pacific Railway Company's proposed station, on Boissevain to Lauder Branch, has been approved.

Glacier, B.C.
Canadian Pacific Railway Company have been authorized to construct bridge near Glacier, on Mountain Sub-Div. No. 88.29.

Halifax, N.S.
Docks. Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, until Oct. 15th, for construction of about 6,500 lin. ft. quay wall, foundation for buildings, sewers, dredging of harbor to depth of 45 ft. at low water and filling reclaimed areas. First Unit, Contract No. 3. Plans, etc., at offices of General Manager, Moncton, Chief Engineer of above Dept., Ottawa, and at office of Supt. Engineer, Halifax, N.S.

Havelock, Ont.
Station contemplated for Canadian Pacific Railway. Plans will be prepared.

Kaslo, B.C.
Wharf and pile boat planned by Dom. Govt. Dept. of Public Works. Plans, specifications, at Dept. Tenders received by Sec., R. C. Desrochers, Ottawa, till Oct. 7, 1913.

Newcastle, Ont.
Pier. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 15th, for Eastern Pier. Plans, etc., at offices of J. G. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, Postmasters, Kingston and Newcastle, and at Dept., Ottawa.

Peterboro, Ont.
Freight sheds, cost $15,625, Sharlotte St., for C. P. Rly., Peterboro office. Part of building to be erected this year. One storey, 50 x 410, frame construction. Plans drawn.

Quebec, Que.
G. T. Rly. Co. has been authorized to construct bridge in Parish of Dewittville, Co. Godmanchester, over Portage Creek, also bridge No. 113 over Coaticook River.

St. John, N.B.
Harbour terminals for Dom. Govt (Intercolonial Rly.). Manager, F. P. Gutelius, Moncton. Tenders will be called shortly.

Summerland, B.C.
Wharf planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Plans and specifications at offices of F. W. Aylmer, District Engineer, Chase, B.C., and Postmaster at Summerland and at Department, Ottawa. Tenders received by Secretary until Oct.

Taghum, B.C.
Bridges planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor. Engineer, J. E. Griffith. Plans, specifications, etc., at offices of the Govt. Agents at Nelson, New Westminster and Vancouver. Tenders received by Minister till Oct. 14th.

Bridge planned by Dom. Govt. Dept. of Public Works. Engineer, J. E. Griffiths, Victoria. Minister, Hon. Thos. Taylor. Plans, specifications, etc., at Dept., Victoria. Tenders received by Minister till Oct. 14th.

Vespra Twp., Ont.
Tenders received by Clerk until Sept. 27th for construction of reinforced concrete beam bridge over Willow Creek, Lot 13, Con. 4, Twp. of Vespra, at or near Midhurst. Clerk, A. B. Coutts, Barrie. Engineer, Frank Barber, 57 Adelaide St., E. Toronto.

Victoria, B.C.
G. T. P. Rly. has approved locations of stations at Mount Robson, Albreda and Eddy.

Canadian Pacific Railway Company have been authorized to construct bridge No. 24.20, over Crazy Creek, Shuswap Sub.-Div., B. C. Div., and bridge No. 19.00 near Mitigan, Shuswap Sub-Div., and bridge No. 97.2 over Virmillion River.

CONTRACTS AWARDED

Cheticamp, N.S.
Dredging planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Northern Dredging & Construction Co., Ltd., St. John, N.B.

Fort William, Ont.
Addition to car barns, cost $40,000, Walsh, planned by City Council. Architect, City Engineer. General contractor, P. J. Donahue, Room 1, Cameron Block, S. May St. One storey, 28 x 270. Foundations in.

Meductic, N.B.
Bridge planned by Dom. Govt. Dept. of Public Works. Chief Commsr., Hon. John Morrissy, Fredericton. General contractors, McBean & McLaggan. 250 ft. long.

Montmagny, Que.
Extension to wharf, cost $5,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, J. R. Boulanger.

Montreal, Que.
Ship building shed for Canadian Vickers, Ltd., 75 Notre Dame, Mais. General contractors, Arrols, Ltd., Glasgow, Scotland, or c/o Canadian Vickers, Montreal. Ship building tools mostly being supplied by British firms. 880 ft. long.

Concrete foundation and floor for shed, cost $14,433.75, Lachine Canal, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Architect, Mr. Marceau, Supt. Engineer, Que. Canal, New Birks Bldg. General contractor, K. A. Morrison, Ottawa.

New Hamburg, Ont.
Bridge and retaining wall, cost $3,500, Hartmans Bridge, for County of Waterloo. Engineer in charge, Bowman & Connor, 36 Toronto St., Toronto. General contractors, Eichler & Huehn, New Hamburg. Bridge will be strengthened and new cement floor put in and retaining wall built, bridge 120 x 18.

North Bay, Ont.
Round house, cost $100,000, for C. P. Rly. Architects and general contractors, Sherwood & Sherwood. Roofing, Gordon O. Maitland. Skylights, Cochrane Hardware Co., $3,100. Two stys., 151 ft. x 108 ft. 10 in.

Ottawa, Ont.
Swing bridge, cost $10,380, Rideau Canal, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, John Donovan and W. A. McCarthy, Belleville.

St. Malo, Que.
Car shop repair plant, cost $1,500,000, for Commrs. of Transcontinental Railway. Sec., P. E. Ryan, Ottawa. General contractor, Jos. Gosselin, Levis, Que.

St. Paul, Man.
Footings in bridge, cost $5,500. Sec.-Treas., W. Gorham, Birds Hill. General contractors, Fowler & Young, 221 McDermott Ave., Winnipeg. Reinforced steel supplied by Manitoba Bridge & Iron Works, Logan Ave. W., Winnipeg.

Toronto, Ont.
Harbor improvements, cost $5,371-372.17, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Canadian Stewart Co., Ltd., E. T. Bank Bldg., Montreal.

Public Buildings, Churches, Schools, etc.

Castor, Alta.
Post office, cost $10,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa Site has been selected.

Charlottetown, P.E.I.
Alterations to picture theatre, Queen St., for Nicholas Carr, Queen St. Capacity 600, seating and theatre fittings required. Plans prepared.

Durham, Ont.
Post office and customs house. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Forster & Clark, Owen Sound. Plans in progress.

Twp. Emily, Ont.
School house for School Sec. No. 8. Tenders received by Wilbert Fee, R. M. D. No. 1 Omemee, Ont., until Sept. 27th. Brick construction, stone foundation.

Fort William, Ont.
Customs examining warehouse, May St. N., extended time. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 14th. Plans, specifications, etc., at offices of H. E. Matthews, Supt. Architect of Dom. Public Bldgs., Prov. of Manitoba, Winnipeg, Man., W. P. Merrick, Dist. Engineer, Ft. William, City Clerk, Ft. William, and at Dept., Ottawa.

Guelph, Ont.
Repairs and improvements to school, cost $3,000, Central School. Chairman, J. M. Duff. Architects, Colwill, Tanner & Co. Plans drawn.

Lethbridge, Alta.
School, cost $2,700, planned. Architects, H. M. and W. A. Whiddington. One storey, 25 x 50, concrete construction. Tenders in.

Montreal, Que.
Public bath, cost $35,500, Rielle St., for Board of Commissioners. Sec., L. N. Senecal. Architect, Thos. Daoust, 26 St. James St. Tenders received from L. Langevin, 228 Parc Lafontaine, $35,500; Savage & Lecocq, 213 St. Ferdinand, $42,000; C. E. Deakin, Sommer Bldg., $46,357; H. Lesperance, 90 Pine E., $46,200; Quinlan & Robertson, Galt Ave., $47,995. Two storeys, 50 x 100, concrete foundation, reinforced concrete and stone construction.

Fire and police station, cost $85,000, Bois de Boulonge, for Board of Commrs. Sec., L. N. Senecal. Architect, C. A. Reeves, 58 St. James St. Only one tender received which was too high. Will probably be called again. Two storeys, 80 x 120, concrete foundation, reinforced concrete construction.

Incinerator contemplated by Town Council of Lachine. Sec.-Treas., Mr. Hector Charette. By-law submitted September 18th.

Nazareth Institute for the Blind, 95 St. Catherine W. Econome, Sister Belanger. Intend to build as soon as real estate deal is put through at present under way, when new site will be sought. Plans will be prepared.

Moncton, N.B.
Nurses' Home planned by the Hospital Board. Architect, C. B. Chappell, Charlottetown, P.E.I.

Ottawa, Ont.
Lavatory, cost $15,000, City Hall Sq. Mayor, J. A. Ellis. Architect, C. Sullivan, Castle Bldg., Queen St. Tile facing inside and reinforced concrete construction, concrete foundation. Tenders received by Mayor until Sept. 30th.

Port Alberni, B.C.
The Alberni Land Company has donated a site on which it is proposed to erect a high school with the aid of the Provincial Government.

Port Arthur, Ont.
Customs examining warehouse, Arthur and Water Sts. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept.. of Public Works, until Oct. 14th. Plans, etc., at offices of F. Y. Harcourt, Dist. Engineer, Port Arthur; H. E. Matthews, Supt. Architect of Dom. Pub. Bldgs., Prov. of Manitoba, Winnipeg, Man.; Thos. A. Hastings, Clerk of Works, Postal Station F, Yonge and Charles Sts., Toronto; City Clerk and at Dept., Ottawa.

Regina, Sask.
Nurses home, cost $25,000, for City Council (Hospital Board). City Commissioners, L. A. Thornton. Plans being prepared.

Toronto, Ont.
Post office alterations, cost $4,000, Yonge St., planned by Dom. Govt., Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, James, Loudon & Hertzberg, 79 Adelaide E. Two storeys, 40 x 40, steel and brick construction, brick foundation. Tenders received by Architects.

Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, until noon Sept. 26th, for plumbing, heating and electric wiring in Balmy Beach School, Pape Ave. School, and McMurrick St. School.

School, Regal Road, planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, untill noon Sept. 26th (either bulk or seperate).

Enlargement of school, Kimberley Ave., planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, until Sept. 26th.

Fruit market, near foot of Church St., contemplated by Board of Control. Mayor, H. C. Hocken. Architect, Engineer E. L. Cousins, City Hall. Plans to be prepared immediately.

Girls' home, Jarvis St., contemplated by Fred Victor Mission, 145 Jarvis St. Site purchased, 235 x 55, 40 rooms.

Truro, N.S.
Post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Three storeys, 40 x 40. New building is contemplated, using old for customs house.

Offices and hall, cost $25,000, Prince, contemplated for Independent Order of Oddfellows. Building will not be commenced this year.

Victoria, B.C.
School, cost $50,000, planned. Secretary, W. T. C. Pope, 1127 Catherine St. Architects, Spurgin & Wilkins, 465 Times Bldg., awarded first place in recent competition for plans.

Wingham, Ont.
Addition to Wingham General Hospital. Secretary, R. Vanstone, Drawer 28, Wingham. Architects, Stevens & Lee, 2 College St., Toronto. Tenders will be received by secretary until Oct. 1st. Plans and specifications at Hospital.

Winnipeg, Man.
School Deer Lodge (Linfield St.), for Rural Municipality of Assiniboia. Sec., F. Ness, Kirkfield P.O. Architect, A. Melville, 405 Builders Exchange, Winnipeg. By-law was submitted to ratepayers on September 13th and passed. Work will start at once.

Church for St. Martins, Seven Oaks. Pastor, Canon Gill, 3 St. Cross St. Architect, E. D. Tuttle, 701 McArthur Bldg. Frame construction, stone foundation. Tenders will be called in a few days.

West London, Ont.
School, cost $25,000, planned by Board of Education. Chairman, E. R. Dennis. Architect not selected yet. Two storeys, white brick construction.

Windsor, Ont.
Public school, cost $40,000, Wyanodtte, for Board of Education. Sec., Alex. Black. Plans under way.

Addition to church, cost $7,000, Windsor St., for All Saints Congregation. Chairman, Capt. W. J. Willoughby. Architects, Leybourne & Whitney. Two storeys, 48 x 27, 22 x 26, structural steel and brick construction, brick foundation, shingle roofing, electric lighting, steam heating, maple floors, sheet metal, seating. Tenders received by Architects until Oct. 2nd.

CONTRACTS AWARDED

Twp. of Barton, Ont.
Two schools for School Section No. 3. Architects, Brown & Fryer, 207 Clyde Block, Hamilton. Masonry, H. C. Gummo, 15 Tuckett street, Hamilton. Carpentry, Murray & Connor, 230 Locke St., Hamilton. Steel and roofing, Thos. Irwin & Sons, 22 McNab St., Hamilton. Plastering, R. J. Passmore, Chedoke. Painting, Briggs & Hutchinson, 50 Aikman Ave., Hamilton. Heating, Adam Clark & Co., 7 Main St. W., Hamilton. Electric, Culley & Breay, King St., Hamilton.

Brockville, Ont.
Arena, cost $11,970, Gilmore street, for Brockville Arena Co. Architect, A. S. Allaster. General contractors, Bislow & Horton. 20 x 110, frame and mill construction, concrete foundation.

East Flamboro, Ont.
School, cost $25,000, planned for School Section No. 2. Sec.-treas., Jos. Smiley, Aldershot, P.Q. Architect, J. A. Armes and W. Scott, Federal Life Bldg., Hamilton. Carpentry, P. H. Coleman, Burlington. Steel, Hamilton Bridge Works, Hamilton. Roofing, plumbing and heating not let. Plastering, Fred Klainka, Burlington. Painting, A. McKay, Waterdown, Electrical, Culley & Breay, King St., Hamilton.

Halifax, N.S.
Laboratory building, cost $6,620, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, D. M. Thomson and A. C. Theakston, Halifax. Building for the Halifax Quarantine Station.

Hamilton, Ont.
Club house, cost $10,000, for East Hamilton Progressive Ass'n. President and architect, Wm. Kinch. Builder, Jas. Bryers, King and Gibson ave. It is planned to erect club house in three days, work to start in about a month.

Hall, cost $5,000, Emerald street. General contractor and owner, William Kerr, 806 Bank of Hamilton Bldg. Brick construction.

Alterations to school, Hess street, for Board of Education. Secretary, R. H. Foster. General contractor, W. H. Yeates, 24 Leeming street. Electric wiring and telephone system, Electric Supply Co., James St. S.

Lindsay, Ont.
Armoury planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, James Bogue. Carpentry, A. McIntyre, Peterboro. Plumbing, Geo. McFadden. Roofing, heating and tinsmithing, W. R. Turner, Peterboro.

Twp. Louth, Ont.
School, cost $8,000, planned by Trustees School Section No. 7. Architect, A. E. Nicholson, St. Catharines. Masonry, J. Nichols & Sons, St. Catharines. Carpentry, Williams & Messler, St. Catharines. Painting and glazing, Leach & Jones, St. Catharines. Plumbing and heating, S. P. Gourlay, St. Catharines. One storey and basement, stone foundation, pressed brick construction. Georgia pine finish.

Montreal, Que.
College building, University, for Wesleyan Theological College, c/o Professor Richardson, Montreal West. Architects, Ross & MacDonald, 1 Belmont, Montreal. General contractor, C. E. Deakin, Sommer Bldg. Carpentry, Wm. Rutherford & Son, 425 Atwater. General contractor receives private tenders for trades. Five storeys.

High school, cost $500,000, Westmount, for Protestant Board of School Commissioners, Westmount Academy. Architect, D. H. MacFarlane, New Birks Bldg. General contractor, C. E. Deakin, Sommer Bldg. Steel sashes and doors, Walker Hardware Co., 252 St. James street. Two storeys, 200 x 150.

Church, cost $225,000, Westmount (Roslyn and Lansdowne), for Dominion Methodist Church. Pastor, Dr. Rose, 64 Windsor. Architects, Badgley & Nicklas, c/o Mr. Barr, 23 Guy Block, St. Catherine W., Montreal. Stone and masonry, W. A. McNeill, St. Mary's, Ont. Other contracts not let. Excavating will start shortly.

Moncton, N.B.
Church, cost $62,000, Church and Queen, for First Baptist Church. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, J. M. Clark, 54 Church street, Moncton. Mason, O. J. Dunham, 50 Brydges, Moncton. Excavating done.

Ottawa, Ont.
Customs Bldg., cost $995,000, Essex St., planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Simcoe Construction Co., 16 King St. W., Toronto, and Midland, Ont. Subcontractors, Crockett & Tharle, 14 Murray Block, Fort William. Mr. Tharle, Chateau Laurier, Ottawa (present address).

Stratford, Ont.
Theatre, cost $10,000, Ontario street, for William Gordon, Albion Hotel. Architect, J. S. Russell, 21 Downie street. Heating, F. L. Duggan. Electric, M. I. Higgins.

Toronto, Ont.
Experimental station, cost $10,000, Cherry, for Sir D. Mann, 74 King St. E. General contractors, Imperial Construction Co., 74 King St. E. Two storeys, 4 x 46, reinforced concrete and brick construction.

Enlargement of school, Shirley street, planned by Board of Education. Secretary-treas., W. C. Wilkinson, City Hall. Masonry, John McMurren, 319 Roxborough St. E., $18,283. Carpenter, J. A. Berridge, 518 Manning ave., $12,000.

Wadena, Sask.
School, cost $26,700. Architects, Rielly, Dawson, Hancock & Reilly, 512 Westman Chambers, Regina. General contractors, Collum Bros., Humboldt. Six rooms, brick construction.

Welland, Ont.
Court House, repairs, planned. County Clerk, Robert Cooper. General contractor, A. Clark, 90 Farnham ave., Toronto. Work to start shortly.

Winnipeg, Man.
Drill hall, cost $519,929. Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Carter-Halls-Aldinger Co., 1919 Union Bank Bldg.

Alterations to theatre, cost $10,000, Fort street, for C. W. Vanderlip, Victoria Theatre. Architect, H. G. Holman, 11 Jordan Bldg., Fort street. General contractors, Lailey & Co., 367 Maryland St.

Business Buildings and Industrial Plants

Brantford, Ont.
Shop and residence, cost $4,000, Colborne street, for Geo. McDonald. Plans in progress.

Dundas, Ont.
Bank building for Royal Bank of Canada, Head office Montreal. Interior furnishings and fittings required. Plans are being prepared.

Edmonds, B.C.
Hotel, cost $75,000, planned for B. G. Walker. Will be built on property on Edmonds Road and Kingsway facing B. C. E. R. tracks.

Kingston, Ont.
Extension to stables for Dom. Govt., Dept. of Militia & Defence. Deputy-Minister, Eugene Fiset, Ottawa. Tenders received by Director of Contracts, Dept. of Militia & Defence, until noon, Sept. 30, for extension to stables, Tete-de-Pont Barracks. Plans, specifications, etc., at offices of Officer Commanding 3rd Div., Kingston, and Director General of Engineer Services, Headquarters, Ottawa.

London, Ont.
Factory, cost $15,000, contemplated for Jas. Cowan & Co., 91 York street. Architect to be selected. Two storeys, white brick construction.

Medicine Hat, Alta.
Addition to store, cost $6,500, Main St., for Hewitt & Black, Main street. Architects, Bourne & Morrison, Huckvale Block. Two storeys, 25 x 40, brick construction and foundation. Plans ready.

Montreal, Que.
Factory contemplated for L. E. Moulton & Co., 955 St. James St. Site not purchased. May build this fall but probably in spring. Incorporated with capital of $50,000.

Factory for Specialties Limited, c/o Mr. D. MacAvoy, 4 St. Lawrence Blvd. Company incorporated with capital of $200,000. Plans under way.

Auto garage for Montreal Autobus Co. U. H. Dandurand, vice-president, 50 St. James St. Architects, Ross & MacDonald, 1 Belmont street. To be built next summer. Plans to be drawn this winter.

Factory and office contemplated for Durbin Drain Pipe Connector Co., Ltd., Montreal. Solicitors, Parker & Clark, Traders Bank Bldg., Toronto. Capital, $300,000.

Addition and alterations to Bank, St. James and McGill, for Bank of Toronto, head office, Toronto. Stone and steel construction. Plans in progress.

Light manufacturing building, cost $45,000, for Robt. Neville, 11 Bushby Lane. Architects, Wright & Son, 204 St. James St. Preliminary prices only received. Specifications will be prepared and tenders called in about ten days. 4

storeys, 40 x 86, concrete foundation, reinforced concrete construction.

Ottawa, Ont.
Alterations to stores and apartments, cost $4,000, Slater street, for C. B. Taggart, 341 McLeod. Architect, W. Herbert George, Castle Bldg., Queen street. Plans in progress.

Factory, cost $6,000, Catherine street, for Wm. F. Frazer, 279 Arlington ave. 50 x 60, concrete and stucco construction, concrete foundation. Plans in progress.

Lumber mill, cost $100,000, contemplated by J. R. Booth, Bridge street; decided to erect fireproof structure on site of mill destroyed by fire. This building will probably not be commenced until spring. Reinforced concrete construction, concrete foundation.

Prince Albert, Sask.
Bank, cost $30,000, for Bank of Nova Scotia, 117 River W. Manager, Chas. McMillan. Plans ready.

Regina, Sask.
Implement warehouse, cost $45,000, contemplated for Tudhope Anderson Co., 8th and Broad. Have acquired site from City Council. Six storeys, 55 x 115. Plans will be prepared.

Warehouse for Campbell Bros. & Wilson, Princess and Bannatyne Streets, Winnipeg. Architect, J. H. G. Russell, 1110-1111 McArthur Bldg., Winnipeg. 5-storeys, brick construction and foundation. Plans in progress.

Sarnia, Ont.
Alterations to head office, cost $10,000, contemplated for Northern Navigation Co. Manager, S. Patton. Architect to be selected. Head office of company to be moved from Collingwood. Office fittings required.

Stratford, Ont.
Addition to factory contemplated for Avon Hosiery Limited, 82 Erie St. Local manager, W. Pearson. Plans will be prepared.

Factory addition contemplated for Canadian General Electric Co., King & Simcoe Sts., Toronto, Ont. General manager, J. Frederick Nicholls, c/o company.

St. Boniface, Man.
Rendering plant, cost $10,000, Dawson Rd., planned for A. C. Turner, Glenwood. Architect, H. G. Holman, Jordon Bldg., Fort St., Winnipeg. Two storeys, 30 x 30, brick construction, concrete foundation. Contract will not be awarded for some time, owner making arrangements for finances.

Strathroy, Ont.
Ice house, cost $3,000, for R. M. Pincombe. Cement construction and foundation. Plans drawn.

Toronto, Ont.
Store, cost $4,000, cor. Davenport and Weston Rd., for R. Leighton, 2113 Davenport Rd. Architect, G. Mason, 2106 Davenport Rd. Owner will call tenders about October 6th. Two storeys, 22 x 48, brick construction, stone foundation,

Four attached stores and residences, cost $8,000, Queen St. E., for M. T. Allen, Queen & McLean. Two storeys, 70 x 52, brick and steel construction. Plans prepared.

Store, cost $2,500, Bloor and Havelock, planned for N. Kaplan, 1015 Bloor W. Architect, H. S. Kaplan, 82 King St. E. Plans and specifications with owner, who will receive tenders. Two storeys, 40 x 25, brick construction, felt and gravel roofing.

Eleven stores, theatre and garage, cost $50,000, Yonge St., planned. Architect, L. Foulds, 21 Leader Lane. Tenders will be called at once. 260 x 50, brick and stone construction, shingle, felt and gravel roofing. Galvanized iron skylights, ventilators.

Store and residence, cost $8,000, Royce ave., planned for M. Yetman, 997 Dufferin St. Architect, W. G. Hunt, 935 Bloor St. W. Three storeys, stone and brick construction, stone foundation, shingle, felt and gravel roofing. Plans and specifications with owner who will receive tenders.

Weyburn, Sask.
Departmental store, cost $20,000, for McKinnons Ltd. Contemplate adding two extra storeys, making five in all.

Windsor, Ont.
Factory contemplated for Renchard-Elmes Shirt & Tie Co. Sec.-treas, B. L. Elmes. Plans will be prepared.

Wyoming, Ont.
Box, basket and woodenware factory, cost $5,000, for Daniel Senecal. One storey, white brick construction. Plans in progress.

CONTRACTS AWARDED

Berlin, Ont.
Factory for Canadian Buffalo Forge Co., 17 Bleury St., Montreal. General contractor, Morris & Allen, H. O., Buffalo, U.S.A. Further information from Mr. MacAvity, 17 Bleury St., Montreal.

Brantford, Ont.
Store and residence, cost $3,900, for Geo. McDonald, 417 Colborne St. General contractor, Jesse Usher, 122 Northumberland. Two storeys, 25 x 65, concrete foundation, sand lime and brick construction. Store fronts and fixtures. Excavating done.

Barn and feed house, cost $13,000, Bow Park Farm, for Dom. Canners Ltd., Hamilton. Manager, O. Herold, Bow Park Farm. Architect, A. A. Gilmour, Preston. Masonry, A. J. Cromar, 448 Colborne St., Brantford. Barn one storey, 60 x 150, feed house three storeys, 30 x 60, corrugated iron construction, concrete foundation, corrugated iron and metal shingle roofing.

Fort William, Ont.
Warehouse, cost $47,000, Hardisty, for Fife Hardware Co., Hardisty St. Architect, R. E. Mason. General contractors, A. C. Stewart & Co. Four storeys, 60 x 115.

Nail plant, cost $110,000, Montreal St., for Steel Company of Canada, 1272 Notre Dame W., Montreal. Architects and general contractors, Prack & Perrine, 38 James St. S., Hamilton. 36 ft. high, 600 x 150.

Business Block, cost $20,000, Simpson St., for T. W. Bowlker, Boston, Mass., c/o G. A. Duncan, Fort William. Architect and general contractor, Henry Russell. Two storeys, 50 x 80, frame and brick veneer front construction, concrete foundation, asbestos roofing. Excavating done.

Hamilton, Ont.
Store, apartments and mill, cost $12,000, for Dunlop-Magee Co., 125 John St. S. Mason, R. Isbister, 125 Wellington St. S.

Store, cost $4,000, King St. E., for B. E. Webster, 661 King E. Architect, F. W. Warren, 808 Bank of Hamilton Bldg. General contractor, Stanley Kerr, 408 Garth street. One storey, brick construction, concrete foundation. Permit granted.

London, Ont.
Addition to factory, cost $40,000, for McCormick Mfg. Co. Manager, Geo. McCormick. Architects, Watt & Blackwell, Bank of Toronto Bldg. General contractors, Canadian Frost & Winchester Co., Ltd., 5 Curry Hall, Windsor. One storey, 100 x 300, reinforced concrete construction.

Medicine Hat, Alta.
Warehouse, cost $15,000, 3rd ave., for Hewitt & Black, Main St. General contractor, Lussier Construction Co. One storey, 50 x 102, structural steel and brick construction.

Garage, cost $7,500, Fewings, for C. Coulter, 621 Fewings St. General contractor, J. Stannard, 418 Fewings Street. One storey, 50 x 120, brick construction.

McAdam Jct., N.B.
Bank building for Bank of Nova Scotia. Manager, Frank Estabrooks. General contractor, Henry Post, Woodstock, N.B. Two storeys, concrete foundation, frame construction, felt and gravel rfg.

Montreal, Que.
Factory addition, cost $17,000, Conde St. Owner and general contractors, Cote Bros. & Burritt, 51 Conde St. Two stys., 49 x 50, concrete foundation.

Bank and offices, cost $14,000, Verdun (Ethel), for Bank of B. N. A., 30 St. James St., Montreal. Architect and general contractor, C. J. Brown, 4263 St. Catherine W. General contractor will call tenders for roofing, heating, plumbing and electric later. Two storeys, 35 x 40, brick construction, concrete foundation. Excavating started.

Store, cost $30,000, Viger, for J. B. Drapeau, 915 St. Hubert. General contractor and carpenter, D. Dupras, 430 Champlain. Private tenders to be received by general contractor.

Store and flats, cost $4,500, Masson, for A. Gaboury, 315 Stuart ave., Outremont. General contractor, F. A. Grothe, 6 Cuthbert St. Three storeys, 22 x 60, concrete foundation, pressed brick construction. Excavating done.

Repairs to offices and warehouse, cost $10,000, for H. Joseph & Co., 16 St. Sacrament. General contractor, Robt. Neville, 11 Busby Lane.

Store, cost $11,000, Masson, J. A. Gauthier, 3593 St. Hubert, general contractor and owner. Two storeys, 35 x 70, concrete foundation, brick construction.

Store, St. Catherine W., for Guarantee Pure Milk Co., 875 St. Catherine West. Architects, Wood & Miller, 50 Royal Insurance Bldg. General contractors, Reid, McGregor & Reid, Guy Block. Painting, Alex. Craig, 41 Jurors. Heating and plumbing, J. A. Gordon, 301 St. Antoine.

Stables, cost $10,000, for Toilet Laundry, 425 Richmond St. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, A. F. Byers, 340 University. 20 x 60.

Warehouse, shops and office, cost $40,-

000, Beaumont, for Gen. Fire Extinguisher Co., 175 McCord St. Architect, Robt. Findlay, 10 Phillips Place. General contractors, Reid, McGregor & Reid, Guy Block. Tenders received by general contractors for roofing. Painting, Alex Craig, 41 Jurors. One and two storeys, 220 x 120, concrete foundation, brick construction.

Stores, etc., cost $750,000, St. Catherine and St. Denis, for U. H. Dandurand, cor. St. James and St. Lawrence. Architects, Ross & MacDonald, 1 Belmont. General contractor, C. E. Deakin, Sommer Bldg. Private tenders are received for all trades. Heating and plumbing, T. Lessard & Sons, 191 Craig E. Ten storeys.

Store and flats, cost $4,500. Architect and general contractors, O. Desrochers, 1756 Papineau and Des Carrieres. Three storeys, 50 x 50, brick and Montreal cut stone construction. Foundations in.

Ottawa, Ont.

Addition to stores, cost $300,000, Rideau & Sussex streets, for A. E. Rae Co. Architects, Ross & MacDonald, Montreal, 1 Belmont St., General contractors, Doran & Delvin, Sussex St., Ottawa. Foundations started on new wing, roof stripped for two additional storeys, inside operations commenced.

Store alterations, cost $3,000, for J. A. H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. General contractors, Esdale & Douglas, 318 Lisgar St. Solid brick construction, concrete and brick foundation.

Business block, cost $190,000, Queen St., for Ottawa Journal Co. Manager, P. D. Ross. General contractors, Shuttleworth & Black, Queen St. Seven stys. Walls up.

Stores and offices, cost $50,000, Rideau, for Blackburn Bros., Creighton St. Architect, W. E. Noffke, Central Chambers, Elgin St. Ornamental Iron, Beaver Brass & Iron Works, Ottawa and Toronto. Painting, heating and plumbing, not let yet.

Factory, cost $10,000, Catherine St. Architect and general contractor, Mc Auliffe-Davis Co., Duke St. Heating, Sheldon Co., Galt, Ont. Felt and gravel roofing.

Alterations to bank building, cost $15,000, Wellington street, for Bank of Montreal. Manager, Mr. Parker. Architect, C. P. Meredith, 126 Sparks St. Mason, T. C. James, 140 Flora. Carpenter, J. G. Adamson, 126 Sparks St. Plastering, Jas. McLaughlin, 649 Gilmour. Painting, Geo. Higman & Sons, 176 Rideau. Heating and plumbing, McKinley & Northwood, Rideau. Electric, Marchand & Donnelly, Sparks St. Ohio sandstone construction, stone foundation.

Red Deer, Alta.

Business block, cost $5,000, Gaetz ave., for C. Hamilton, Builder, Hugh Clark. Mason, J. McIntosh. Heating and plumbing; Day Hardware Co. Electric, Western General Electric Co. Two stys., 22 x 44, brick construction, cement foundation. Fittings for butcher store required.

Toronto, Ont.

Ship building plant, 265 Wellington W. General contractor and owner, E. Rainage Ship Building Co., 265 Wellington W. One storey, 45 x 121, steel and brick construction.

Offices, cost $10,000, 1642 Dundas St., for R. C. McCormack, 336 Annette St. Architects, Ellis & Connery, 72 Queen W. Masonry, Reid & Shortz, West Toronto. Carpentry, H. Chappel, 239 Evelyn. Roofing, A. Matthews, Ltd., 256 Adelaide W. Plastering, Cannon Nelson, 425 Clinton St. Painting, Fell Bros., 44 McMurray. Plumbing, R. Paterson, 907 Keele. Electric, Moon & Dunn, 1724 Dundas St. Three storeys, 18 x 42, brick and stone construction, concrete foundation.

Warehouse, cost $60,000, 439 Wellington W., for Victoria Paper & Twine Co., 415 King W. Architect, S. L. Yolles, 67 Baldwin St. General contractors, H. Weinerman, A. Osherenko & A. Sax, 29 D'Arcy St. Five storeys, 50 x 120, brick construction and foundation.

Store and residence, cost $3,000, Eglinton ave. Owner and builder, W. H. Sharpe, 16 Ferndale ave. Work will be done by day labor. Two storeys, 20 x 38, brick construction and foundation.

Stores and offices, cost $950,000, King and Yonge Sts., for Guardian Realty Co., 501 C. P. R. Bldg. Architects, Ross & MacDonald, 1315 Traders Bank Bldg. General contractors, Geo. A. Fuller Co., Ltd., Stair Bldg. Tenders received by general contractor for ornamental iron, sheet metal and roofing.

Addition to packing house, cost $25,000, for Puddy Bros., 45 Paton Road. Architects, Chadwick & Beckett, 18 Toronto street. General contractors, Wm. Vokes, 228 Rusholme Rd. Two storeys, reinforced concrete and brick construction, concrete foundation.

Thorold, Ont.

Alterations to bank building, Main St., for Royal Bank of Canada. Architect, A. E. Nicholson, St. Catharines. Carpenter, J. N. Joyce, Thorold. Two storeys, stone foundation, brick construction.

Victoria, B.C.

Hotel for C. M. Cookson, 711 Pandora, Architect, L. W. Hargreaves, 504 Sayward Bldg. General contractors, B. C. Granitoid & Construction Co., Exchange Bldg., Vancouver. Four storeys, reinforced concrete construction.

Vancouver, B.C.

Addition to hotel, cost $1,000,000, for Hotel Vancouver. Architects, Painter & Swales, 553 Granville. General contractors, Skene & Christie, 782 Howe. 11 storeys, 228 x 85.

Windsor, Ont.

Store, cost $8,000, Pitt St., for Osterhout & Little. Architects, Leybourne & Whitney. Two storeys, 85 x 26. Foundations in. Work being done by day labor.

Residences

Calgary, Alta.

Residence, cost $6,000, 13th St., for J. G. Poretous, 610 24th ave. west. Two storeys, 24 x 34. Plans ready. Permit granted.

Lacombe, Alta.

Residence, cost $6,000, Barnett Ave., for A. M. Campbell. Plans prepared.

Montreal, Que.

Residence, cost $18,000, Outremont (Blvd. St. Joseph and Querbes), for Wilfrid Duquette, 2668 Park ave. Owner will purchase supplies and build residence.

Six flats, cost $6,000, Iberville, for W. C. Ball, 204 St. James. Architect, J. O. Harris, 180 St. James. Three storeys, 25 x 40, concrete foundation, brick construction. Plans ready.

Ottawa, Ont.

Residence, cost $6,000, for Walter J. Martin, 392 Nelson street. Brick veneer construction, stone foundation. Plans will be prepared.

Residence, cost $4,700, Fourth Ave., for G. A. Clark, 106 Kent St. 2½ storeys. 24 x 33, brick veneer construction, stone foundation. Plans in progress.

Residence, cost $4,000, 3rd ave., for Stanley Ferguson, 119 McLaren. Two storeys, 19 x 36, brick veneer construction, stone foundation. Plans in progress.

Regina, Sask.

Residence, cost $30,000, planned for J. P. McColl, 203 Rose St. Architects. Storey & Van Egmond, Credit Foncier Bldg. 2½ storeys, brick construction and foundation. Tenders called.

Toronto, Ont.

Residence, cost $3,500, Orchard View. for Wallace Smith, 117 Delaware ave. Architect, Thos. Hancock, 836 Dovercourt Rd. Two storeys, 18 x 38, brick construction and foundation. Plans drawn.

Two pair residences, cost $10,000, St. Clair Gardens, for W. Pennock, 5 Burlington Cres. Tenders received by owner for brick and stone work. Carpentry being done by day labor. Two storeys, 32 x 46, brick construction and foundation.

Victoria, B.C.

Apartment, cost $45,000, Cook and Collinson streets, planned. Architect, C. E. Watkins, Green Block. Tenders will be called soon. Three storeys, brick construction, frame interior, 34 suites of 2 and 3 rooms.

Bungalow, cost $12,000, Qualicum. Architects, Spurgin & Wilkins, 465 Times Bldg., are preparing plans.

Apartment, cost $70,000, planned. Architect, H. Bryant Newbold, Jones Bldg., Fort St., expects to call for tenders about October 1st.

Vancouver, B.C.

Apartment, cost $17,000, Broadway E. Architects, Stuart & White, Metropolitan Bldg. Two storeys and basement, 66 x 66, frame and stucco construction. 12 suites, disappearing beds, hot water heating.

Winnipeg, Man.

Residence, cost $4,800, Balfour, for J. H. LaPlante, 271 Evanson St. Two stys., 24 x 34, frame construction, stone foundation. Plans ready.

Residence, cost $5,000, Wolseley, for J. Beaton & Sons, 417 Maryland. Two storeys, 28 x 30, frame construction, stone foundation. Plans ready.

Residence, cost $3,000, Polson avenue, for C. G. Perry, Suite 14, Fairbairn Blk. Two storeys, 20 x 24, frame construction, stone foundation. Plans ready.

CONTRACTS AWARDED

Brucefield, Ont.

Residence, cost $3,500. Architect and general contractor, Robt. Watson, Brucefield, P.O. Red pressed brick construction, stone and concrete foundation. Excavating done.

Fort William, Ont.

Apartment block, cost $25,000, Brodie

(Continued on page 75)

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Repairs to Eastern Pier at Newcastle, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 15, 1913**, for the Repairs to Eastern Pier at Newcastle, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmasters at Kingston, Ont., and Newcastle, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46374. 39-40

Department of Militia and Defence

Extension to Stables, Tete-de-Pont Barracks, Kingston, Ont.

Notice to Contractors

Sealed tenders, marked on the envelope "Tender for Construction of extension to stables, Tete-de-Pont Barracks, Kingston," and addressed to the Director of Contracts, Department of Militia and Defence, Ottawa, will be received until noon, **September 30th instant**, for the construction of an extension to the stables at Tete-de-Pont Barracks, Kingston, Ont.

Specifications may be seen and full particulars obtained at the offices of the Officer Commanding the 3rd Division, Kingston, Ont., and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on the form supplied by the Department of Militia and Defence, and accompanied by an accepted cheque on a Canadian Chartered Bank, for ten per cent. (10 p.c.) of the amount of the tender, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into or fails to complete the contract in accordance with his tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET,
Deputy Minister.

Ottawa, September 2, 1913.

Newspapers will not be paid if this advertisement is inserted without authority from the Department. - 47356. 38-39
H.Q. No. 44 7-73.

Stratford's Water Commissioners Invite Separate Bids for the Supply of

(a) A 150 h.p. steel boiler to carry a 120 lbs. working pressure. The offer to be accompanied by full specifications and drawings showing the type, sizes, fittings, foundation and setting.

(b) Also, for a similar boiler capable of 150 lbs. working pressure.

(c) Also, for one high duty reciprocating steam pump, to deliver 1¼ million imperial gallons of water per 24 hours at 80 lbs. pressure. Preference will be given to a pump that could do this duty economically, and yhe when required for fighting fire, could get 120 lbs. water pressure. This offer to be accompanied by full specifications and drawings that show the foundation.

The Commissioners will be at the cost of putting in all foundations and steam pipes, but not of steam shut-off valves for each. All metal work must be put together by the contractor, and delivered here f.o.b.

Time for delivery—from acceptance of bid—six weeks.

Bids to be in on or before the 4th of October, 1913.

The lowest or any bid not necessarily acaccepte.

W. H. TRETHEWEY,
39-40 Sec.-Treas. Water Commissioners.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf Extension and Warehouse at Barcebridge, Ont.," will be received at this office until 4 p.m. on **Tuesday, October 21, 1913**, for the construction of a Wharf Extension and Warehouse at Bracebridge, District of Muskoka, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. H. Armstrong, Esq., District Engineer, Midland, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Bracebridge, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. Desrochers, secretary.

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 47003. 39-40

Sealed tenders addressed to the undersigned and endorsed "Tender for Examining Warehouse, Fort William, Ontario," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Mr. H. E. Matthews, Superintending Architect of the Dominion Public Buildings, in the Province of Manitoba, Winnipeg, Man.; W. P. Merrick, Esq., District Engineer, Fort William, Ont.; at the office of the City Clerk, Fort William, Ont.; and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47782. 39-40

Sealed tenders addressed to the undersigned, and endorsed "Tender for Examining Warehouse, Port Arthur, Ont.," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of the City Clerk, Port Arthur, Ont.; F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; H. E. Matthews, Esq., Superintending Architect of the Dominion Public Buildings, Winnipeg, Man.; Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47781. 39-40

TENDERS

To Contractors

Bulk or separate tenders will be received by the undersigned up to

Wednesday, the first day of October,

at 5 o'clock p.m., for the several trades required in the erection of a Warehouse Building on the southeast corner of Adelaide and Charlotte Sts.

Plans and specifications may be seen and all other information obtained at the offices of the architect.

The lowest or any tender not necessarily accepted.

GEO. W. GOUINLOCK, Architect.
Suite 1108 Temple Building,
39 Toronto, Ont.

Notice to Contractors

Asphalt Pavements

Sealed tenders addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, up to 4 p.m., **Thursday afternoon, October 2nd, 1913**, for the construction of asphalt pavements on:—

Clarence St. from King Edward Ave. to Chapel Street.

O'Connor St. from Queen St. to Laurier Ave.

Any tender received after the above stated time will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, Sept. 23rd, 1913. 39

To Contractors

Sealed tenders marked "Tender for Plumbing, Etc.," addressed to the undersigned, will be received at this Department until noon of **Monday, October 6th, for** heating, plumbing and electric wiring of the Dormitory for the Boys at the Institution for the Deaf and Dumb, Belleville, and the Institution for the Blind, Brantford.

Plans and specifications can be seen at this Department and at the above Institutions.

An accepted bank cheque payable to the Honourable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender and the bona fide signatures and addresses of two sureties or the name of a guarantee company approved by this Department, willing to provide bonds for the due fulfillment of the contract, must accompany each tender.

The Department is not bound to accept the lowest or any tender.

By order,

H. F. McNAUGHTEN,
Secretary, Public Works Department.
Department of Public Works, Ontario.
Toronto, September 22nd, 1913.

Newspapers publishing this advertisement without authority will not be paid for it. 39

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Residences

(Continued from page 73)

St. N., for C. G. Jenkins, 711 Victoria Ave. Architect, R. E. Mason. General contractor, C. E. Ward. Heating, Higginbottom & Co., 117 Leith St. Plumbing, Wm. Brayley, Frederick St. N. 3-storeys, 50 x 55.

Hamilton, Ont.

Residence, cost $25,000, for J. W. Lamoreaux, 26 Canada St. General contractor, W. H. Yeates, Jr., 24 Leeming St. Plastering, J. Clapham & Son, 69 Hughson St. N.

Montreal, Que.

Six pair semi-detached residences, cost $35,000, Outremont, Architect and general contractor, Geo. W. Goodbody, 549 Durocher. Two storeys and basement, 40 x 50 each pair, concrete, pressed brick construction.

Twelve flats, cost $15,000, Richelieu. Owner and general contractor, D. F. Deslauriers, 343 Richelieu. Three storeys, 63 x 54, concrete foundation, brick construction.

Residence, cost $4,500, Church. Owner and general contractor, Patrick Farmer, 1128 Galt ave. Two storeys, 30 x 30, concrete foundation, brick construction.

Flats, cost $10,000, Verdun (1st Ave.). Owner and general contractor, Ulric St. Amand & Pilon, 1337 Wellington. Three storeys, 46 x 66, concrete foundation, brick construction.

Ottawa, Ont.

Residence, cost $7,000, Rosedale, for W. H. Collins, c/o General contractor. Geo. Eaman & Son, Isabella St. Brick veneer construction, stone foundation.

Residence, cost $7,000, Carling, for A. E. McCormick, 77 McLaren. Architect, W. Herbert George, Castle Bldg., Queen St. Carpentry, Saunders Bros. Plastering, Bowman & Son. Painting, A. J. Marshall, 5 O'Connor. Heating and plumbing, M. M. O'Connell, Gloucester. Electrical, J. A. Ellacott, Bank Street.

Toronto, Ont.

Two family residences, cost $5,000, Woodbine. General contractor and owner, J. Ellenson, 211 McCaul St. Architects, Ellis & Connery, Manning Chambers. Two storeys, 28 x 36, brick construction.

Power Plants, Electricity and Telephones

Montreal, Que.

The city contemplates the purchase of electric lighting standards for police and fire departments. Sec. Board of Commissioners, L. N. Senecal. Engineer, Mr. Parent, Supt. Lighting Dept., City Hall.

Telephone Exchange, cost $100,000, St. Urbain, for Bell Telephone Co., Notre Dame and St. John. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractors, Jno. Stewart & Co., Bethune St. Concrete foundation, Ohio sandstone and steel construction, concrete floors, electric lighting, hot water heating, tile floors, plate glass, two passenger elevators, copper cornices, architectural iron stairs. Excavating done.

Street lighting, St. Catherine and Bleury, planned. Secretary, L. N. Senecal. Engineer, Mr. Parent, Light Supt., c/o City Hall, Montreal. Plans to be submitted to Board of Control for 225 single standard lamps. Tenders will be called shortly.

Regina, Sask.

Power house planned by City Council. Supt. of Light and Power Dept., E. W. Bull. Architects, Storey & Van Egmond. Steel work, Western Steel Supply Co., Ltd., 1941 Scarth, $33,434. Piping and valves, Crave & Ordway, Toronto, $18,000. Boiler feed line, Canadian Fairbanks-Morse Co., Ltd., 300 Princess St., Winnipeg, $3,084. 174 x 130, concrete foundation, brick and stone construction.

Saanich, B.C.

Lighting system planned by Municipality of Saanich (Works Committee), 2 constant current regulators, with a capacity of 500 lmps, of 80 watts or 450 lamps of 94.4 watts and 250 locations.

Victoria, B.C.

Council have adopted recommendation of Electric Light Committee for the purchase of additional machinery for the telegraph street lighting station, including a spare transformer. Secretary, W. J. Dowler.

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

MacLean Daily Reports Limited
The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.
220 King Street West - TORONTO

BAY STATE

Prevent your concrete or cement from hair cracking with

Bay State
Brick and Cement Coating

It excludes dampness and will protect building material from rust and disintegration.
Gives an artistic dull effect which does not take away the distinctive texture of concrete.
Can be used in mills, garages, private houses, hotels, railroad stations and office buildings.
Ask your dealer for it. If he cannot supply you write us for Booklet M. that tells you all about Bay State Brick and Cement Coating.

Wadsworth, Howland & Co., Inc.
Paint and Varnish Makers and Lead Corroders
82-84 Washington Street - Boston, Mass.
New York Office, 101 Park Avenue at 40th Street
CANADIAN REPRESENTATIVES:
Gouinlock & Crawford, 217 Confed. Life Bldg., Toronto, Canada
David McGill, 83 Bleury St., Montreal, Canada

Messrs. Waitt & Bond, Boston, Mass.
Densmore & Le Clear, Engineers.

The ATHEY Cloth-lined Metal Weather Strip

THE only one that keeps out all draughts and dirt.

THE only one with a cloth-lined channel in the sash.

Installed by

The EBERHARD & WOOD Mfg. Co.
Ornamental and General Iron Works
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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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"The Red Brick People"

Bradford, Pa.

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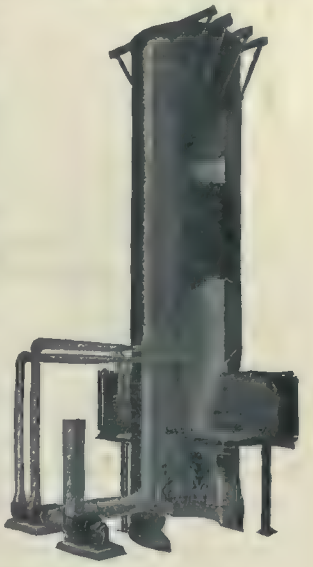

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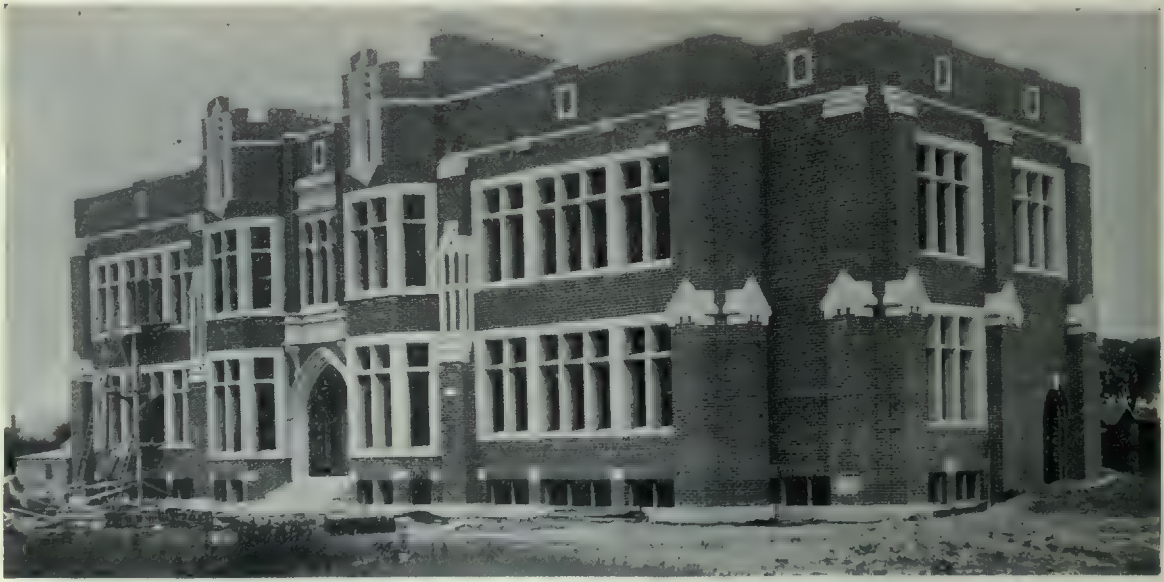

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ESTABLISHED 1886
Contract Record and Engineering Review

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Vol. 27 **October 1, 1913** **No. 40**

Standardisation of Road Stones and Standard Nomenclature

CONSIDERABLE importance attaches to the "British Standard Specification for Sizes of Broken Stone and Chippings" which has recently been issued by the Engineering Standards Committee. Standardisation is essential to prosperity in every trade, and quarry owners should welcome the possibility of specifications in which the technical provisions will always be practically identical. The vagaries of both engineers and architects have in the past been responsible for endless muddle and delay in the supply of materials, and the sooner the whole field of supplies is placed upon a standardized footing the better will it be for all parties to a contract. The Committee recognized early in their deliberations that in any gauged material there must be certain proportions respectively above and below the nominal size, and that although these should be limited in amount they must yet be sufficient to allow of the quarries complying with the Standard Specification. The Committee have adopted four Standard gauges for broken stone: 3-in., 2½-in., 2-in. and 1-in. The following is the specification for 3-inch stone: "Broken stone specified as 3-inch gauge shall all pass through a 3-inch ring and shall consist of the following percentages by weight:—Not more than 15 per cent. passing through a 2½-inch ring in every direction. Not less than 65 per cent. over 2½ inches, and not exceeding 4 inches, in greatest length by measurement. Not more than 20 per cent. over 4 inches in greatest length by measurement." Proportional allowances are made in the other grades, and it cannot therefore be said that the committee have erred on the side of stringency. As regards chippings the Standard Gauges run in eights of an inch, from 1 in. to ⅛ in., and each gauge is clearly defined. "One inch chippings must all be capable of passing through a square hole of 1 inch side and at least 70 per cent. by weight must be retained by a sieve having square holes of ¾ inch side." A point of no little interest in the Specification is the definition of the terms "gauge" and "size." It is of course quite obvious that "gauge" does not indicate a dimension, but the Committee have wisely retained the use of the term in that sense, owing to the fact that "it is in general use in the quarry industry." "Gauge" then is used to describe the Standard group of sizes into which broken stone is divided, while "size" is used to describe the sub-divisions of the gauge.

In an Appendix to the Report, under the heading "Nomenclature of Road Stones," is given what may be described as an elementary essay in the standardizing of the stones themselves. The details are to be filled in later, so there is no need to go further in the matter at this juncture, but this trial flutter brings to the mind the necessity for a far-enlarged nomenclature, to include not only road stones, but all roads, materials and forms of construction. In the leisurely march of former ages, word-making and phrase-building were among the slowest of processes for the simple reason that there was very little that was new needed description. In these days of swift advancement, the coining of new words and phrases has become an everyday necessity, and unless the utmost care is exercised the confusion which already exists must become worse and worse confounded. This is true of every branch of the sciences and the arts, but a consideration of that obtaining in highway matters will suffice for present purposes. Take the simple matter of applying a coat of tar to a road surface. The process has, a contemporary points out, been variously described as tarring, tar dressing, tar painting, tar spreading, tar spraying, tar treating, tar coating, tar surfacing, tar varnishing, surface tarring, top dressing, flush coating, and superficial tarring. The redundancy of expressions here is absolutely ridiculous, and equally ridiculous are those used in the designation of the various layers of carriageway. Four names would suffice, and some thirty-five have not been found sufficient. To say that these names are coined largely by ignoramuses desirous of impressing their wiser fellows does not clear the air. What is wanted is a committee, a standing committee (an unfortunate expression, by the bye, as it means one that is always sitting) to which new processes and appliances would be referred for naming. The scope of the Engineering Standards Committee is too limited, since any such committee as is suggested would be called upon to prepare nomenclature for the whole of "the sciences and the arts" (taking the expression in its widest sense) and such nomenclature should be adopted by all English-speaking nations. There is no reason why England, Canada and the United States should not converse, at least technically, in one common language. Standardization would follow nomenclature, and both would assist incalculably in the promotion of trade, commercial, professional and scientific intercourse between the various countries. World-wide nomenclature is not yet within the range of practical politics.

At a meeting convened recently in Regina by Mr. R. O. Wynne-Roberts, steps were taken looking to the formation of a Canadian Institution of Municipal Engineers.

Hydro-Electric Power Development Near Calgary, Alta.

Specially contributed by W. W. Hay, B.Sc.

THE Calgary Power Company, Limited, of Montreal, have under construction west of Calgary, at the Kananaskis Falls of the Bow River, a new hydro-electric power plant and they are also installing an additional unit in their plant at the Horseshoe Falls, two miles down the river.

Particular interest is attached to the development at present through the negotiations with the city of Calgary for a power contract. Heretofore the city has been the largest consumer of power from the company and hesitates to enter into further contracts unless the power company will guarantee continuous power the year round. The extreme fluctuations in the flow of the stream preclude the continuous operation of the plant to capacity during periods of low water, forcing the customers to install auxiliary power units in case of failure in delivery of electric power. It is to enable them to guarantee this continuous service that the power company is building the new plant, in spite of conditions which ordinarily would not warrant such a development. It is expected that when the new plant is completed the city of Calgary will enter into a contract for some 5,000 horse-power at $26 per horse-power year, with a reduction of $1 per horse-power year per each additional 1,000 h.p. used, until the price reaches $20 per h.p. year for over 10,000 h.p. per year.

Watershed and Reservoir

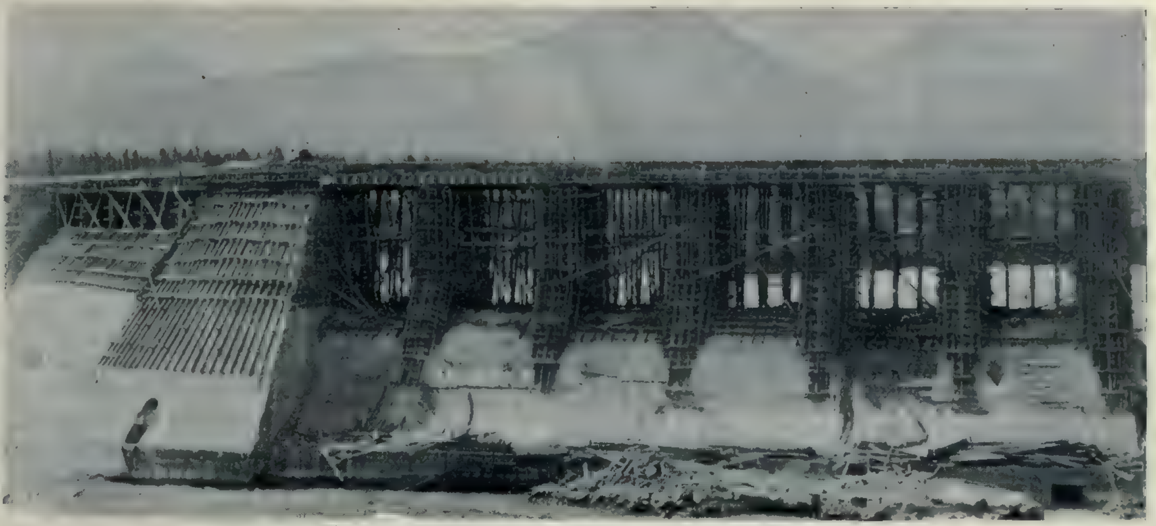
The Bow River has its source at the great divide, in the watershed of the Rocky Mountains, and flows southeast until it reaches the foothills, when it turns to the east as far as Calgary. It then flows south and east to its confluence with the Belly River. Between its source and the plains a number of small streams flow into it from the many mountain valleys that it intersects. Almost immediately after leaving the mountains it is joined from the south by the Kananaskis River, a stream of good size and fairly uniform flow, which has its source in the eastern ranges of the Rockies in muskegs and lakes lying at a considerable elevation. From this point to its junction with the Belly River it furnishes the main run-off channel for the eastern slope of the Canadian Rocky Mountains. At its junction with the Kananaskis River, 53 miles west of Calgary, there is a combined maximum run-off of about 12,000 sec. ft. reached during June, when the snow is melting most rapidly and the spring rains are prevalent. During the winter months, when the run-off from the glaciers and snow-fields is at its lowest, the run-off is as low as 1,000 sec. ft. There are but few available reservoir sites, as the river flows in a very wide, deep valley, and the two sites selected for the power plants with dams are at points where the valley is very narrow, in rock formations. The largest storage reservoir available was the one most easily dammed. Lake Minnewanka, about forty miles west of these developments, has a total length of some twelve miles, with a varying width of less than one mile, and has its only outlet through a very narrow canyon. During the winter of 1912 a dam was built across the Cascade River, at the outlet of Lake Minnewanka, giving a storage of 44,000 acre-feet by raising the level of the lake 12 feet. This is sufficient for a flow at the power stations of 275 sec. ft. during the four most severe months of the winter. The dam lies within the limits of the Banff National Park and in consequence of the agreement with the government, the power company has had to remove all timber and debris from the flooded area and for a distance of ten feet beyond and has left a thimble in the dam whereby the Parks Department may carry out a small development of 800 or 1,000 h.p. for use at Banff and elsewhere. The dam structure is about 70 feet high, constructed between the rock walls of the outlet. It has three stop-log openings 10 feet wide, with deck overhead, and, besides the sluice for the power development, has an unwatering valve 6 ft. in diameter, hand operated. A hand-operated winch running over the dam handles the stop-logs. The dam was designed by the power company and was built in three months, during severe winter weather, by the Foundation Company, Limited, of Montreal.

Addition to Existing Plant

Early during the year 1911, the plant now in operation was completed except for the installation of one 6,000 h.p. unit. The first units installed were one 6,000 h.p. unit, of which the new unit is a duplicate, and two 3,750 h.p. units, with two 150 h.p. exciter units, all of the horizontal type turbine, with direct connected generators. In general, the plant consists of a dam, 400 feet long and 50 feet high, located just above the Horseshoe Falls with the power house just below the falls and about 300 feet distant from the gate house, the water being conveyed to the turbines by rivetted steel penstocks 12 ft. in diameter. At present, power is supplied to a sub-station in the city of Calgary by two 55,000 volt transmission lines, and to a sub-station at Exshaw, for the mill of the Canada Cement Company, Limited, by a 12,000 volt line. The installation of the fourth unit is about completed and consists of one 6,000 h.p. horizontal turbine, manufactured by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, operating under a 70-foot head at 225 r.p.m., and direct-connected to a 4,000 kv.a. three-phase, 60-cycle, 12,000-volt horizontal shaft a.c. generator supplied by the Canadian General Electric Company, Limited. The new installation necessitated the construction of a new rivetted steel penstock, 12 feet in diameter, controlled by a gate of the "butterfly" type, weighing 25 tons in place. The draft tube was completed in the original construction of the power house. The switching equipment installed in connection with the new unit and its accompanying 3,000 kv.a. three-phase transformer will duplicate that already installed for the control of each of the other units. Provision had been made in the station switchboard design for the control of this generator, as was also the case in regard to exciter capacity and switching equipment.

New Development at Kananaskis Falls

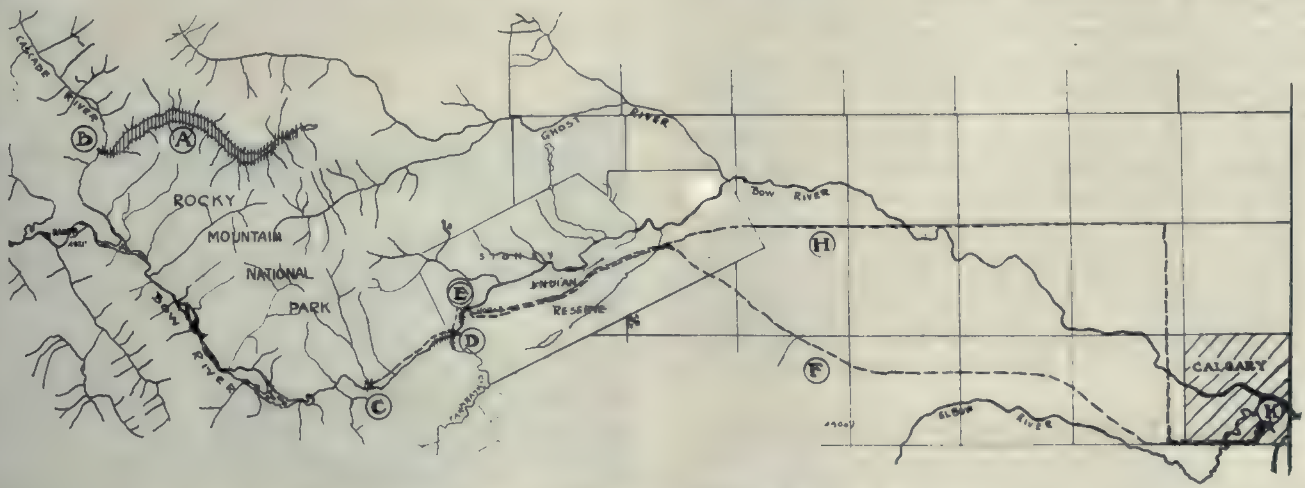
The new power development now in course of construction is about two miles above the operating plant, and well above the backwater from the dam. The gen-



Dam at Kananaskis Falls. Stop-log section under construction.

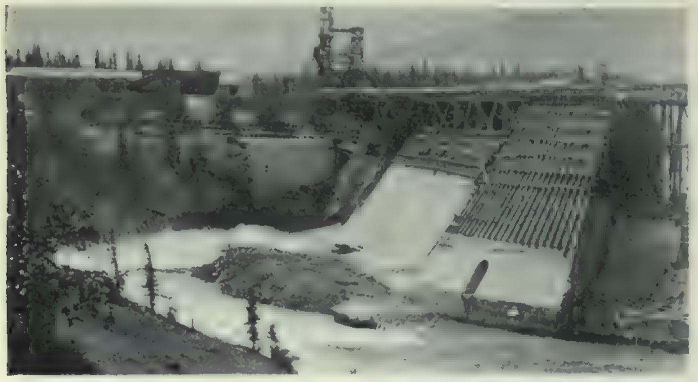
eral scheme consists of a dam above the falls, a canal flume leading to the headgates, pressure tunnels leading to the scroll chambers of two water wheels, and draft tubes with tail race tunnels to the river below the falls. The dam will have a total length of over 800 feet, including wing walls, is 57 ft. 6 in. high above the lowest foundations, and has 11 stop-log openings 18 ft. wide, main sluiceway with log run, and will raise the water level about 59 feet. The dam will back the water up into the Kananaskis River beyond the Canadian Pacific Railway, necessitating the raising of a two-span bridge a height of four feet, with a corresponding rise in the grade of the railway in either direction. The wing walls are thrown well into the banks at either side, well above the maximum high water mark. There will be a 6 ft. unwatering valve in the dam, besides three tunnels in the overflow section for the observation of seepage. There will be 215 lineal feet of free overflow in the length of the dam, high water level being 20 ft. above the lowest stop-log opening. There will be a deck 20 ft. wide over the sluiceway and stop-log openings, 10 feet wide over the other sections, and upon it will run an electrically operated winch for the handling and placing of the stop-log. The foundation is in general a soft shale, very seamy in spots, and in order to prevent the seepage of water below the dam, the rock is being grouted under pressure so as to fill all seams. Two-inch holes are being drilled about 30 inches apart above and below the dam, Caylx drills being used for drilling, and the holes will be filled with cement grout forced in under pressure. In one instance, during the grouting of one hole in the upstream face, forty bags of cement were required before the flow ceased.

Along the south shore of the river, for a distance of 1,000 feet from the dam, and rising slightly from the height of the top of the dam, there is a ledge of rock similar to that upon which the dam is constructed, and this ledge has been used as a natural dam for the canal flume, which has its head at the south end of the dam and in the east bank of the Kananaskis River. The rock in general is a soft, seamy shale alternating with occasional thin beds of sandstone, the whole formation belonging to the Jurassic Period. The first 200 feet of the canal will run through a deposit of gravel overlying the rock, and the rest of the section must be cut through the solid rock. The canal will be over 700 feet long, with a trapezoidal section, in gravel, 80



Map showing watershed, location of power stations and market.

feet wide at the top, 50 feet wide at the bottom, having a normal operating depth of 15 feet. Through rock the canal section will be rectangular in general 50 feet wide and 15 feet deep. The section in gravel will be lined with concrete, the remaining length being unlined to the headgates. The rock left in place at the head of the canal forms a natural dam to the water and the water will pass through the headgates into pressure tunnels leading to the scroll chambers. These tunnels, together with the power works and tailrace, are cut through solid rock, and, with the canal section through rock, involve the removal of some 45,000 cubic yards of rock excavation. Gratings will be placed in front of the headgates, and in front of the gratings will be stop-log gates to allow for repairs to the main gates. The headgates will be steel rivetted Tainter gates, operated by electric winches placed in the gate-house above. Four concrete lined pressure tubes lead from the gates and develop into scroll chambers formed in concrete in which are set the two turbines. Two 5,800 h.p., vertical, single runner, mixed flow hydraulic turbines set in the scroll chambers will be direct connected by 15 in. steel shafts to 4,250 kv.a. three-phase, 60-cycle, 12,000 volt, vertical, alternating current generators. The centers of the water wheels will be 55 feet below normal water level, operating under a 68 ft. head at 164 r.p.m. In addition there will be an exciter unit of 150 h.p. with separate penstock and draft tube. Turbines and generators are being supplied by the Canadian Allis-Chalmers, Limited. The floor of the power house will be 25 feet above the center of the turbines; the power house will be 40 ft. wide by 90 ft. long, and 37 ft. high, of brick and steel construction, with steel roof trusses, and will house a 50-ton travelling crane for use in handling the machinery. From the turbines the water will flow through concrete lined draft tubes to the tail-race. The draft tubes are 9 ft. in diameter at the wheel, and develop from the circular section to a rectangular section, 14 ft. by 16 ft., at the entrance to the tail-race tunnels. Normal tail water will be 15 feet below the center of the turbines. There will be two tail-race tunnels, 186 ft. long, 14 ft. wide, and 18 ft. high with semi-circular tops, lined with concrete. At the end of the tunnels in the river are stop-log piers for checking the entrance of the tail water into the tunnels in case of extreme high water.



Dam at Kananaskis Falls—Log-run and spillway section.

Electrical Equipment and Transmission Lines

The present transmission system consists of two 55,000 volt lines, 50 miles in length, each of No. 0000 stranded aluminum cable carried on substantial wooden poles with cross-arm construction, serving the substation in the city of Calgary, and two 12,000 volt lines, 25 miles in length, of the same construction, serving the station at Exshaw, where transformers and synchronous apparatus are installed to obtain power at an operating voltage with good power factor. Under ordinary circumstances, the two 12,000 volt lines serving Exshaw will be carried by the new plant, and provision has been made in the switching equipment to enable this load to be transferred to the 12,000 volt busses at the present plant. In addition, outgoing feeders will be installed for the purpose of connecting the 12,000 volt busses of the two stations, enabling the new plant to feed the 55,000 volt lines to Calgary through the step-up transformers at the present plant. The switchboard gallery is 19 feet wide, running the full length of 90 feet along the east side of the power house, and contains the station service, exciter, and remote control boards. Generator circuits and outgoing feeders are operated by remote control, electrically operated, circuit breakers installed in the high tension chamber. Owing to the necessity of handling two 12,000 volt incoming lines from the new plant, in addition to the Calgary and Exshaw out-going lines, the installation of three 12,000 volt busses and two 55,000 volt busses was provided for in the original layout of the present plant. Interconnection of the low tension busses provides for the operation of the outgoing lines from a combination of any of the four units in the present plant as well as from either or both of the two units in the plant now under construction, an arrangement of maximum flexibility. In order to handle the increased load on the high tension line, it is intended to erect two additional 55,000 volt transmission lines serving the Calgary Sub-station. The survey for the first of thees lines has been about completed, and the other will be surveyed at once. The route of these two lines will follow closely that of the most northern of the existing high tension lines. All switchboard and transformer equipment in the operating plant, as will be the switching apparatus for the new plant, was supplied and installed by the Canadian Westinghouse Company, Limited.

Construction Methods

The isolated location of the power development has necessitated the building of nearly two miles of sidings, including a timber trestle over the Kananaskis River, a camp for the feeding and shelter of over 500 men, together with power plant and pumping stations, with other necessary adjuncts for the conduct of so large a job of construction. There are at present over 450 laborers and mechanics employed con-

Power house at Horseshoe Falls, showing new penstock.

tinuously, about 100 of these being on night shift to carry on blasting and excavation. Work on the dam was commenced during the month of February, 1913, and has been prosecuted with vigor so that it is expected to have the entire plant completed and in operation by the first of November. In the beginning a steam power plant was installed, using two 100 h.p. Leonard boilers, and supplying steam for the Sullivan air compressor and pumps, besides an engine used for the driving of machine and wood-working tools, and a 35 h.p. dynamo for electric lights. As the work progressed the dynamo was overloaded, without the possibility of adding to the load on the boiler, so that transformers were installed that would later be required in the equipment of the power plant, and all the electric energy required was "stepped down" from the 12,000 volt line running past the site to Exshaw. After the construction was well under way, a bed of excellent gravel was uncovered within 2,000 feet of the dam and close to the power works, and a Model 20, Marion steam shovel, with one cubic yard dipper, was installed to move it. The gravel proved to be entirely suitable for the work in hand, being well graded in the bank, and containing but 6 per cent. of clay loam. Weekly tests have been made as the work progressed, and have enabled the engineers to satisfy themselves as to its suitability. It is estimated that the proximity of this gravel to the work will result in a saving of about $4 per cubic yard of concrete, or some $100,000 in the original estimates. The gravel is hauled to the concrete plant in 6 cu. yd. side dump cars moved by a Vulcan steam contractors engine. The concreting plant is situated at the end of the main dam, about 1,000 feet from the power works proper, and consists of two 1 cu. yd. Milwaukee mixers, with hoisting towers and distributing system. The mixers are placed 30 feet below the track level, gravel being dumped from the cars into wooden hoppers having a capacity of 120 cubic yards of material, and dropping through four sheet-metal tubes with arc gates, directly into the charging hoppers of the mixers.

The cement shed is close to the mixers, at the track level, and the cement in sacks slides down an incline to the platforms in the rear of the mixers. There are two hoisting and distributing towers, one 40 feet high serving the main dam, the other 60 feet high for other concreting. Insley hoisting buckets and hoppers are used in both towers. Concrete for the dam was placed from a track running along the deck upon which were run one cu. yd. side-dump industrial cars charged from the hoppers in the towers. That portion of the concrete nearest the high tower was placed by spouting through an 8-in. open trough direct to the final point. This plant has already been used for placing over 15,000 cubic yards of concrete, and has attained a maximum of 350 cu. yds. of concrete in one 10-hour shift.

Concrete for the canal and other works is being placed from the same plant, conveyed from the mixers in side dump cars lined with cement sacks to keep tight. A gate arrangement at the hopper of the tall tower enables an operator to turn concrete from the chute into the cars standing on the tracks. The cars are then hauled to the dumping spot by the "dinkey" engine, and the concrete dumped into hoppers, whence it is conveyed by closed chutes to its final position. These chutes are practically vertical, being as long as 90 feet, and are 10 inches in diameter, fabricated from sheet metal.

In the construction of the dam, a cofferdam of 2 in. by 10 in. planks was first built, leaving a temporary sluiceway 104 feet long at the north shore of the river, and another 18 feet wide in one of the stop-log openings next the south end of the dam. All concrete is being deposited in wooden forms built of heavy timbers and amply braced, with planed surfaces where ever in contact with the concrete. Concrete has been deposited in sections the width of the stop-log openings. There will be about 20,000 cubic yards of mass concrete deposited before the completion of the dam.

Excavation of the canal section in gravel is being carried out by means of a Model 30 Marion steam shovel with a one-third cu. yd. dipper, loading into dump cars on the track between dam and power works. Two 12-yd. and eight 6-yd. Peleter side dump, wooden cars have been kept in constant use handling excavation and concrete. Rock is excavated by blasting and manual labor, eight Holman compressed air drills being in constant operation in the canal section through rock and in the wheel pit and tail-race tunnels. Excavation from the pit and tunnels has been removed in steel stone-boat hoisted by two 5-ton stiff-leg derricks operated by Marsh-Henthorn steam hoisting engines. One of these derricks operates a one cubic yard Hayward clamshell bucket for excavating portions of the canal prism next the headgates. For the construction of the two tail-race tunnels, a heavy timber cofferdam was constructed at the foot of the ledge of rock in the river, and the tunnels were driven from the river face while excavation was in progress for the pressure tunnels and wheel pits. The second bench was then driven from both ends to completion. Concrete for lining the scroll chambers, draft tubes and tunnels is being placed from the track above, the forms being built on the ground above and lowered to place by the derricks used for excavation.

Storage dam at Lake Minnewanka.

To date the concrete has been placed for all the dam sections except the temporary sluiceways, and the concreting of the scroll chambers and draft tubes is well under way. So far there have been no fatal accidents, though construction has been in full swing for over five months.

The estimated cost of the construction is $750,000. The plant has been designed and the entire construction is being carried out by the Power Company, for whom Mr. H. A. Moore, is the general manager and chief engineer. All detailed plans have been made at the site under the immediate direction of Mr. Harold A. Johnston, resident engineer. There are nine engineers and draftsmen employed for field and office work at the site. Mr. A. W. Allen is the superintendent of construction. The electrical equipment installation is under the direction of Mr. A. Barnes, operating superintendent for the company's plants. The author is endebted to the company's officers for their courtesy in enabling him to gather the details set forth above, and to Mr. Wm. Smith, of the Canadian Westinghouse Company, Limited, for the brief particulars of the electrical switching installations.

Purchasing through the Consulting Engineer

IN the present state of engineering development a good many people appear to be somewhat at sea regarding the wisdom of employing an expert adviser in connection with the purchase of machinery and supplies. This ought to be a pretty late day to set up an argument as to the benefits of a consulting engineer's services. The increasing complexity of modern industry, the interconnection of technical specialties, and the multiplying resources of the manufacturers leave no room for discussion as to the real economy of outside advice of the right kind, by the bonafide expert, rendered to the plant owner who is by force of circumstances unable to maintain a specialized knowledge of many auxiliary matters bearing upon his business. It is a difficult enough job to keep up to the times in any branch of applied science, manufacturing or business, to-day without attempting to be one's own guide, philosopher and friend in solving stiff problems outside one's normal line of work.

On some kinds of work the routine services of a purchasing bureau are no doubt sufficient for all practical requirements, provided those are supplemented by the scrutiny of the owner's technical staff. Successful experience with given makes of apparatus not involving large individual investments per unit naturally leads to "repeat orders" on which the expenditure of any considerable sums for outside advice is often needless. It requires good judgment to know when the duplication of supplies and machinery should be called into question and expert advice sought on later products. Where the investment is large the purchaser will do well, before placing a repeat order, to ascertain whether the last type of apparatus installed represents the latest and most economical machinery available for the desired service, making a special point of determining whether the service itself may not have changed sufficiently to warrant fresh engineering consideration of the best methods of meeting the demands. This may at times be done within one's own organization with entire success, while in other cases it must be done by the aid of outsiders. In a nutshell, the retention of a consulting engineer in every case should depend upon the magnitude of the problem at issue, the uncertainty of the solution, the amount of money involved, the possibility of difficulties in the execution of the project, and, perhaps above all, upon the knowledge of the purchaser or his engineering staff of the class of work contemplated. Self-sufficiency is a dangerous trait in handling new engineering problems; if there exists any doubt as to the proper machinery or supplies for an important piece of work the safest course is to put the problem in the hands of a consulting engineer of acknowledged standing.

The troubles which follow undue reliance upon purely "home talent" or upon salesmen in the purchase of engineering equipment are well set forth in a contribution to the Engineering Supplement of the London "Times" of August 20. The writer deprecates falling back upon the advisory service of sales engineers, discusses the preparation of specifications by amateurs, and, after exposing the pitfalls of guarantees inadequately demanded by novices or unsuspiciously swallowed whole by non-technical apparatus buyers, outlines the duties of a consulting engineer in the selection of power-plant equipment. He shows that the sales engineer, no matter how honest, cannot but be biased in favor of his concern's products. Such a man may well be called into conference in the purchase of equipment and his recommendations given due weight; but it pays to go slowly in accepting anything extensive in the way of designing from such sources.

The subject of specifications affords material for a treatise. Here the independent purchaser often fails utterly, either by loose expressions which easily can be evaded or by excessively strict requirements at unimportant points, which increase the cost of his apparatus far beyond what it would have been had a consulting engineer been employed. The man who buys machinery without adequate knowledge as a guide runs grave risk of getting little for his money. Attempts to cover one's own ignorance by ready-made specifications based largely on the generalities of manufacturers' tenders are pretty certain to result disastrously. Makers' specifications seldom include everything necessary for complete plants, the consequence being that the unsuspecting purchaser is finally overburdened with the cost of extras which he did not anticipate when he placed his order.

Without the consulting engineer, or, in his absence, the properly qualified technical adviser or group of experts on the staff of the purchasing organization the buyer is liable to be exposed to the evils of "leaky" guarantees, unskilled analyses of bids, scattered responsibility for the operating results of diverse apparatus assembled under a single roof, insufficient inspection of work in progress in the manufacturer's shops, delays in placing orders and in stimulating shop production, drawings lacking necessary details for the most rapid filling of orders, unreasonable or inadequate specifications, and ignorance as to the apparatus which in the long run will prove the best, all factors considered, and consequently the least costly for the required service. The cost of expert advice, in cases where the resources of one's own staff are insufficient—as they often must be on account of rapid progress in every branch of engineering—is too small a proportion of the total expense of a well-conducted undertaking to justify the slightest hesitation on the part of a wise purchaser to avail himself of this aid toward economy.

The Philippine government has recently announced the plan for a comprehensive system of loans from public funds for public improvements. In all, about $15,000,000 in gold is involved, which will be spent mostly for various municipal improvements. The present schedule calls for 66 reinforced concrete market places. Plans and specifications for these have been prepared and construction will proceed at once.

Plain Concrete Paving

What has been learned from Mason City work

By F. P. Wilson, City Engineer

I HAVE tried here to set down, from my experiences and several years of investigation, what I deem necessary to obtain satisfactory results in the construction of cement concrete pavements. The important essentials which should enter into the construction of concrete paving are:

1—To have the sub-grade thoroughly drained where it is necessary, by using farm drain tile not less than 4 in. in diameter, after which the sub-grade should be rolled and compacted with a heavy steam roller until it is perfectly solid over its entire surface.

2—After the sub-grade has been prepared, great care should be taken to keep it wet, before placing the concrete, as a dry sub-grade draws the moisture from the concrete mixture and is thus harmful.

3—Have a first-class Portland cement that will stand the tests required by the American Society of Civil Engineers.

4—Have a sharp, clean sand, which does not contain more than 2 per cent. of loam.

5—Have a good hard limestone or other stone equally as good, free from dust, loam or clay, and crushed so that it runs from ¼ in. to 1¼ in. in size, 66 per cent. of the stone to be the coarser and 34 per cent. the finer of the stone aggregates.

6—For the base concrete, use the proportions as follows:

1 part Portland cement by measure.
2 parts sand by measure.
5 parts stone by measure.

7—The fine aggregates and coarse aggregates should be thoroughly mixed with a good batch mixer, until all stone is coated and is of such consistency that all it requires, is to level off the mass so that the concrete runs into place, no tamping being required and a dense, compact volume is obtained.

8—For the wearing surface use the proportions as follows:

1 part Portland cement by measure.
1 part screened sand by measure.
1 part screened, ¼ in. crushed granite.

The proportions to be thoroughly mixed to a proper consistency with a good batch mixer.

9—After the concrete or base has been placed, put, on immediately the top or wearing surface so that there is a complete bond between top and base.

10—Have an expansion joint 1 in. in width left next to the curb on each side of the street, this space to be filled with an asphalt filler. Have transverse expansion joints ½ in. in width left every 37 ft. 6 in. at right angles with the curbs, these expansion joints to be protected on either side with steel plates 2½ in. in depth, ¼ in. in thickness, with a shear member 6 in. in length cut out of the sides of the plates at equal distances and bent at right angles and extending into the concrete, these steel plates to be not less than 10 ft. in length. Between these plates place a 3-ply tar felt paper especially prepared for the expansion joint.

11—A contraction or blind joint should be left every 12 ft. 6 in. at right angles with the curbs, these joints to be clear through pavement from top to bottom, on the top or surface of pavement the joints floated over and not lined or corrugated.

12—For the crown of concrete streets use the same crown that is used on the other kinds of pavements for different width of roadways.

13—The wearing surface should be finished off with a wood float made of a coarse grained soft wood, so as to give a uniform rough surface which will give a good foothold.

14—The curing of concrete pavement is one of the most important features and on it depends the durability and strength. A concrete pavement immediately after it is laid, should be covered and protected from the sun, and as soon as it is hard enough, should be sprinkled frequently and kept wet not less than 8 days.

15—Concrete paving, where the width of roadway is more than 20 ft. between curbs, should be reinforced with No. 7 American wire to eliminate cracks or cracking.

16—A concrete pavement, after it is laid, should be protected and the traffic kept off for at least 3 weeks so as to give it a chance thoroughly to harden.

17—To obtain first-class results in the construction of concrete streets every detail as heretofore described must be followed.

The methods described, I have followed in the construction of 200,000 sq. yds. of concrete paving and the results speak for themselves.—**Concrete Cement Age.**

The Use of Cinder Concrete

WITH every succeeding year the utilization of reinforced concrete for building purposes of every sort is becoming more and more general. Both from experience with actual constructions and through the use of tests, engineers are able to foretell how the various forms of the material will act under different conditions. Moreover, in the field of fireproof construction of buildings, concrete stands pre-eminent, with regard to durability, economy, and fire-resisting qualities. Many interesting facts have been brought to light with regard to the manner in which concrete withstands fire, and the investigations along these lines have been thorough and far-reaching.

The use of cinder-concrete in fire-proof floor construction has been growing in popularity from day to day. Objections to the use of this material have been advanced, in view of the fact that in some cases where it has been used, piping for the sprinkler systems or for other purposes has been corroded to such an extent as to be rendered useless. For this corrosion the cinder-concrete has been blamed. However, it has been demonstrated that, if the cinders are not new, are free from sulphides, and that if the mixture consists of one part of cement to ten parts of cinders, with enough sand to make a dense mixture, there is little or no danger of the corrosion of water piping.

A recent fire, water and load test, carried on upon cinder, terra-cotta and gypsum floor arches, showed that the first-mentioned material was the best of the three. A fire was kept burning continuously below the floor for a period of four hours, and during that time the floor was subjected to an average temperature of 1,700 deg. F. At the end of the four hours a fire stream was turned on the roof while it was still red hot. The floor load during the test was 150 pounds per sq. ft.

The cinder-concrete suffered very little damage, and the test served to furnish an additional proof that this material is an excellent fire-resisting medium.

Results of Mechanical Gravity Filtration at Saskatoon, Sask.

By George T. Clark, City Engineer

THE city of Saskatoon obtains its water supply from the south branch of the Saskatchewan River. This river and its tributaries are being polluted by the sewage from a number of towns and cities, including Calgary, McLeod, Lethbridge and Medicine Hat. In addition to being contaminated, the water of this river is very turbid at certain seasons of the year, and it is generally believed that a turbidity in the water such as is presented in this case, consisting to a large extent of fine quartz particles, predisposes to enteric conditions. For these two reasons, therefore, namely periods of excessive turbidity and danger of contamination, the civic authorities decided that it was advisable to take the necessary steps to purify the water, and the writer was requested by the city to report on the subject of filtration. Before doing so, some filtration plants of different types were visited, including those at Albany, N.Y.; Hackensack, N.Y.; Harrisburg, Pa.; Philadelphia, Pa., and Columbus, Ohio. The outstanding features of each were noted.

Requirements of Water for Domestic Purposes

Water which is required for domestic purposes, should possess the following qualities:—(1) It should be free from disease-producing germs; (2) it should be free from those allied organic forms, which are not conducive to health, although they may not as yet be recognized as accompanying disease; (3) it must be uniformly clear and free from turbidity, whether it be produced by mineral or organic matter; (4) it must be free from color, odor and taste.

The methods adopted by the city of Saskatoon to accomplish these results may be divided into three steps, viz:—sedimentation, filtration and sterilization.

Sedimentation

The sedimentation basin has a capacity sufficient to give the water eight hours' subsidence when the filter is working at full capacity, and is divided into two parts by a weir wall across the centre. In the north half of the basin, plain sedimentation takes place, and in the south half, sedimentation and coagulation. The coagulant used is sulphate of alumina, because the water has a sufficient alkalinity content, so that sulphate of alumina present the necessary reaction to form an alumina hydrate, which, in precipitating, coagulates much of the organic matter, and drags down the finer suspended matter.

Provision has been made for applying the coagulant at three points: (1), when the water enters the basin; (2), when it passes over the weir; (3), just before it enters the filters.

The solution of sulphate of alumina used is 350 lbs. to 1980 I.G. of water or 1.8 per cent. solution.

Filtration

The three best known types of filters were duly considered before a decision was reached as to which one was best suited to our purpose. A strong point in favor of the pressure filter was that with this type of installation one system of pumps would have been all that was necessary to deliver the water from the river direct to the distributing system, whereas with either of the other systems a double pumping system is necessary. The excessive turbidity of the water, however, made preliminary sedimentation absolutely necessary, and the idea of installing pressure filters, therefore, had to be abandoned. The gravity mechanical filter was chosen in preference to the slow sand type for the following reasons: (1), the mechanical filter will handle fifty times more water per unit of area per day than the slow sand filter; (2), the mechanical filter, on account of its being much smaller in area, is much more easily protected from excessive cold; (3), the initial cost of construction is about one half; (4), the cost of operating slow sand filters in the case of highly turbid waters is much in excess of mechanical filters; (5), cleaning the surface of slow sand filters requires the dangerous personal contact of workmen.

Description of Plant

The mechanical plant installed consists of the following:

(1) One filtered water basin, capacity 125,000 Imperial gallons.

(2) Six concrete filter units, each with an effective filtering area of 290 sq. ft. The filtering material consists of an 8-in. layer of gravel, graded in sizes from .2 to .5 of one inch, the larger pebbles being placed on the bottom and a 36-in. layer of sand graded from .36 of a millimeter to .55 of a millimeter, and consisting of hard silicious material free from vegetable matter or other foreign substance.

(3) A wash water pump and motor.

(4) An air compressor.

(5) A complete apparatus for preparing and feeding sulphate of alumina, and hypochlorite of lime.

(6) Hydraulically-operated valves for controlling the operations of the filter units.

Sterilization

This is the third operation which is sometimes required to be performed in cases where harmful bacteria are still present in the filtered water. It consists in our case of the addition of hypochlorite of

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TABLE I.

Monthly expense report for the month of August, 1913.

Filtration Plant

Salaries of Operators and Superintendent	$315.00
Bacteriologist	59.33
Additional labor, none.	
Alum, 4,550 lbs. at $2.25 per cwt.	102.37
Hypochlorite, 240 lbs. at $2.74 per cwt.	6.58
Wash water, 1,922,000 gallons at 6c per 1,000 gals.	115.32
Stores, none	
Power, 1,077 kw.h. at 6c per kw.h.	64.62
Light, 235 kw.h. at 6c per kw.h.	14.10
Heat, none.	
Repairs, none.	
Laboratory, fixed charge of	25.00
Interest and sinking fund	400.00
Total cost for month	$1,101.32
Water filtered for month, 57,283,000 gallons.	
Cost of filtering per 100,000 gallons	1.93

lime in the form of a .5 per cent. solution and is applied to the water at the point where it enters the filter beds. The total amount of hypochlorite used by us since the plant was first put in operation in June, 1912, was only 900 lbs.

Results

Table I.—Appended hereto is a typical monthly operating cost sheet. It will be noted that the chief items of expense are salaries of Superintendent and operators, and the charge for interest and sinking fund. The cost for filtration for the month of August, 1913, per 1,000 imperial gallons was 1.93 cents.

Table II.—Shows in detail the operation of the plant during the month of August. The quantity of water pumped and filtered, the chemicals used, and the turbidity of the water is given for each day. Sixty per cent. reduction of turbidity is accomplished by sedimentation.

Table II.—Illustrates clearly how the amount of coagulant required and the amount of wash water used vary directly as the turbidity. The amount of coagulant required varies from about one-quarter to one and one-half grains per gallon with an average for eight months of three-quarters of a grain, while the amount of wash water required varies from two and one-half to five per cent., with an average for eight months of 3½ per cent.

Table IV.—Shows that although the superintendence, interest and sinking fund remain constant, the turbidity is of sufficient range to vary the cost of filtering from a minimum of 1.4 cents per 1,000 I.G. to a maximum of 2.16 cents per 1,000 I.G., or an average for the eight months of 1.77 cents per 1,000 I.G. It is of interest here to note that the turbidity of the South Saskatchewan River water varies from 30 parts per million to 3,750 p.p.m.

Table V.—Shows the bacterial removal efficiency for eight months. For six months the removal has been over 97 percent. For the month of February the removal was only 80 per cent., but the bacterial count in the raw water was very small. The high count in the raw water in March is accounted for by the melting of the snow during that month and the consequent depositing in the river of the filth collected in the snow during the winter months, and also by the increased volume of water underneath the ice scouring the river bottom.

A study of these records shows that the plant, in respect to wash water required and bacterial removal,

TABLE II.

Summary of Water Filtered, and Chemical Distribution for Month, August.

August	Venturi Gallons per day	Wash-water Gallons per day	Alum used Grains per day	Alum used Grains per gal.	Chloride Grains per day	Chloride Grains per gal.	Turbidity raw	Turbidity treated
1st	2,043,000	72,000	1,208,644	0.57	123,600	0.058	130 ppm.	100 ppm.
2nd	2,027,000	72,000	938,304	0.45	185,380	0.089	130 "	100 "
3rd	1,468,000	72,000	982,584	0.64	77,250	0.05	130 "	100 "
4th	2,082,000	72,000	1,009,152	0.45	47,628	0.06	110 "	65 "
5th	2,081,000	72,000	1,009,152	0.45	126,908	0.059	120 "	65 "
6th	1,856,000	72,000	912,744	0.47	63,504	0.060	120 "	100 "
7th	1,827,000	72,000	623,520	0.33	0	0	100 "	90 "
8th	1,772,000	72,000	752,084......	0.41	0	0	100 "	90 "
9th	1,643,000	72,000	623,520	0.36	0	0	100 "	85 "
10th	1,464,000	......	623,520	0.43	0	0	75 "	55 "
11th	1,706,000	72,000	703,860	0.4	0	0	75 "	55 "
12th	1,737,000	60,000	623,520	0.35	0	0	75 "	55 "
13th	1,817,000	60,000	691,584......	0.35	0	0	95 "	75 "
14th	1,688,000	60,000	665,860	0.38	0	0	75 "	55 "
15th	1,748,000	60,000	666,060	0.36	0	0	65 "	50 "
16th	1,793,000	60,000	666,060	0.36	0	0	65 "	45 "
17th	1,487,000	......	623,520	0.40	0	0	65 "	45 "
18th	1,750,000	60,000	623,520	0.34	0	0	80 "	55 "
19th	1,660,000	60,000	768,132	0.45	0	0	130 "	80 "
20th	1,842,000	60,000	1,328,863	0.7	0	0	180 "	70 "
21st	1,701,000	60,000	1,238,823	0.7	74,088	0.07	150 "	45 "
22nd	1,869,000	60,000	1,210,008	0.63	127,008	0.066	180 "	45 "
23rd	1,893,000	50,000	1,210,008	0.62	127,008	0.065	250 "	65 "
24th	1,559,000	60,000	1,067,728......	0.66	127,008	0.078	200 "	70 "
25th	1,937,000	60,000	1,158,203	0.58	68,790	0.06	180 "	70 "
26th	1,917,000	72,000	1,702,913	0.8	108,528	0.09	250 "	70 "
27th	1,920,000	72,000	1,953,542	0.98	186,048	0.093	350 "	65 "
28th	1,856,000	72,000	1,869,999	0.96	186,048	0.096	400 "	45 "
29th	1,910,000	72,000	1,524,839	0.76	54,264	0.094	300 "	30 "
30th	2,061,000	72,000	1,438,727	0.69	0	0	300 "	35 "
31st	1,347,000	72,000	1,451,200	1.plus	0	0	500 "	100 "
	55,361,000	1,922,000	31,870,204	0.556	1,683,060	0.063		

Water pumped to city mains, 55,361,000 gallons.
Wash-water used, 1,922,000 gallons.
Total water filtered, 57,283,000 gallons.
Pounds of sulphate of alumina, 4552.8.

Pounds of hypochlorite of lime use, 240.
Average turbidity of raw water, 167 ppm.
Average turbidity of treated water, 67 ppm.
Percentage reduction turbidity by sedimentation, 60 ppm.

has fulfilled the guarantee given by the Roberts Filter Manufacturing Company, who installed it.

TABLE III.

Summary showing average for eight months' operation

	Alum	Wash water	Filtered water	Cost per 1,000 galls.
January	None	1,300,000	78,095,704	1.23 cents
February	None	1,213,968	75,631,738	1.19 "
March..	1,900	2,323,000	82,321,140	1.27 "
April	19,380	4,388,880	79,591,588	2.04 "
May.	11,580	2,800,000	61,919,060	2.13 "
June	12,675	2,842,800	59,416,800	2.30 "
July	7,475	2,316,000	58,541,000	2.04 "
August.	4,550	1,922,000	57,083,000	1.93 "
Total	57,560	19,106,640	552,600,030	

Average grs. of alum per gal. for period of excessive turbidity	1.52
Average grs. of alum per gal. for period of normal turbidity	0.28
Average grs. of alum per gal. for period of eight months	0.73
Average amount of wash-water for period of excessive turbidity	4.9 %
Average amount of wash-water for period of normal turbidity	2.58%
Average amount of wash-water for period of eight months	3.45%

TABLE IV.

Average cost of operation

Average cost of filtering 1,000 Imp. gals. during period of excessive turbidity	2.16 cents.
Average cost of filtering 1,000 Imp. gals. during period of normal turbidity	1.4 "
Average cost of filtering 1,000 Imp. gals. during period of eight months	1.77 "

TABLE V.

Bacterial Removal

Month	Bacteria		Efficiency
	Raw Water	Filtered Water	Per cent. Removal
January, '13	27.0	1.4	98.5
February..	2.5	0.5	80.0
March	11,144.0	16.0	99.8
April	4,644.0	20.0	99.6
May	4,172.0	37.0	96.7
June	2,553.0	28.0	99.0
July	7,358.0	21.0	99.7
August	2,199.0	42.0	98.1

Opportunities in Engineering

IN a recent editorial the New York "Times" commented as follows on engineering work: "There is a dearth of engineers and there is a mighty good livelihood awaiting those who enter this profession. Other professions are overcrowded. We should think that young men about to enter college would consider seriously the opportunities of engineering." As was to be expected, these views were promptly characterized as erroneous by readers of the paper. Unfortunately there is much misconception as to the opportunities in engineering work, and especially as to the monetary returns, though it is less pronounced than it was ten years ago, says the Engineering Record. Then the air was full of tales of the remarkable future in engineering and technical schools were swamped with young men who had picked an engineering career not because they had an aptitude for the work but because in very many cases they had no special tastes for any line and chose the one apparently offering the most alluring financial inducements. They were caught by the lure of gold and became square pegs in round holes. The situation is changing, not only because the truth as to engineering prospects is better known but because the "business" courses have come into prominence and are believed to be a more direct route to captaincies in industry and commerce. The truth is that an engineering career must be selected as one would choose law, or medicine, or the ministry, or teaching—not for financial reasons but because of aptitude and liking for the work. To those who select it for these reasons there are good opportunities—but the boy whose eye is covered by the dollar and who has no sincere interest in things mechanical will be sure to fall into the ranks of the discontented if a kind Providence does not guide him into some non-technical allied line. If his chief aim in life is a monetary reward he must select some other profession than engineering. Yet, in one respect, the "Times" editorial was correct, for even the misfit can, and generally does, earn a "mighty good livelihood." That will be disputed, of course to the extent that there is difference of opinion as to what constitutes a "mighty good livelihood." If the returns of men in financial life are taken as the standard, the statement is wrong; but for men of sobriety, reliability and application, with a taste for engineering work, the financial returns and the opportunity to branch out in the often more renumerative fields of contracting, manufacturing and business fully justify the statement made in the "Times."

A 20-in. Dow centrifugal pump belted to a 100 h.p. Westinghouse induction motor and mounted on a barge is used by the Moulton Irrigated Land Company for delivering water to rice fields along the Sacramento River, California. As the barge is towed from point to point by a gasoline launch, it is able to accomplish what would otherwise require four stationary plants. Power is obtained at the four pumping stations from the 11,000 volt transmission line of the Pacific Gas & Electric Company. A bank of transformers on the barge steps down this tension to 440 volts as used by the motor. About 16,000 gal. per minute are handled by the pumps, and as the head varies from 12 to 23 ft. with the river stages the motor is about 30 per cent. overloaded when the river is at its lowest point. So far, it is reported, no trouble due to this overload has been experienced. The outfit is operated almost continuously from the latter part of April to the end of August, being shut down only when the barge is towed from one point to another.

Another ten-storey building is to be erected in Montreal. It will be constructed on St. James street, for the Marcil Trust, from designs by E. and W. S. Maxwell, the estimated cost being $350,000. The building will be 130 feet high, with a frontage of 78 feet and a depth of 104 feet. The frame is to be of steel, and the exterior of granite up to the first floor, the remaining portion being of artistic terra cotta. The cornices will be of granite and terra cotta. The architects have designed a fire-proof building: the foundations will be of reinforced concrete on the Kahn system; the floors will be of the same material, and the stairs of iron with marble treads. Marble will also be employed in the entrances, and the interior will be finished in mahogany. A small refrigerator plant will be installed for the purpose of supplying ice water to every office. Three elevators are to be put in.

The Design of Large Bridges, With Special Reference to the Quebec Bridge—Part I

By Ralph Modjeski, Consulting Engineer, Chicago

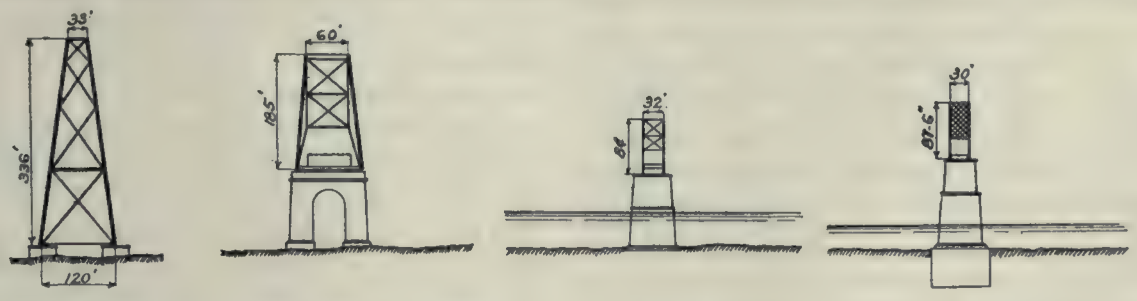
SOME of the more important questions to be considered by the designer of large bridges and the propriety of selecting the location not only to secure a favorable site for construction but also to make the bridge most efficient in relation to traffic, which may justify a more costly structure at one place than at another point where its location would involve disproportionately increased operating expenses, are the principal factors emphasized in the paper presented before the Mechanical and Engineering Section of the Franklin Institute, which is reprinted below in the slightly condensed form arranged by The Engineering Record. The permanency of the river bed and the character of the foundation are also very important considerations which should be thoroughly investigated.

Length of Spans

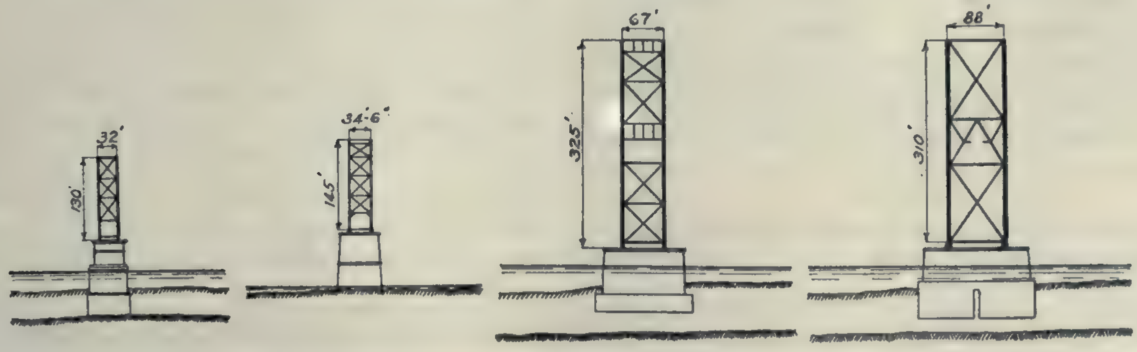
Where no limitation is placed by the Government as to length of all spans, the spans should be made of economical length, provided the piers do not reduce the cross-section of the river sufficiently to cause an undesirable increase in the current velocity. This economical length may be determined by trials, and will be attained approximately when the cost of the superstructure and of the substructure are nearly equal.

In the case of the Quebec Bridge, while the navigation interests fixed the clear height of the structure above high water at 150 ft., the length of span is entirely due to the physical conditions of the crossing. The stream at this point is narrow and deep, the depth in the center of the stream being about 190 feet. The current velocity at ebb tide is very high—about 9 miles an hour. Very heavy ice runs at times and tends to gorge. The bed rock, as shown by the borings, while accessible near the shore lines, dips rapidly toward the center of the stream. All these conditions made it imperative to build a span of great length. The information as to bed rock which we now have would indicate that the original project could have been designed with a somewhat shorter span. Yet we should remember that this original project was undertaken by a private corporation, and we should perhaps recognize the value to it of such advertisement as the building of the longest span in the world would obviously afford. The next longest span is that of the Fifth of Forth Bridge, and is 1,700 ft. long. It is doubtful if a shorter span than 1,700 feet would have been practicable at the location adopted for the Quebec Bridge. I consider it perfectly legitimate to build a more expensive structure than economy of the work itself would call for, if the more expensive structure will afford sufficient advertisement and publicity to compensate for the additional expenditure. Cases also often arise where a purely economical and utilitarian structure would be entirely out of harmony with the surroundings.

A project to build a large bridge at Quebec, pre-



FORTH BRIDGE BLACKWELL'S ISLAND BRIDGE THEBES BRIDGE MEMPHIS BRIDGE

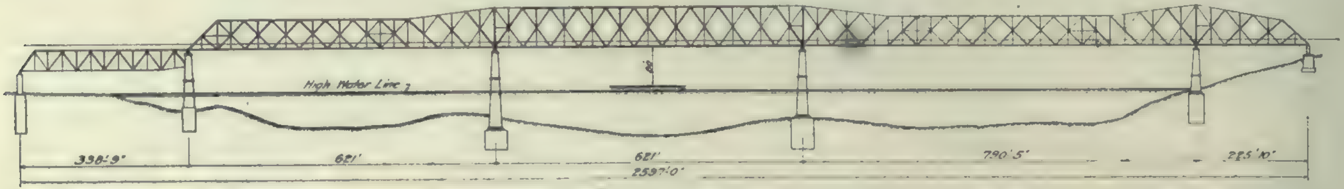


MONONGAHELA BRIDGE BEAVER BRIDGE QUEBEC BRIDGE (Old Design) QUEBEC BRIDGE (New Design)

Main pier vertical posts or towers for longest cantilever spans.

sumably in the same location as the present one, was seriously considered in 1884 and 1885. Messrs. James Brownlee, A. Luders Light, and T. Claxton Fidler designed a structure with a clear span of 1,442 feet. The description of that project mentions rock foundations. The more complete information we now have, and which was obtained by a costly series of borings, shows that at the present location rock could not have been attained in both piers with any known method of foundation if the piers had been spaced only 1,442 feet apart, even if the great depth of water could have been overcome.

It may be remembered that after the disaster of August 29, 1907, the Dominion Government took up the reconstruction of this bridge. A board of three engineers, including myself, was appointed to design and construct the bridge. After some study of the situation, the board decided that the new bridge should be made wider between trusses and designed to carry heavier loads than those originally contemplated; that, further, none of the old steel work could be used to advantage. It also decided to keep the same location. The final outcome is a double-track span 1,800 ft., with a width of 88 ft. between centers of trusses, designed to carry on each track a live load consisting of two E 60 engines placed in any position in a train weighing 5,000 lb. per foot so as to produce greatest strains. The old piers were not large enough for the new design and could not, therefore, be used. At first the board contemplated building an entirely new pier 57 ft. south of the present north pier, and enlarging the foundation of the south pier by sinking additional caissons adjacent to the old caisson. The necessary span length would then have been 1,758 ft., and it was on that length of span that tenders were asked. It developed later, from the experience of sinking the north caisson, that the method proposed for enlarging the south foundation would not be safe, even if it were practicable, and so an entirely new foundation and pier were decided on for the south shore. The new north pier could not be placed farther out in the river because of the sloping bed rock and great depth of water. The south pier could not be placed on the north, or river, side of the old south pier because of the old wreckage, so it was placed 64 ft. 8 in. south of the old pier, or as close as possible to it. Both new piers being placed 64 ft. 8 in. south of the old piers, measured between centers, the new span remains 1,800 ft. long.



Memphis Bridge, Memphis, Tenn.

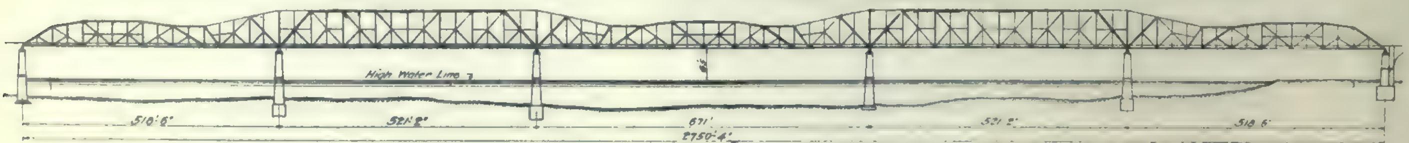
Substructure

The piers are all of granite backed with concrete. There is an increasing tendency now to build everything of concrete. Certainly, concrete is a most convenient material and quite economical. When it comes, however, to providing supports for a very important and expensive structure, cut-stone masonry should be used in preference to concrete, except for backing. There are many varieties of excellent building stone on this continent. I have used granite, some varieties of oolitic limestone, also sandstone, which all show excellent lasting qualities in works constructed many years ago, while concrete present some uncertainties and requires expert care to give good results. Concrete may in ages prove to be as lasting as stone masonry, but as yet we do not know. We know that well-constructed stone masonry will last for centuries. A notable example of this is the great Aqueduct of Gard, built by the Romans in the first century B.C.

Types of Superstructure.—Having fixed the span lengths of a bridge, the next thing to determine is the type of superstructure to be used. The various types usually applied to long spans may be classified as follows: (1) Arches (steel)—(a) three-hinged; (b) two-hinged. (2) Simple spans. (3) Cantilever structures —(a) with suspended span; (b) without suspended span. (4) Suspension bridges.

I have purposely omitted masonry and concrete arches as structures not coming clearly within the scope of this paper. Steel arches have a rational application only where Nature has provided natural abutments, as at Niagara Falls, for instance, or where natural surroundings lend themselves to ornamental construction.

Crooked River Arch.—I have recently completed an arch bridge for the Oregon Trunk Railway in the Crooked River Canyon. It is a two-hinged spandrel braced arch. Three-hinged arches are now seldom used for a railway bridge because they are less rigid than two-hinged arches. They still have a good application in roof trusses which are not subject to heavy and rapidly moving loads. In several large arch spans the central connection offered considerable difficulties. The reason is that the top chords at the center of a purely two-hinged arch are calculated to have stresses in them, due to dead load and temperature, when the span is rivetted up and ready to receive the rolling load. These stresses had to be introduced by powerful jacks, or other means, before the final point could be rivetted up. To avoid this difficulty, I have proceeded as follows in the Crooked River arch. It was assumed that the dead load and temperature stresses at 60 deg. Fahr. in the top chord at center are zero. This being the case, the arch acts as a three-hinged structure under those conditions—namely, with all



Thebes Bridge, Thebes, Ill.

dead load in place and at 60 deg. Fahr. The span was, therefore, erected as a three-hinged arch, all dead load, or the equivalent, including the decking, was placed thereon, and at a time when the temperature was very nearly 60 deg. the center panel of the top chord was inserted and rivetted up. The calculations were simple. The dead-load stresses were calculated as in a three-hinged arch, the temperature and live-load stresses as in a two-hinged arch, and the various results combined.

Type of Span

A two-hinged spandrel braced arch is probably the best type to use for railway traffic, where the natural abutments permit of sufficient rise, which will often be the case where the arch type or bridge is a logical solution. This particular type of arch is more rigid and less subject to vibration than the other types of arch, and presents the advantage of easier erection, which can then be simply performed by treating each half as a cantilever arm held back by suitable temporary anchorages until the center connection is made. An arch bridge is a somewhat special structure and is rarely used for long spans, except, as I remarked before, where Nature has provided abutments.

Simple Spans.—Twenty-five or thirty years ago the system of truss most favored for long simple spans was a double intersection Pratt truss with parallel chords. Nowadays the type most used is a single intersection Pratt truss with subdivided panels and curved top chord. The curved top chord is an element of economy. The single system has also a slight advantage of more definite stresses. It has its disadvantages, such as, for instance, the lack of uniformity in deflection, about which I will speak more in detail in connection with cantilever system. There is no doubt that a bridge composed of simple truss spans is a better bridge than a cantilever system or a suspension design, chiefly because of its rigidity. This rigidity results from the fact that a load placed on one span has no lifting action on the adjacent spans, as in a cantilever system, or on other portions of the same span, as in a suspension bridge. But long simple spans must be erected on falsework or floated into position. The first method is often inadmissable on account of the necessity of keeping the channel open for navigation or excessive depth of water combined with navigation requirements, or other local conditions. The floating of a span into position is not only costly but hazardous. It has been successfully performed, but is not always feasible or safe. Then, too, generally speaking, a cantilever bridge is more economical for long spans. These considerations often lead to the adoption of a cantilever design in preference to simple spans. A cantilever span can always be erected without falsework, although the adjacent or anchor spans must generally be erected on falsework. Sometimes simple spans are erected without falsework.

The length of simple spans has been growing from year to year. It may be remembered that the Cincinnati Southern Bridge at Cincinnati, built in 1877, contains a simple span of 515 ft. In 1891 Mr. George S. Morison built the Cairo Bridge, connecting a span 518 ft. in length, single track. The Municipal Bridge in St. Louis has three simple spans of 668 ft. in length, 110 ft. high at the center, double track and roadways. The Metropolis Bridge over the Ohio River, if the present design is carried out, will have a simple span 720 ft. long, double track. This increase is due largely to the use of higher grade materials, such as nickel or chrome-nickel steel, and to the improvement in shop and field methods.

An here we may say a few words about wind forces. In small spans the action of wind rarely affects the main members of the span, and the wind bracing used is calculated more to make the structure rigid against lateral motion under rapidly moving loads than to take care of actual wind stresses. As the length of span increases, this element of wind becomes more and more important, until in very long spans it may become as important as the moving load. In a simple span the heaviest members, as well as the greatest height of truss, occur near the center of the span. In other words, the resistance to wind per lineal foot of truss in a simple span is greatest at the center of the span, and, owing to the overturning moment due to wind, grows in importance with the height. In a cantilever span the greatest height of truss and the heaviest members are near the piers, hence the greatest resistance to wind per lineal foot of truss is near the piers. This remark is sufficient to explain why wind stresses are easier to provide for in a cantilever structure than they are in a simple span of the same length.

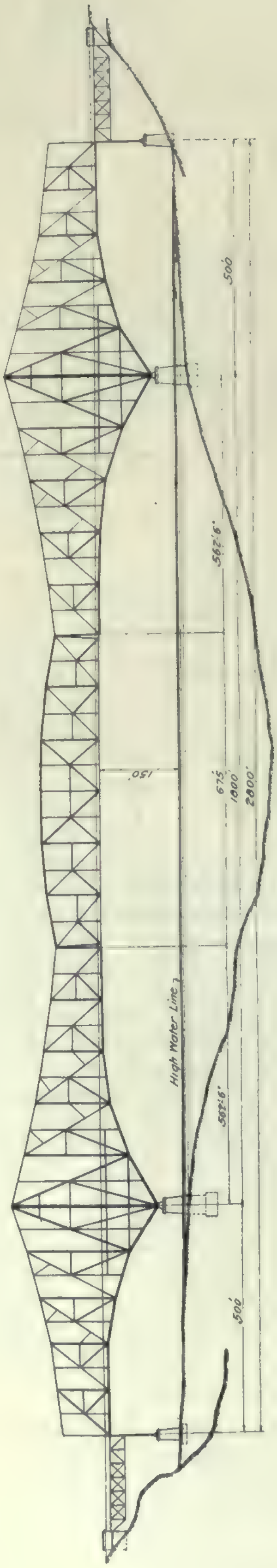
Proportion of Single Spans with Curved Top Chords

	Per cent ratio height to length	Per cent ratio width to length
Municipal Bridge, St. Louis, Mo.	16.47	5.24
Cincinnati, Ohio, over Ohio River	15.41	5.60
Pennsylvania Railroad, over Deleware, Phila.	15.76	5.82
Ohio Connecting Railway, Pittsburgh	14.53	5.57
McKinley Bridge, S. Louis, Mo.	15.07	5.73
Merchants Bridge, St. Louis, Mo.	14.47	5.80
Mobridge, Mo.	15.18	5.48
New Brunswick Bridge, N. D.	16.25	5.50
Quebec suspended span	17.19	....
Thebes suspended span	15.03	....
Average	15.56	....

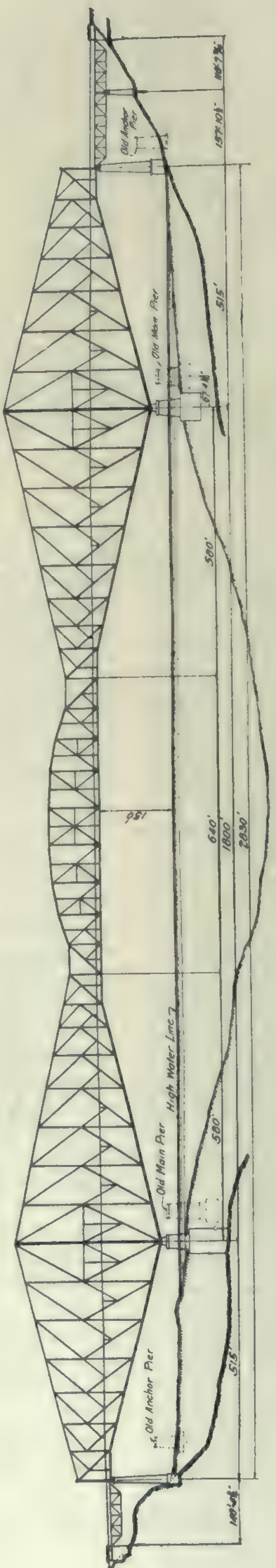
Longest Simple Span.—No hard-and-fast rule can be laid down as to the length at which a simple span becomes uneconomical as compared with a cantilever span. Generally speaking, considering the present knowledge of materials, a simple span of 700 ft. may be taken as the practical economical limit, beyond which it is not advisable to go without a thorough investigation and comparison with a cantilever system. Where conditions require unusual methods of erection this limit may be much lower. For instance, in the Thebes Bridge it was necessary to erect the 671-ft. channel span without falsework. A simple span would have required the addition of a considerable amount of metal, both in the span itself and in the adjacent spans, to permit of its being erected as a cantilever; this excess of metal would have been useless after the completion of the bridge, and its cost would have made the bridge more expensive than the adopted cantilever design.

Dimensions of Simple Spans.—In designing long simple spans the following general principles should be observed. The width, center to center, of trusses should not be less than one-twentieth of the span, preferably one-eighteenth. In double-track spans the width required for clearance generally governs, except in very long spans. The height at center of span, for a Pratt system of truss with subdivided panels, should be from one-seventh to one-fifth of the length.

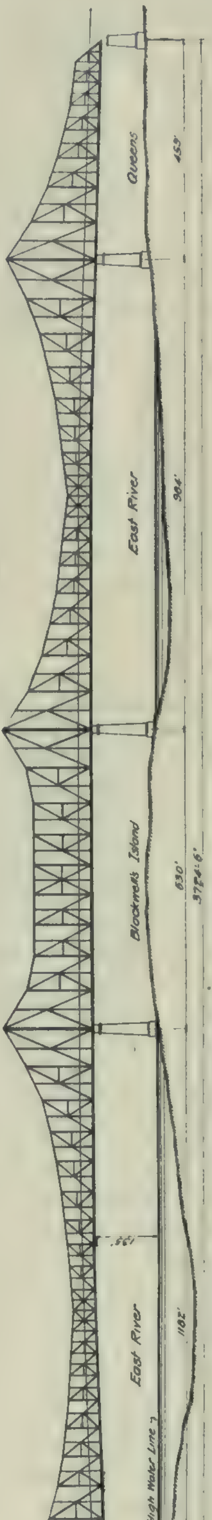
The height at the ends should be only sufficient for



Quebec Bridge (old design), Quebec, Que.



Quebec Bridge (new design), Quebec, Que.



Blackwell's Island Bridge, New York, N. Y.

an effective portal. A rigid mathematical research by Mr. Joseph Mayer, principal assistant engineer of the Quebec Bridge, leads to a theoretical proportion between the height at center and length of span equal to 0.18, or somewhere between one-fifth and one-sixth, for heaviest loads and double-track spans.

Panel Length.—The best panel length is not so easy to determine. Since the economical inclination of diagonals is very nearly 45 deg., it would result that in a Pratt truss with subdivided panels their length should approach one-half of the height of truss. This would mean that in a truss with a curved top chord the panels in the center should be longer than those near the end. This has been done at least in one instance, namely, in the Municipal Bridge in St. Louis. The advantages of such an arrangement are a slight economy in the weight of steel and an improved appearance, since the diagonals have nearly the same inclination throughout. The equal panels, however, present, in my opinion, two decided advantages, which may more than offset the advantages of the former system, namely, that, all panels being equal, there is a greater duplication of parts, the floorbeams are all alike, except at ends, the stringers are all alike, the length of bottom chord eyebars is the same throughout; and, further, that the falsework may be built in uniform panels, and the traveller, which is usually designed with a view to have the uprights in proper relation to the panel points, so that the connections may easily be made, preserve its relation to the various panels points as it is moved from panel to panel. For these reasons uniform panels should be preferred in the majority of cases of simple spans.

I have stated that the greatest practical length of a simple span is about 700 ft. With the use of certain known alloys of steel of greater strength than medium carbon steel this limit may become as much as 750 ft. Beyond this limit the weight of simple spans becomes so great, in comparison with cantilever spans, that the latter must be considered. A mistaken idea sometimes prevails that the weight of steel in a span increases in proportion to the square of the length. This is, in a measure, true for short spans, say 100 to 300 ft. This ratio of increase, however, is not a constant, but increases with the span. A simple span above 1,200 ft. in length increases in weight approximately as the cube of the length, and this exponent increases more and more rapidly until at about 2,000 ft. weight of carbon steel required to carry the weight of such a span and of a moderate live load becomes infinite. For a span built of nickel steel the weight becomes infinite when the length reaches 2,700 ft. Simple spans much below those limits, even if possible, would still be very uneconomical until we get down to spans 700 ft. or under.

Cantilever Spans.—This leads us to cantilever spans. I mentioned two types of such spans—one without a suspended span and the other with a suspended span. A remarkable example of a cantilever bridge without a suspended span, which may be called a semi-continuous structure, is the Blackwell's Island, also called the Queensboro Bridge, in New York. There seems to be no advantage in omitting the suspended span; on the contrary, the structure differs from a truss continuous bridge over several supports only by the introduction of a hinge at the center of the main span which transmits shears but not moments. The vibrations and deflections of each segment are, therefore, transmitted through those hinges to all the other segments. Furthermore, since the stresses in such a structure depend on deflections, there is more or less uncertainty in the calculations. I do not wish to be understood as objecting to any type of structure seriously, because of the uncertainty of calculations. In any logical construction the calculations can always be made with sufficient accuracy for the safety of the work. It is only when everything else is equal that determinate stresses should be preferred.

Let us consider the usual type of cantilever bridges, the one in which two cantilever arms support a suspended span. We may assume that in bridges requiring the construction of a cantilever span the length of the main spans is usually determined by local conditions. The general dimensions to be fixed by the designer are, therefore, the length of the suspended span, the length of the anchorage spans, when these are not determined by local conditions, the height of the trusses at various points and the relative distances and positions of trusses to one another. Let us discuss these various dimensions in connection with the new Quebec design. The Quebec Bridge, with its longest span in the world, has justly attracted much attention among engineers and has naturally elicited comment and criticism. It is acknowledged that a discussion of a scientific subject by professional men is often of greater value than an elaborate paper on this same subject by one individual. If I refer to some of the criticisms, let it be considered as a friendly discussion which may be of value to the profession.

New Quebec Bridge

The new Quebec Bridge has been finally designed with two anchor arms 515 ft. long, a suspended span 640 ft. long, and two cantilever arms 580 ft. long. The moving loads finally adopted for the Quebec Bridge are: On each track two Cooper's Class E-60 engines, followed or preceded, or followed and preceded, by a train load of 5,000 lb. per foot per track. In addition to the actual dead load of the structure, a load of 500 lb. per lineal foot on suspended span and 800 lb. on balance of bridge was allowed for snow.

Wind Loads.—The wind loads were taken as follows: A wind load normal to the bridge of 30 lb. per square foot of the exposed surface of two trusses and one and a half times the elevation of the floor (fixed load), and also 30 lb. per square foot on travellers and falsework, etc., during erection.

A wind load on the exposed surface of the train of 300 lb. per lineal foot applied 9 ft. above base of rail (moving load).

A wind load parallel with the bridge of 30 lb. per square foot acting on one-half the area assumed for normal wind pressure.

In the Forth Bridge the enormous wind load of 56 lb. per square foot was assumed. This load was imposed on the designers by the Board of Trade soon after the Tay Bridge disaster. The Tay Bridge was not designed to withstand even a 30-lb. pressure. This assumption of a 56-lb. wind in the Forth Bridge results in a very large addition of metal in the bottom chords through which the wind stresses are transmitted to the piers. The material in those members is distributed as follows:

	Gross tons
Dead load	2,282
Live load	1,022
Wind load	2,920
Total	6,224

The metal here provided for the wind is nearly three times that provided for the live load, and is about 47 per cent. of the total required.

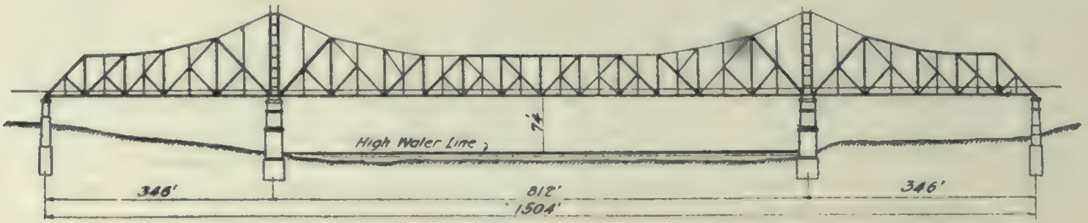
In the new Quebec Bridge design the wind pressure is equivalent to about 35 per cent. of the uniform live load near the piers and to about 20 per cent. of the live load near the ends of the cantilever arms.

A pressure of 30 lb., according to German experiments with electric cars, would correspond to a wind of a velocity of over 100 miles per hour. Other experiments made at various times on small surfaces show that a velocity of 85 miles would correspond to a pressure of about 30 lb.

The following formula for wind pressures is generally used: $P = kv^2$, in which P = pressure per square foot, v = velocity in miles per hour, and k = a coefficient.

Eiffel's two hundred or more experiments show this coefficient to vary from 0.0026 to 0.0032, and the average is 0.0030, which he recommends. Trautwine makes $k = 0.0050$, which seems too high. But, even using the latter, a pressure of 32 lb. would correspond to a "hurricane" of a velociey of 80 miles. The German experiments agree with Eiffel's. Making $k = 0.0030$, a pressure of 30 lb. would correspond to a velocity of 100 miles per hour, which, according to Trautwine, is a violent hurricane uprooting "large trees."

With a wind of this velocity there would be no traffic on the bridge—empty freight cars or even light passenger cars would be overturned. Velocities of more than 85 miles may occur in cyclones and tornadoes over restricted areas. Such storms are very rare in Canada; but even should such an extraordinary disturbance happen, causing a wind pressure of as much as 60 lb. to be applied to the entire Quebec Bridge as now designed—the stresses in the truss members would be less than with the maximum live load and a 30-lb. wind—and although the stresses in the laterals would be increased above the specification limits, they would still remain within the elastic limit of the members.



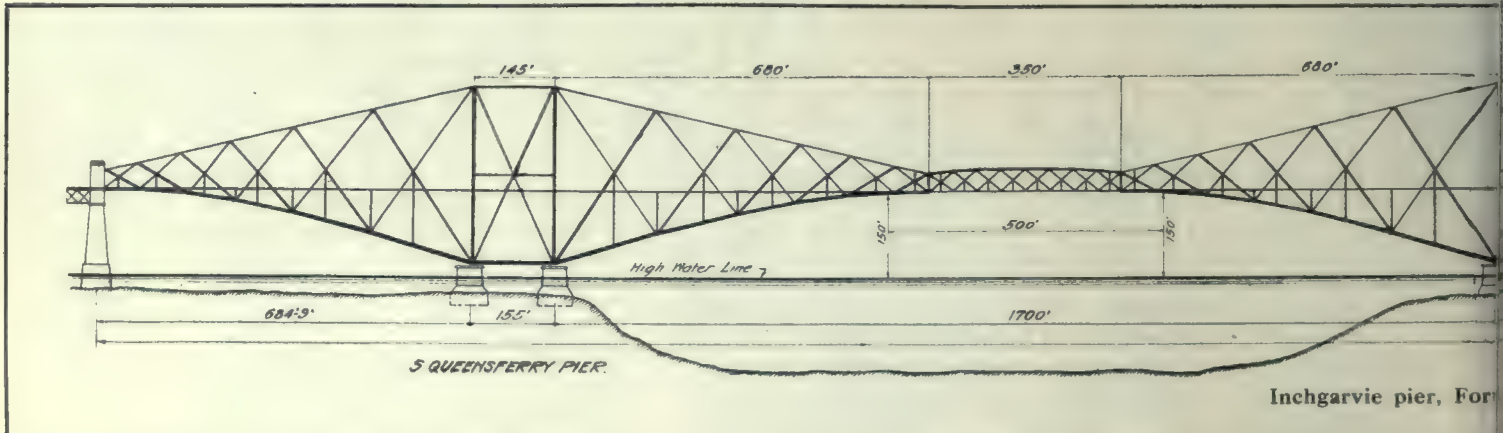
Monongahela Bridge, Pittsburg, Pa.

Length of Suspended Span.—The length of the suspended span does not depend merely upon the most economical distribution of material required for carrying the live loads and the dead load of the bridge after it is completed. Where there are no other considerations beyond the actual working stresses in the finished structure, the most economical length of the suspended span for a total span of 1,800 ft. would be in the neighborhood of 1,000 ft. But to erect a simple span of such unprecedented length, either by floating or by cantilever method, would be impracticable. Furthermore, the cantilever method of erecting a suspended span of even a moderate length always requires additional material, both in the cantilever arms and in the suspended span, to take care of the erection stresses.

The longer the suspended span in relation to the total main span, the greater will be the required addition—so that whether it be contemplated to erect the suspended span by cantilever method or by floating into position, the length of the suspended span finds itself limited not by mere economic considerations of the finished bridge, but by either the excess of material required during erection by cantilever method, and difficulties arising therefrom, or by the difficulties attending the floating of a very long and heavy span into position. These difficulties increase very rapidly with the length of the span to be floated. In the new design the suspended span is the longest which the board considered safe to float, and it fits the entire design very well.

Erection by Floating

The erection of this span by floating made it possible to design it with the view to greatest economy. Its various members will not be subjected to any greater stresses during erection than they would be in a simple span of the same length resting on two piers. It was, therefore, possible to design it as economically as to weight as a well-designed simple span would be. It is more important to save weight in a suspended span than in an independent simple span, because each pound in the former requires several pounds in the entire structure to carry it. The importance of eco-

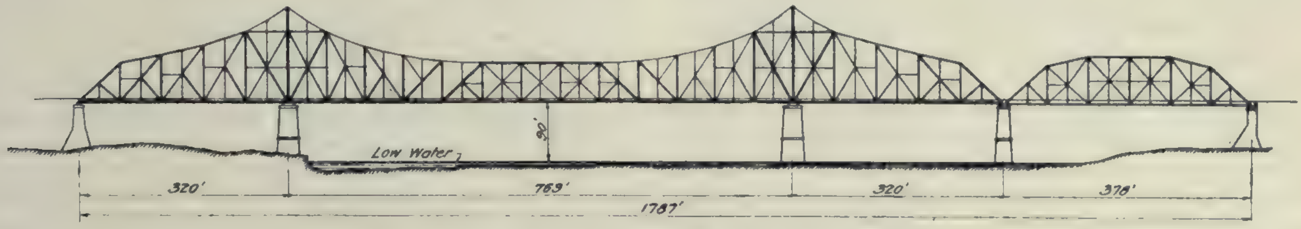


Inchgarvie pier, For

nomy in the suspended span of the Quebec Bridge will be appreciated when it is considered that one pound uniformly distributed over the trusses of the suspended span needs 3 lb. of metal added to the bridge to carry it, making an addition of 4 lb. in all. This accounts for curved top chords in the span in question, as well as for the use of nickel steel for the trusses thereof.

Length of Anchor Arms.—It has been pointed out that the length of the anchor arms is uneconomical—that a shorter arm would have been cheaper. It must not be forgotten that a shorter anchor arm increases the pier reactions, as well as the steel in the anchorage proper. The present anchor piers are founded on rock ledges which dip rapidly toward the river. To move them nearer to the river would have involved much more expensive foundations.

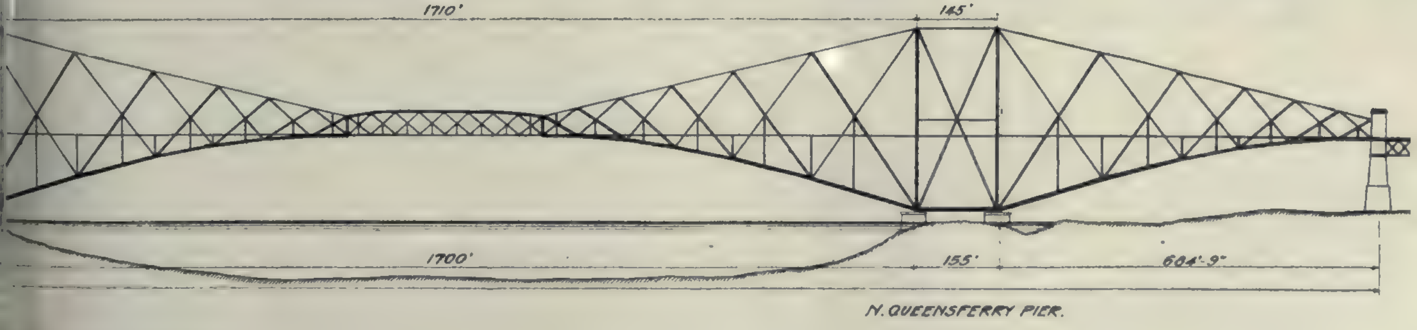
It may be remarked here that, while an addition of dead load in the main span will require several times the weight of metal to carry it, an addition of dead load in the anchor arm requires no increase of metal to carry it when there is an upward or negative reaction on the anchor pier. This is explained by the fact that any load placed between the main piers or on the main spans increases all moments and shears over all the spans, while any load placed on the anchor arm, if the reaction on the anchor pier is negative, decreases that reaction and consequently the moments in the anchor arm, but has no effect whatever on the main span. For this reason carbon steel will be used mostly in the anchor arm of the new design. The carbon-steel unit stresses adopted for the Quebec Bridge are generally five-sevenths of the nickel-steel stresses, the former requiring heavier members. This additional weight in the anchor arms is a source of economy when the relative prices of carbon and nickel steel are considered.



Beaver Bridge, Beaver, Pa.

Height Over Piers.—An opinion has been expressed that the height over the piers of the new Quebec Bridge is not great enough for economy. Actual calculations show that for economy the height of 310 ft. in the Quebec design is too great by about 20 ft. for the "K" system of trussing adopted; further, that this height would have been at least 40 ft. too great for the original system of the official design. The height of the Forth Bridge towers, while 26 ft. higher than the Quebec Bridge, though the span is 100 ft. shorter, is no doubt economical for the form of trussing adopted for it. The economical height is not only a function of the length of the span but also of the panel length next to the pier. This height should be such as to correspond to an inclination of the diagonals not far from 45 deg. A double-intersection system with very long panels near the pier, such as adopted in the Forth Bridge, would have been economical for the Quebec Bridge, except that it requires a system of secondary members or sub-posts, or very heavy longitudinal girders, or both, to carry the load from panel to panel. Then, too, it is well to reduce in the members the stresses due to their own weight—which in long panels become quite important. The 20-ft. excess in height of the present Quebec design over what would have been the economical height is justified by the resulting reduction in the sections of the bottom chords, which are of considerable size at best.

Straight versus Curved Chords.—In long cantilever spans the bottom chords of the cantilever and anchor arms should be straight when possible. With a curved chord the joints must be made at the panel points. These joints are of great importance, as has been shown in the report of the Royal Commission on the Quebec Bridge disaster. They should be fully spliced to take care of secondary stresses due to deflections of the span during erection and under the action of live load. It is advisable, therefore, to place them outside of the point of connection with the diagonals and keep them clear of gusset plates. The same objection does not exist in top chords of simple spans, which are of moderate sizes, even in the longest spans known. The economy in simple spans resulting from such curved chords is worth while and quite important, while if any economy were to result from curving the bottom



Edinburgh, Scotland.

chord of the cantilever and anchor spans, such economy would certainly be of little importance in comparison with the resulting disadvantages. The vertical deflections from live loads are not as great in a straight chord design as in a curved chord design.

Another consideration in favor of the straight chords is that the most important, in fact the bulk, of the wind forces travel to the pier through the bottom chords of the cantilever and anchor arms and the wind bracing, or lateral system situated in their plane. The straight bottom chords carry these stresses direct to the piers without transmitting any appreciable components to the web system of the trusses. Not so with curved bottom chords. At each point where the chord's direction is changed a component stress is transmitted to the web. This means that while a pair of straight chords with its lateral system deflects under the action of the wind in the plane of the chords only, a pair of curved chords, by transmitting shear to the web members, causes the trusses to deflect, the windward truss downward, tending to flatten the curve, and the leeward truss upward, tending to make the curve pronounced. The rigidity of the straight chord design against lateral deflections and oscillations is therefore greater than that of the curved chord design.

One of the reasons why curved bottom chords were used in the cantilever arms of the original Quebec Bridge design was the fact that it was the aim of that design to provide full headroom of 150 ft. on a width of 1,000 ft. The bottom chords of the anchor arms were then made curved also for the sake of symmetry. The width on which the full headroom will be obtained has been reduced in the new design to about 760 ft., which certainly is more than ample to accommodate navigation. Only the highest vessels will be limited to this width of 760 ft., and that only at high water.

The top chord of the Quebec Bridge cantilever and anchor arms is straight. The Forth Bridge cantilever arms have straight top chords also. While there was good reason for making the Forth Bridge top chord straight, there was no serious reason, beyond a slight increase in vertical rigidity, for making it straight at Quebec. The two trusses on the Forth Bridge are in planes inclined toward each other at the top. The two top chords are parallel. Had they been made curved they could not have been parallel, since they must necessarily be situated in the inclined planes of the trusses. The appearance of tension chords having a greater distance apart at the center of the arm than at either end would have been very bad. But there is no such reason at Quebec. The trusses are in vertical planes and the top chords could have been curved without serious inconvenience, but also without any advantage. The board considered that, aside from the additional vertical stiffness, a straight chord will present an appearance of strength which a curved chord would not do.

(To be concluded)

Retaining walls of molten slag were built a few years ago at the plant of the Butte Reduction Works, Butte, Mont. The forms were composed of cast-iron plates or panels, which were removed as soon as the slag had solidified. Culverts, reinforced with steel bars, were built in the same way. This unusual style of construction was designed by A. H. Wethey, now of New York, and was done to provide for a dump or fill of the tailings deposit from the concentrators, the culverts passing through the fill.

Waterproofing Concrete

ONE of our architectural contemporaries publishes a letter from an industrial company for whom an engine-house roof has been constructed with steel framework and panels of concrete made of crushed furnace slag, sand and Portland cement, and mixed in the following proportions: furnice slag, 4 parts; sand, 1 part; cement, 1 part. The concrete was put on 2½ in. thick, with a layer of expanded metal of 3 in. mesh in the middle, and the upper surface of the roof was skimmed over with a mixture of spar sand and cement. The water got through this, so another layer of about ¾ in. of the sand and cement mixture was laid over the whole surface, but water still got through and cracks appeared all over the roof, especially over the principals. These cracks have been cut out from time to time and liquid cement has been poured into them and afterwards painted over with bitumastic solution. The whole roof has also been painted over with two coats of this, and in spite of all leaks badly when there is any weight of rain.

The writers of the letter seem to think that concrete is an unsuitable material for keeping out water, but the fact that the proportions adopted were such that the concrete could not possibly be watertight, and the idea of trying to make it so by exterior rendering is somewhat humorous. As we have previously pointed out, it is quite easy to prepare concrete of perfectly watertight character by using properly graded aggregate and sand proportioned so that all the voids in the aggregate shall be as nearly as possible filled with particles of sand, by using sufficient cement to ensure that all the remaining voids between the particles of aggregate and sand shall be completely filled. Concrete so proportioned, and carefully mixed, forms a variety of artificial stone absolutely impervious to penetration by water, and which experience has been proved to be not only effective in keeping roofs perfectly dry, but may be used with confidence in the construction of tanks, reservoirs, and pipes where the water is under considerable pressure.—Ferro-Concrete.

Use of Gravel Concrete

Standard gravel concrete specified by the Illinois Highway Commission for general bridge work may be used in place of broken stone and sand in structures built for the State of Illinois. It is to be of three classes X, A and B, proportioned respectively 1:2:3½, 1:2½:4 and 1:3:5.—For Classes X and A all material which passes a ⅛-in. screen will be considered sand and all material which is retained on a ⅛-in. screen and passes a 1-in. screen will be considered stone; but at least 40 per cent. of the stone shall be retained on a ½-screen. For Class B all material which passes a ¼-in. screen will be considered sand and all material which is retained on a ¼-in. screen and passes a 2½-in. screen will be considered stone; but at least 40 per cent. of the stone shall be retained on a 1½-in. screen. In all classes of concrete, if the volume of sand is found to be less than 60 per cent. of the volume of stone, sufficient sand shall be added to bring up the proportion of sand to stone to 60 per cent. If the volume of sand is more than 60 per cent. of the volume of stone, sufficient stone shall be added to reduce the proportion of sand to stone to 60 per cent., or sufficient cement shall be added so that the volume of cement to sand shall be as required.

Requirements of Waterway Structures*

Standard Practice in Wisconsin—Use of Corrugated Metal Culverts Improperly-Designed Foundations Common Source of Trouble

By A. R. Hirst †

AMONG the most important considerations affecting the construction of public roads is that of drainage. The life of every road structure depends upon the draining given it, and the culverts and bridges necessary must be built not only to serve the purpose of drainage, but must serve also the convenience and safety of travel. The failure of a road results only in the additional expense necessary to replace it in proper condition, but the failure of a bridge results also in the suspension of travel, and if it occurs at the wrong moment, may cause considerable loss of property and possibly injury or death to those travelling the road.

For many years both the design and erection of highway bridges was practically entirely in the hands of the steel bridge companies, who used their opportunity to the utmost and decorated the landscape with structures which had little to commend them except the fat prices they brought from an unknowing public.

Within the last few years, however, many states have created highway commissions which have effectually taken up the problem of bridge design and a considerable change for the better has occurred, both in the strength of bridge superstructures and in the foundations, more especially in the latter, which was the place where most of the older structures were especially deficient, if one point of weakness can be selected from the mess of general ineffectiveness.

Requirements of Well-Designed Structure

A properly designed waterway structure should fulfil the following requirements:

1.—Waterway sufficient to carry off promptly the water coming to it.

2.—Proper foundations to bear the loads, resist undermining, and give long service.

3.—Superstructure designed to bear for a long period of years any load which may legally be imposed upon it.

4.—Superstructure wide enough and so constructed as to serve the comfort and convenience of travel.

5.—Economy of maintenance.

A sixth factor, that of aesthetic design and fitness of the structure to the surroundings, has been and is little considered in bridge and culvert design, but will probably be demanded more and more as public appreciation of the value of pleasing design grows.

In the short compass of this paper we cannot enter into a discussion of bridge design, or give any details of any specific type of structure. We will, however, give some account of our standard practice in the state highway work in Wisconsin, and probably this will be sufficient evidence of our views as to what constitutes a proper waterway structure.

Standard Practice in Wisconsin

Wisconsin is a state aid state, and gives state aid to bridges and culverts as well as to road construction. All waterway structures six feet in span and under, are classed as culverts, and built out of the funds available for the construction of the road. All waterway structures over six feet in span are considered as bridges and must be provided for by separate appropriations, the state paying twenty per cent. of their cost instead of 33 1/3 per cent. as in the case of culverts on roads.

Wisconsin has a drastic bridge law which provides that culverts under 18 inches in span must be so constructed or reconstructed as to stand without planking a load of 18 tons, and waterway structures over this span must be designed, "in accordance with standard engineering practice," to stand a load of 15 tons without planking.

In addition to the duty of designing all state aid bridges and culverts, the state highway commission has imposed upon it by law the duty of approving as to their safety and engineering sufficiency the plans of all bridges constructed with county aid. In the seven seasons of the existence of the Wisconsin Highway Commission and its predecessor in highway work, the Wisconsin Geological and Natural History Survey, we have designed about 1,000 highway bridges of a span exceeding 10 feet for counties, and about 400 bridges exceeding 6 feet in span, and innumerable culverts under this span for the state aid construction. In addition to this, we have approved the plans for probably 300 bridges not designed by our engineers, but simply checked as to engineering efficiency. Actual culvert and bridge construction under our own designs has cost about $2,000,000.

Classification of Bridge Superstructures

We may roughly divide our bridge superstructures into five classes as follows:—

Class 1—Spans from 18 inches to 10 feet.—Almost invariably constructed of reinforced concrete of the slab type. We are building even the smallest culverts of reinforced concrete, as we find in Wisconsin that they are entirely serviceable, easily constructed, and in probably fifty per cent. of the cases cost less than any other type of culvert except wood, which is not allowed on any of our work. The smallest concrete structure we are now building is 18 in. x 12 in, as we have found the smaller sizes equally as expensive and very easily blocked with ice and debris.

In some cases, where the foundation conditions are extraordinarily soft and difficult, or concrete materials are not reasonably available, we use culverts of corrugated metal with concrete or stone end walls, but such culverts are used only where it is impracticable to use concrete, and probably not one per cent. of our culverts are now built of this material. Vitrified clay is not used at all on state aid work, as they have been found almost invariably to crack by filling and freezing. Concrete pipes molded in place and afterwards moved to the job are not used for the same reason. Under conditions favorable to their use, both make excellent culverts, and we could recommend them in less severe climates. Cast iron water pipe has not been used on account of its cost, which invariably exceeds that of concrete.

We find in the small concrete culverts from 18 inches to 10 feet the average cost per cubic yard complete, including the excavation and back-filling, is about $8.00, and very seldom runs above $10 per cubic yard; sometimes as low as $6.

Class 2—Spans from 10 feet to 40 feet.—Either reinforced concrete, the slab type up to 18 feet and the through girder type up to 40 feet, or I-beam structures with concrete floors are used. We are building many true reinforced concrete bridges, but with public lettings open to any bidder, the workmanship and finished appearance has been so poor in many cases that we are using more I-beam structures than we otherwise would. In the case of I-beams, a five inch concrete floor is placed on top of the I-beams, and the corrugated arch type of support for the concrete between the I-beams is but seldom used.

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* Paper presented at the Third American Road Congress, Detroit, Sept. 29—Oct. 4, 1913.

† State Highway Engineer of Wisconsin.

Class 3—Spans from 40 to 80 feet.—We are using the Warren rivetted pony truss practically exclusively, though a few plate girders are being used where the conditions of hauling are favorable. All of these structures have concrete floors.

Class 4—Spans from 80 to 135 feet.—We use the rivetted Pratt high truss with a horizontal top chord, also with a reinforced concrete floor.

Class 5—Spans over 135 feet.—We use a Pratt rivetted high truss with a curved top chord. Practically all of these larger spans are also built with a reinforced concrete floor. Very seldom do we use a pin connected truss, either for Class 4 or 5, probably not once in twenty-five cases.

From our cost figures on all bridges so far constructed, we find that for any span the price erected (including substructure and superstructure) figures out very closely to $40 per linear foot of the over-all span. Reinforced concrete floors average about 20 cents per square foot. Steel in plate girder and truss spans averages from $65 to $70 a ton erected, and I-beam spans figure from $50 to $60 a ton erected.

We have adopted for widths for concrete culverts and bridges the standards recommended by the Association of State Highway Departments, which are as follows:

First Class Roads

	Feet
Culverts under 12 ft. span, minimum width	24
Slab bridges over 12 ft. span, minimum width	20
All other concrete spans	20
Very long bridges if necessary.	

Second Class Roads	Feet
Culverts less than 12 ft. span minimum width	20
Slab bridges over 12 ft. span, minimum width	18
All other concrete bridges, minimum width	18

Third Class Roads	Feet
Culverts less than 12 ft. span, minimum width	20
Slab bridges more than 12 ft. span, min. width	18
Longer bridges may be, minimum width....	16

Steel bridges are built almost invariably with a 16-ft. roadway; that is, 16 feet clear distance between trusses or rails, no matter what the class of road, although for spans under 80 feet some 18 feet clear roadways have been built.

Abutments under practically all structures are plain concrete, as with concrete materials as cheap as we have them in Wisconsin, and with the difficulty of getting first class workmanship in reinforced concrete foundations without constant inspection, we find that this is the cheapest type of abutment. Occasionally common rubble masonry abutments are used, and once in many times driven steel I-beam piles surrounded by a concrete wall are used. The last type of abutment has been found to be very satisfactory and economical for high abutments on sandy bottoms, and has largely displaced the use of cylinders with steel backing. Steel backing is not allowed on any state aid structure. The price of concrete in bridge abutments and piers averaged last year about $8 per cubic yard.

Concerning Foundations

A large share of the trouble with bridge structures results from improperly designed foundations. A common fault is stopping work before a proper depth below stream bed is reached. Seldom should foundations extend less than four feet below stream bed, and whenever doubt as to the bearing power of the soil at that point is entertained, or as to undermining from a rapid stream, they should be carried down to solid soil or thoroughly piled. All foundation work should be inspected as the excavation is made and material is placed, not necessarily by an engineer, but at least by an honest man with good judgment and backbone. All concrete work in any part of the structure should be inspected as it is placed. Inspection of steel and workmanship on it as it is erected is not so necessary, as it can be inspected and its compliance with the specifications determined after erection at the time acceptance is to be given.

Open Competition for Work

As to methods of letting the work. We have found it necessary to have open competition and sealed bids on bridge work, and by asking for mailed bids on all work have established true competition and have to a very large extent broken up the old system of "pooling," and combinations of the bridge agents who may be on the ground at the letting. We furnish complete plans for foundations and for reinforced concrete, I-beams and plate girder spans, and all bidders submit prices on our uniform plans. For truss spans, we furnish the truss diagram showing the stresses in the truss members and the make-up of the truss members, floor system, and principal connections, and the successful bidder submits for approval the shop drawings before fabrication is commenced. For trusses we believe the latter system is preferable to that of furnishing complete shop drawings, as it allows manufacturers to follow their standard shop practice in detailing so long as these details are satisfactory.

The proper design for culverts and bridges is an engineering problem which should always be left to engineers. Probably a state highway department can handle it more economically than can private engineers, as so many bridges will be built of one span that superstructure plans can be standardized and even the same foundation plan may fit several bridges. The cost of designing, letting and accepting bridges in Wisconsin has averaged us about 5½ per cent. of the total cost. Inspection has been paid for separately by the local units. It would probably be better to have a state inspector on each bridge, but we have had very good results through local inspection at probably 25 per cent. of the cost of placing a man on each job. Important jobs should have a skilled inspector, by all means.

Following the repassage of the vote of a million dollars for the site of the Canadian Government buildings in London, three eligible sites are now before Lord Strathcona and the Ministers. One is Westminster Hospital, 26,500 square feet, facing Westminster Abbey, valued by the owners at one and a half million dollars. The Government is not expected to pay any such price, especially as the separate arrangements made by British Columbia, Alberta and other Provinces preclude the realization of the idea of the Provincial Governments being housed with the Federal and sharing the expense. It is understood that Earl Grey's option on the Aldwyche site has been transferred to Lord Strathcona, but many feel that Canada would do best if the headquarters were given a distinction of their own and not crowded up with the Australian. Mr. Griffith, the official Secretary to the Canadian Government, says that nothing is likely to be settled yet awhile, and that Ottawa has no intention of rushing its decision.

The Board of Works of London, Ont., recently decided upon the preparation of the storm sewer and breakwater bylaws for presentation to the vote of the ratepayers at the earliest opportunity. The storm sewer system will cost $400,000. A similar by-law was defeated upon the occasion of its last submission to the ratepayers, but it is expected that no opposition to this by-law will develop as, in the meantime, London has had ample evidence that such a system is an absolute necessity. Until the system is at least well started practically no progress can be made in the matter of building better roads and the need of improved pavements is most urgent. City Engineer Ashplant reported that he could build a good breakwater for West London for $25,000, and the bylaw will call for debentures for only this amount.

Selection of Macadam Road Material*

A Matter of Equal Importance with Location, Drainage and Construction—Use of Local Products—Dust Preventives and Binders

By L. W. Page†

Of all the factors which go to make up the perfect macadam road, there is undoubtedly none more potent than that of the suitability of the material which enters its construction. A road may be located, drained and constructed along the very best lines and according to the most approved methods and be a total failure if the material of which it is built has been poorly chosen. It is perhaps not too much to say that large sums of money are wasted annually in this country because too little importance is attached to this phase of the road problem. The engineer, then, is confronted at the very outset with the important problem of selecting the most suitable material for his work, and on the care with which he performs this task depends in a large degree the success or failure of the road he is to build. The purposes of the present paper is to discuss in some detail the methods which may be used in aproaching this problem, with special reference to the value of laboratory tests as an aid in the selection of suitable materials for roads.

Methods of Testing

There are two ways in which the engineer may avail himself of the information necessary to a proper selection of a road material. The first and only certain one is to make an actual service test on the material under observation, and under the same conditions of traffic and climate to which the proposed road will be subjected. This method is, of course, impractical except in certain rare instances, due to the length of time which must elapse before definite results can be obtained. The second method is, by means of short time laboratory tests to approximate as nearly as possible the destructive agencies to which the material will be subjected on the road, supplementing the knowledge thus gained by a study of the results already obtained in practice on material of a similar noture.

The laboratory testing of road building materials originated in France over forty years ago, and was introduced into this country by the writer in 1893, when he became Director of the Road Material Laboratory of the Lawrence Scientific School at Harvard University. The United States Government became interested in this work shortly afterwards, establishing, in 1900, a laboratory in the Department of Agriculture, at Washington. This Laboratory is now a part of the Office of Public Roads, and has thus been able to give much assistance throughout the country in regard to the proper selection of material for macadam roads.

The three most important properties which a rock should possess in order that it may successfully resist the destructive agencies to which it is subjected are hardness, toughness, and cementing value.

Hardness, from the road builder's point of view, may be defined as the resistance which a rock offers to the displacement of its surface particles by friction. It is well illustrated in practice by the grinding action of iron tired vehicles which tend to reduce to dust the rock fragments of which the road is composed. This property is determined in the laboratory by a special method, the essential features of which are as follows:

A core 25 mm. in diameter is drilled from a sample of the solid rock by means of a core drill. After being accurately weighed, it is held in a perpendicular position against a cast steel disc revolving at the rate of thirty-three revolutions per minute, while crushed quartz sand of a standard size is fed upon the disc to act as the abrasive agent. After one thousand revolutions of the disc, the core is again weighed, the loss calculated, and a measure of the hardness of the rock thus obtained.

Toughness, or resistance to impact, is a measure of the ability of a road material to resist the pounding action of traffic such as is caused by the shoes of horses, etc. It is determined in the laboratory in the following way:

A cylindrical test specimen of the rock 25 mm. by 25 mm. is taken from the core used in the hardness test, and subjected to the impact of a two kilogram hammer through a spherical end plunger in a machine especially designed for the purpose. The test consists of a one centimeter drop of the hammer for the first blow, followed by an increase in the drop of one centimeter until failure of the test piece occurs. The height of blow at failure is taken to represent toughness of the specimen.

The combined effect of the mechanical agencies causing wear is very effectively determined by means of the Deval abrasion test, which has been the standard for over thirty years, and which is conducted essentially as follows:

Five kilograms of the rock to be tested is broken so as to number as nearly as possible fifty pieces, and is placed in an iron cylinder, mounted in such a way that the axis of the cylinder is inclined at an angle of thirty degrees with the axis of rotation of the machine. After ten thousand revolutions of the machine at the rate of thirty-three per minute, the material is taken out and sieved through a 0.16 centimeter sieve, the material passing being that used in calculating the percentage of wear.

The cementing value of a road stone is that property which caused the fine rock dust to act as a cement and thus bind the coarser fragments of which the road surface is composed into an impervious shell. A laboratory test to determine this property was devised several years ago by the writer, and is conducted substantially as follows:

Five hundred grams of the material to be tested is broken to about pea size, and placed, together with a sufficient quantity of water, in an iron ball mill. Five thousand revolutions of the mill reduces the mixture to the consistency of a stiff dough, which is moulded by means of a hydraulic moulding machine into cylindrical briquettes 25 mm. by 25 mm. in size. After drying twenty-four hours, these briquettes are tested by impact in a machine especially designed for the purpose. A one kilogram hammer falling upon an intervening plunger, which in turn rests upon the test piece, is allowed to drop from a height of one centimeter until failure of the specimen occurs. The number of blows causing failure is used to represent the cementing value of the material.

It will readily be seen from the foregoing that a very accurate preliminary idea of the properties of a road stone may be obtained by means of laboratory tests. Many years' experience in testing these materials have made it possible to adopt certain standards of excellence which, when used intelligently and in conjunction with the other factors in the case, are of much value in selecting suitable materials for water-bound roads.

The results of laboratory tests alone, however, are not sufficient to judge of the suitability of a rock for road building purposes, unless supplemented by additional information as to , (1) the character and volume of the traffic to which it is to be subjected, (2) climatic conditions under which it is to be used, and, (3) its name and general character, including, if possible, its mineral composition. In addition to the above, consideration in any specific instance should be given to such matters as the availability of the material, especially with reference to cost, transportation facilities, etc.

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*Paper presented at the Third American Road Congress, Detroit, Sept. 29-Oct. 4, 1913.

†Director U. S. Office of Public Roads, Washington, D. C.

The value of taking these factors into consideration will be briefly illustrated below.

It is a well known fact that a given road rock is far from being equally well suited to different traffic conditions. A high grade trap rock would be as unsuitable as it would be uneconomical on a road subjected to light traffic, in that the dust worn off would not be sufficient to bind the coarser fragments together, and the road would consequently ravel. On the other hand, the comparatively soft limestone which would be well adapted for the light traffic road would quickly pound to dust if subjected to conditions which would hardly affect the trap.

As a general rule, it may be said that the ideal rock for any particular road should be just so hard and tough that the fine material worn off by the action of traffic would be sufficient to supply that lost by the physical agencies of wind and rain. By correlating the information obtained by observing the behavior of the various rock types under different traffic conditions, with the results of laboratory tests on material similar in character, it has been found possible to determine quite definitely under just what conditions any given material would be most suitable, even before it had ever been used in road construction.

Many years of observation of the behavior of the various road building rocks in service has demonstrated the fact that, as a general rule, certain classes of material possess for particular purposes distinctive advantages over others. It is obviously of advantage, therefore, to know the general type of the material under observation, in order that an intelligent comparison my be made between it and material of a similar nature which has already been used. The different varieties of trap, for instance, such as diabase, basalt, etc., are generally considered to make the most satisfactory road material, especially when the traffic is heavy enough to supply by wear the dust lost from natural causes. The limestones, as a class, being softer and less tough are, as a rule, better adapted for light traffic than the traps. 'Laboratory tests in these cases are, therefore, mostly of value in enabling the engineer to make a definite choice between a number of materials which in a general way might be considered as suitable for his work.

The granites, owing to lack of toughness and cementing value, are, as a rule, only suitable for the foundation courses in plain macadam construction. Here the value of taking into consideration the character of the rock tested may be illustrated by the fact that frequently granites are found by laboratory tests to have good cementing values, due to highly altered minerals, when, as a matter of fact, such material should not be used on account of the ease with which it disintegrates under traffic.

Foliated material, such as gneiss, schist, slate, etc., should never, of course, be used when better material is available. Material such as quartzite and marble should also be avoided, the first on account of its hardness and lack of cementing value, and the second because of its crystalline structure and general lack of durability.

The availability of various materials considered for use in road construction should, of course, be considered, and this is highly important, especially from a financial standpoint. In considering this point, however, care should be taken not to lose sight of the other factors in the case. Experience has shown in innumerable instances where poor material has been used because it was cheap that money would have been saved in the long run by the use of a superior rock, even though shipped from a distance and costing considerably more at the outset. There are cases, however, where local material may be used advantageously. It is in such instances as these that engineering judgment, combined with laboratory results, is necessary for proper selection.

An accumulation of data resulting from the great number of tests made on road building rocks in the Government laboratory has quite recently made possible some very interesting investigations concerning the relation between the properties of hardness and toughness. By plotting numerous values of these tests, it was found that, in a general way, hardness increases with toughness and that, whereas for low values of toughness the hardness was extremely variable, as the rock became tougher the hardness showed less and less deviation from an average of the plotted points. The significance of this fact is that the property of hardness appears to be invariably associated with that of toughness, although the reverse is not the case. It seems, therefore that for a quick determination of the qualities of a road building rock, the hardness test might possibly be omitted, since material which satisfactorily passes the toughness requirement invariably appears to be hard enough for use in road construction.

When rock is to be used in bituminous construction, the importance of some of the above-mentioned tests is diminished. The cementing value, for instance, may be practically disregarded when the use of an artificial binder removes the necessity for dependence upon a dust bond. A tough rock is, of course, preferable, and more especially when the surface is to withstand the shock of heavy traffic, but both toughness and per cent. of wear become less important in the body of the road with bituminous construction when the surface is maintained by occasional surface treatments to preserve a wearing mat with a hard and tough aggregate.

Dust Preventives and Road Binders

Since public health and comfort have universally demanded an abatement of the dust nuisance, and economic maintenance is correlated with their demands, a few words on the selection of dust preventives and road binders can not be out of place in a discussion of materials for macadam roads. The selection of a form of treatment or construction must be governed by a full consideration of the volume and character of traffic which the road surface is called upon to carry. In rural sections where a macadam road is subjected principally to the average farm traffic and a relatively small number of automobiles, a surface which is in good condition at the outset may be economically and satisfactorily maintained by an occasional application of one of the lighter dust laying tars or oils. The purpose in a case of this character is simply to preserve an already good surface by keeping the products of wear saturated with a material that will prevent them from being removed from the road surface. This purpose is really best accomplished by a product that is not possessed of marked binding qualities—a material that will not pick up nor "ball" when mixed with dust only. Hygroscopic salts and other non-bituminous dust preventives have also served the above purpose successfully where climatic conditions favor their particular characteristics.

The value of a simple dust preventive decreases, however, with an increase in the volume of automobile traffic, and a more permanent form of wearing surface then becomes necessary. Up to a certain limit, and particularly on park roads, this character of traffic is successfully provided for by means of an annual surface treatment of oil or tar covered with cleaned screenings or fine gravel. For cold surface treatment, the oils which give particular satisfaction are the natural or partially refined products which, through laboratory tests, are shown to consist of low-boiling constituents carrying in solution a relatively high amount of heavy adhesive asphaltic base. For most successful surface treatment, it is essential that an oil shall develop decided adhesive qualities in the residue from the standard volatilization test at 163 deg. C. Tar products should be free from water.

When the traffic becomes of such a character and magnitude as to cause a too rapid deterioration of a surface mat, the macadam must be constructed or resurfaced with a heavy binder as an integral part of the upper two or three inches of the wearing surface. The selection of a binder, whether it be a tar or asphalt product, now becomes dependent on several factors, among which the method of construction, character of the aggregate, and climatic conditions are most important. For instance, a dense aggregate may permit of the use of a lighter tar than will a poorly graded one; or a lighter tar or softer asphalt product would be specified for northern latitudes rather than for use in the south. A single standard for all materials and conditions can not, therefore, be established, but with the various factors in mind, a specification can be drawn to cover the consistency and desirable chamical characteristics. In fact, in the purchase of road materials for whatever purpose it should be to the advantage of the producer as well as a protection to the consumer, that a definite specification be required. All shipments when received should be submitted to laboratory tests that will insure fulfillment of those specifications.

American Road Builders' Association Congress
New York, December 9-12

Plans for the Fourth American Good Roads Congress, to be held under the auspices of the American Road Builders' Association in the First Regiment Armory, Broad and Gallowhill Streets, Philadelphia, Pa., are being worked out in detail by the Convention Committee and officials having the matter in charge.

The following outline of program shows the subjects to be discussed at this convention:

Subject A—Organization

1. Highway Officials—Their Duties and Powers.
2. Division of Expense, Responsibility and Authority Between the various Municipal and Other Units Participating in a Road or Street Improvement.
3. Relationship of the Contractor, the Chief Engineer, the Resident Engineer and the Inspector.
4. Details of Arrangement for the Use of Convict Labor.

Subject B—Construction

1. The Proper Determination of the Amount of Realignment and of Grading to be Done.
2. The Factors Governing a Proper Selection of a Road or Street Pavement or Surfacing.
3. Materials and Methods Suitable for Road Surfaces.
4. Unit Price vs. Lump Sum Contracts.
5. Plant Equipment.
6. Preliminary Traffic Census.
7. Efficiency and Economy of Using One Size Crusher Run Stone Bituminous Concrete Pavements as a Substitute for Bituminous Pavements Constructed by Penetration Methods.
8. Dirt Roads.

Subject C—Maintenance

1. Sub-Organization for Securing Efficient Maintenance.
2. General Methods of Repairs and Renewals.
3. Methods of Dust Prevention.
4. Maintenance of Different Road Surfaces.

The general plan of providing for discussion of subjects, rather than long papers, which has been so successful in the past will be adopted at this meeting. The speakers are being selected with reference to their fitness to discuss the various questions, and announcement of these assignments will shortly be made. The list of speakers will include men who are recognized as the leading authorities in the United States and Canada.

In connection with the Congress and Convention, there will be held an exhibition of road machinery, materials and appliances. This exhibition will be known as the Fifth Annual Good Roads Exhibition and will include everything that enters into the construction, repair and maintenance of roads and pavements. This exhibition will also be held in the First Regiment Armory.

LETTERS

New York, Sept. 16, 1913.

Editor Contract Record:

I have read with much interest the article by Mr. Russell Spaulding on "Ozone Applied to Water Purification," appearing in your issue of August 13th of this year.

This article seems to bring together all recent data upon the various sterilizing plants in Europe. I quite agree with the author that there has been a marked advance in the sterilization of water supplies, and especially in so far as the application of ozone to the water is concerned. However, I should be very glad if the author or any of your readers would give better evidence as to the accuracy of the following statement found in the author's "Conclusion":

> "Aside from its wonderful and unfailing bactericidal power, ozone totally removes from water all trace of odor, color and taste due to the decomposition of organic matter."

This claim is so broad and far-reaching, that if ozone will do what the author claims for it is in this regard, its place in water purification, even as a substitute for filtration in many cases is at once assured.

I sincerely trust that the author can furnish us with evidence as to the relative accuracy of this statement.

Yours very truly,

Alexander Potter.

The report on the Ottawa water supply will be ready at an early date. The British engineers, Messrs. Binnie and Tickell, are making such progress in their work that there is a good possibility of the report being ready early in October. The mayor has stated that the reports which will be presented to the city council will be most comprehensive, taking in Lake Deschenes and other proposals which have been made from time to time. There will also be a report as to what the government is prepared to do though it is understood that as yet the cabinet has not discussed figures. When special legislation was secured for raising five million dollars for the work the stipulation was that a two-thirds vote of the city council or endorsation by the people would be necessary. It is generally understood that the five million will not be sufficient but it is also believed that there would be no difficulty in getting special legislation to expend a couple of millions more on the same condition. If the estimated cost is not too far over the five million mark there seems quite a probability of the council by a two-thirds vote settling the matter for good.

Architects' Record Meeting at Calgary

Important Transactions of The Royal Architectural Institute of Canada at Their Sixth Annual Convention Last Month

Special to the Contract Record

THE Sixth Annual Convention of the Royal Architectural Institute of Canada was held in Calgary, September 15th-16th. The first session of the Convention was held in the Lecture Room of the Calgary Public Library. Forty delegates and visitors were present from every province. The meetings were presided over by Mr. J. H. G. Russell of Winnipeg, president of the organization. The freedom of the city and a hearty welcome were extended to the visitors by Alderman W. J. Tregillus, the Acting-Mayor, in a few well chosen words. Mr. Roland W. Lines, of Edmonton, as President of the Alberta Association, in a brief speech, made the visitors welcome and at the same time gave a short resume of the business that the Convention had before it for consideration. Mr. R. A. Brocklebank, President of the Calgary Builders' Exchange, extended a cordial invitation to the Institute to be the guests of the Builders' Exchange at a "smoker" the following night. To all these expressions the president responded on behalf of the Convention, and the meeting then proceeded to business.

The reports of the Secretary, Mr. Alcide Chausse, of Montreal, and of the Treasurer, Mr. John W. H. Watts, of Ottawa, were gratifying in the extreme, and showed the Institute to be in an excellent financial condition, with a total membership of 558, of whom 491 are active members by virtue of being members of provincial associations associated with the institute.

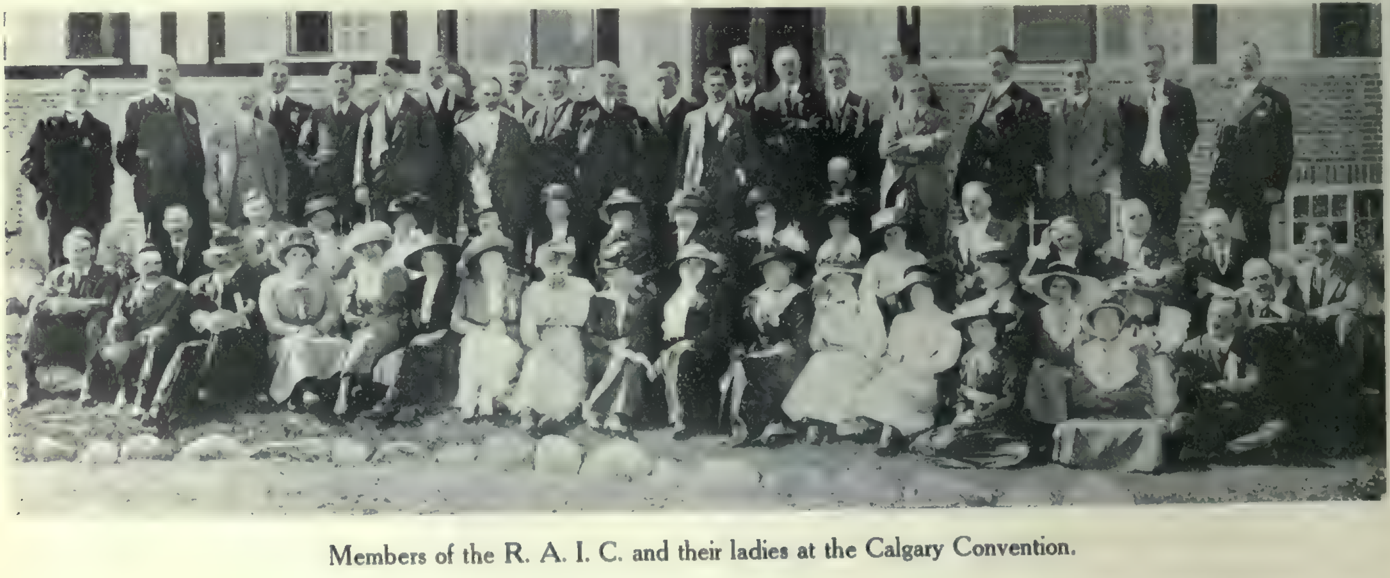
The principal business before the Convention was the consideration of certain amendments to the by-laws, together with a proposed code of ethics, a schedule of minimum fees and regulations governing competitions. A lecture on "Cement and Concrete," by Prof. Brydone-Jack, of the Engineering School of the University of Manitoba, occupied the main portion of the first afternoon.

The most radical change in the by-laws of the Institute as adopted was that changing the method of paying dues to require each provincial association to pay into the treasurer the sum of $2 for each accredited member. Another change was that which requires the election of other than active members to be unanimous by letter ballot of the council. In the matter of the code of ethics and the rules governing competitions, the president was directed to name a committee to deal with the proposed code and rules presented to the convention before final action should be taken. By unanimous vote the convention rejected the schedule of fees proposed, at the same time voting to revert to the schedule formerly in effect.

The election of officers and members of council for the coming year resulted in the re-election of Mr. Russell as President, and of Messrs. Chausse and Watts as Secretary, and Treasurer, respectively, and of Messrs. Roland W. Lines, of Edmonton, and M. Ouillette, of Quebec, as vice-presidents. The members of council from Alberta are Mr. G. M. Lang, of Calgary; Mr. Jas. Henderson, and Mr. Roland W. Lines, of Edmonton. The next place of meeting will be the city of Quebec in 1914.

Everyone seems to have been agreed that the convention was the most successful, both in attendance and in the way of entertainment, that has yet been held, and that the West has pointed the way for future gatherings of the Institute. From the very first, both the architects and their wives were treated with the best of hospitality, and in spite of the differences of professional opinion inevitable at such meetings, the best of good fellowship prevailed. The ladies of the Calgary Chapter of the Alberta Association provided entertainment for the visiting ladies, while the delegates and visitors were royally entertained by the local architects, under the watchful eye of Mr. G. M. Lang, past vice-president.

On the evening of the 15th, the Sixth Annual Banquet of the Institute was held in the Alexandra Hotel, with the President, Mr. Russell, as toastmaster. There were many enjoyable toasts proposed and answered. Those responding, among others, were Prof. Brydone-Jack, of the University of Manitoba, Mr. H. A. Sylvester, Superintendent of Buildings for the City of Calgary, Dr. Tory, President the University of Alberta, and others. But the best of all was the informal eloquence of Sir Gilbert Parker, the Canadian author, member of the British Parliament, himself no mean architect, though not of buildings. Though present inform-



Members of the R. A. I. C. and their ladies at the Calgary Convention.

ally, Sir Gilbert held his audience well in hand with words more serious than the occasion might have demanded, taking as his theme "The Arts."

Tuesday, September 16, the members of the Convention were guests of the Alberta Association at a luncheon served at the estate of John Hextall, on the outskirts of the city, in Bowness Park, one of Calgary's beauty spots. About sixty were present at the luncheon, following a tour about the city. In the evening, when the cares of the business sessions were over, the members of the local Builders' Exchange were the hosts at a most enjoyable "smoker," at which over eighty were present. It was a characteristic of the Convention—and it is probably unique in the annals of any such professional bodies—that the architects and contractors could get together so informally at the closing function without being accused of conspiracy.

Mr. J. H. G. Russell, of Winnipeg, who has been re-elected president of the Royal Architectural Institute of Canada.

W.W.H.

The Dominion Government are negotiating for the construction of a drydock at Vancouver with an initial capacity of 16,000 tons, which can be considerably enlarged if necessary.

Should a grain blockade occur this winter, as in some seasons past, the National Transcontinental Line from Winnipeg to Cochrane will be placed in commission as a means of relief. Although this section of the Transcontinental will not be entirely complete until next spring, it can be utilized for service to relieve a strain if necessary this fall. A train of six heavy private cars was moved over the line at high speed recently.

Excavation is under way at Prince Rupert for an hotel for the Grand Trunk Pacific Railway Company. The new hotel will, when completed, be the largest of the system. The site is bounded by First and Second avenues and Third and Sixth streets, and the building is 310 feet long with an average depth of 150 feet. Standing a short distance back from the water's edge the hotel commands a magnificent view of the harbor. It will be complete and up-to-date in every respect and will rank with the finest hotels of the Dominion when finished. The plans were drawn by F. M. Rattenbury, of Victoria. The general design of the building is of the Chateau type, similar to that of the Fort Garry in Winnipeg and other hotels now in course of erection.

Mainly Constructional

The News in Brief—From Coast to Coast

Messrs. Nicholson & Bain will erect a six-storey warehouse with basement at Edmonton at a cost of $70,000.

The first "flatiron" building in Edmonton, which is now in course of construction, will be finished before the end of the year.

The first annual meeting of the Sanitary Inspectors' Association of Western Canada was held at Regina on September 19th.

The Mount Royal Brick Company, of Montreal, will begin operations during October. There has been some delay in the completion of the plant.

A three-storey brick and concrete customs house building is to be built at Fort William. The structure will be one hundred feet long and eighty-five feet wide.

The new water system for the City of Hamilton, Ont., will be ready for operation in a few weeks and no difficulty is expected in supplying satisfactory service.

The Pedlar People, Limited, have established a branch factory at Montreal and removed their eastern office to 26 Nazareth Street, Montreal. Mr. W. E. Ramsay is manager.

It is the intention of the Dominion Dredging Company to continue the work on the Welland canal throughout the winter, and it is hoped that the work will be completed in five years.

Representatives of the Board of Trade of Toronto recently made an extensive tour of that city in company with the commissioner of works to inspect the various large municipal undertakings now being carried on.

The Dominion Bridge Company recently placed a two million pound steel bridge in position on the stone upright of the Lachine bridge in the remarkable time of one hour and twenty-five minutes.

The addition to the No. 1 elevator of the National Harbour Commissioners will be completed before close of navigation, which is earlier than was anticipated, J. S. Metcalf & Company, Montreal, are the builders.

The Canadian Westinghouse Company have decided to build an additional factory at Hamilton, Ont., at a cost of about $150,000. The building will be of reinforced concrete and work will be started on it at an early date.

The Canadian Northern and the Great Northern railways are negotiating as to the building of a joint union depot at False Creek, B.C. It is also possible that the Grand Trunk Pacific Railway may join in this scheme.

The city council of Winnipeg have decided to make a number of improvements towards beautifying their city, one of the most important being the laying out of a straight new thoroughfare from Portage avenue to Broadway.

The budget of the City of Westmount, P.Q., shows appropriations of $395,264, of which $96,574 will be spent on roads, $25,000 on street lighting, and $142,977 will be appropriated to the finance and municipal buildings committee.

At a recent conference between Mr. F. H. Gutelius, general manager of the Intercolonial Railway, and the Minister of Railways and Canals, it was decided to let the tenders for double tracking this railway at Levis, Que., at an early date.

Plans have been completed for a combined fire-hall and police station, costing $350,000, to be erected at Elizabeth street and Fraser avenue by the municipality of Edmonton. It is announced that provisions will be made in the estimates for 1910 so that work on the structure may proceed early next season.

Montreal's new $3,000,000 filtration plant is not large enough. Within twelve months at the latest another $1,000,000 or more will have to be spent on the work in order that it may meet the requirements of the city.

The five-storey and basement warehouse and office building of the Cockshutt Plow Company, Limited, at Calgary, has just been completed. It has a frontage of one hundred feet and a depth of one hundred and twenty feet and cost over $150,000.

Building permits at Fort William for the first eight months of 1913 amounted to $3,310,760, as compared with $2,781,950 for the corresponding period of 1912. Many large plants are at present in course of construction, the most noticeable being the incinerator plant, the car works and the nail works.

It is stated that by the end of this year there will only be a break of fifty miles in the whole transcontinental line of the Canadian Northern Railway Company from the Pacific coast to Quebec. At this point the line connects with the Atlantic coast, via Intercolonial Railway. The 50-mile stretch is in British Columbia.

A Commission has now been appointed to draw up a scheme for the beautification of Hull and Ottawa. The Commission will consist of the following: Mr. Herbert S. Holt, Montreal; Mr. Frank Darling and Mr. R. Home Smith, Toronto; Sir Alexander Lacoste, K.C., Montreal, and the mayors of Ottawa and Hull ex-officio.

That the general hospital board of Medicine Hat proceed with the preparation of plans and the construction of a new hospital building to cost in the neighborhood of $250,000 was the recommendation contained in the report of the special committee appointed to go thoroughly into the question of building a new hospital, received at a meeting of the hospital board recently.

Excavation work on the site of the new Hudson's Bay department store in the city of Victoria will commence in a day or two by Messrs. Luney Brothers of Winnipeg, who have been awarded the contract for this preliminary undertaking. and it is expected that the announcement of the letting of the contract for the construction of the building itself will be made while the excavation is in progress.

Sir William Mackenzie, accompanied by Lady Mackenzie and Mr. M. H. MacLeod, general manager of the western lines of the Canadian Northern Railway, arrived in Winnipeg recently on his return from a tour of inspection over the western lines of the system. Sir William has been over the new portion of the main line, and has had an opportunity of visiting several of the important points on the system.

Mr. J. D. McArthur, railway contractor, of Winnipeg, has written to the Government offering to take over the Albert and Great Waterways railway on terms satisfactory to the representatives of the bondholders and the Royal Bank and to construct a line between Edmonton and Fort McMurray via a route approved by the Government, the specifications, however, to be similar to those of the Edmonton-Dunvegan and B. C. Railway.

Officials of the Great Northern and C. N. R. railways were in conference recently at Vancouver discussing the question of a union depot. No definite decision has been issued as yet, According to the city's agreement with the C. N. R. that railway was bound to build a station to cost $1,000,000. The present station of the C. N. R. on the north side of the creek is entirely inadequate for the needs of a transcontinental railway.

The Dunnville, Wellandport & Beamsville Electric Railway is reported to have completed arrangements for a sale of additional bonds, and will resume construction work on its projected 23-mile line. About 13 miles have been graded, and the bridges and structural work completed on the section. The line has a charter from Port Dover to St. Catharines, with branches to Dunnville, Welland, Jordan Harbor and other points. J. A. Ross, Wellandport, Ont., is president.

The annual convention of the American Road Congress is now in session at Detroit. The congress is being held under the auspices of the American Highways Association, and is presided over by Mr. L. W. Page, director of the United States Office of Public Highways and president of the American Highways Association. Mr. W. A. McLean, vice-chairman of the Provincial Highways Commission, will lead the discussion on bitulithic construction and maintenance.

It is said that the government is considering a large building programme for Ottawa. It is proposed to tear down the present unsightly printing bureau building and replace it by a large modern building on another site. On the present building bureau site it is the intention to build a national library, the parliamentary library being too small to meet the present requirements. It is also proposed to enlarge the archives building, which has become crowded, to twice its present size.

At the meeting of the Committee on Works on October 3, Assessment Commissioner Forman and Works Commissioner Harris, of Toronto, will present a report on the widening of Yonge street by 20 feet, from north of Bloor to the north city limits. The Assessment Department is at present engaged in making valuations of the buildings and land damages. The work is to be carried out under the Local Improvement Act and the necessary land taken from the west side of the street. The subway is to be 86 feet wide.

Over $20,000 has been spent by the Provincial Board of Health in conducing the sanitary survey of lake waters during the past summer. The work, which is now nearing completion, involved investigating boundary waters at a score of points between Kingston on the east and Fort Frances on the west. Between 17,000 and 18,000 tests have been made, and while the results have not been tabulated, it is understood that positive evidence of the board's contention that there was pollution from sewage deposited into the great lakes from large cities along the border has been established. The work has taken six months.

A report by the provincial government surveyors who have inspected Seymour Creek, a stream flowing south into Burrard Inlet, for the Vancouver civic authorities, has just been published. It is stated that a lake at the Seymour Creek Falls with an area of 8 to 10 square miles could be formed by a dam at this point. Provision for a hydro-electric power plant could be made by piping water down three miles, where a head of 200 feet could be obtained and the water still be available for the supply of Vancouver after passing through the turbines.

With a view to erecting a provincial government telephone line from Heriot Bay across Valdez Island to the mainland. Mr. H. E. Elsden, is at present engaged in a survey of the route and preparing an estimate of the cost of construction. The proposed new line will be sixty miles in length and will connect with the Dominion Government line at Heriot Bay and terminate at Loughbury Inlet on the mainland, Mr. H. E. Elsden is at present engaged in a survey of purpose of the proposed new line is to afford communication to the fire guards and timber officials who are engaged in preserving the forest wealth of the district through which the line will pass.

Personal Mention

Mr. W. S. Harvey has been appointed Acting City Engineer of Lethbridge, Alta., vice Mr. A. C. D. Blanchard resigned, until such time as a permanent appointment shall be made.

Sir Philip Watts and Mr. J. H. Noble, directors of the Armstrong-Whitworth Company, Newcastle, England, in company with Mr. M. J. Butler, the consulting engineer, recently visited the steel works of the company now being constructed at Longueuil, P.Q. The contract for the buildings is being carried out by Mr. E. G. M. Cape, some two hundred men being engaged in erecting five buildings. The visitors are now in the west on their way to Japan.

Messrs. Arthur H. Blanchard, M. Can. Soc. C. E., Consulting Highway Engineer and Professor in charge of the Graduate Course in Highway Engineering at Columbia University, and Provost Hubbard, Assoc. Am. Soc. C. E., Consulting Chemist, in Charge of the Division of Roads and Pavements, The Institute of Industrial Research of Washington and Lecturer in Highway Engineering Chemistry in Columbia University, have formed a partnership under the firm name of Blanchard and Hubbard, Highway Efficiency Experts, with offices at Broadway and 117th Street, New York City. At present Messrs. Blanchard and Hubbard are retained by Commissioner John H. Delaney as the Advisory Board on Highways for the New York State Department of Efficiency and Economy.

The Late Mr. James Ross, C.E., of Montreal

The death of Mr. James Ross, C.E., in Montreal, on September 20th, from heart disease, involves the loss to Canada of one of its foremost engineers and contractors, and one who has been identified with the development of many important enterprises. He was chiefly known as a contractor for national railways and the promoter and manager of electric lines. A Scotchman by birth, he received his training in England and Scotland, and then went to the United States, where he acted as engineer and manager to some railway companies. Later, Mr. Ross was connected with Canadian lines, and in 1883 took control of the construction of the Canadian Pacific Railway west of Winnipeg, and in 1885 completed for the company their line over the Rocky Mountains, the Selkirk and the Gold Range. In 1886 he undertook for the C. P. R. the settlement of their location east of Montreal, and their legislation in Maine, and upon the completion of this work took the contract for the construction of the remaining portion of their line not already provided for.

In later years Mr. Ross devoted his chief attention to the reorganization of street railways. In 1892 he joined Mr. William Mackenzie in purchasing the Toronto railway from the city of Toronto, and afterwards rebuilt its tracks, making it an electric line. In 1892 he undertook the reorganization of the Montreal Street Railway, changing it from a horse line to an electric service. He also converted in a like manner the street railways of Winnipeg and St. John. In 1896 he and Mr. Mackenzie acquired the tramways systems in Birmingham, Eng., and formed the City of Birmingham Tramways Company, Limited, for the operation of the road under an electric system, and in 1897, with Mr. Mackenzie and others, he secured a charter and franchise from the Government of Jamaica to build electric tramways on the Island.

He was at various periods president and managing director of the Montreal street railway; vice-president of the Toronto street railway; president of the Winnipeg and St. John street railways and president of the Dominion Bridge Company. Mr. Ross took a prominent part in the affairs of the Dominion Coal Company and the Dominion Iron and Steel Company, and fought strenuously for the former concern when the two companies became involved in litigation. After judgment had been given, his interests in the Coal Company were purchased for $4,750,000, and he retired from the presidency, the two concerns being amalgamated.

At his death Mr. Ross was director of the Bank of Montreal; Calgary and Edmonton Land Company, Limited; Canada Life Insurance Company; Canada Sugar Refining Company, Limited; Canadian General Electric Company, Limited; Dominion Bridge Company; Laurentide Paper Company, Limited; Royal Trust Company, and St. John Railway Company.

Successful New Enterprises

A concern, news of whose entrance into the constructional field will be of interest to our readers, is the Eberhard & Wood Manufacturing Company, makers of ornamental and general iron work.

The principals, Mr. C. R. Eberhard, C.E., and Mr. T. H. Wood, have had extended experience in this class of work and are also the Toronto representatives of the Dennis Wire & Iron Works Company, Limited, London, Ont. The company actually commenced operations about two years ago, directing their attention to local orders, which have assumed such importance that the number of employees engaged has increased from three to fifty.

Among the recent contracts executed in conjunction with the Dennis Wire & Iron Works, mention may be made of the west wing of the Parliament Buildings, six buildings of the new General Hospital, Sick Children's Hospital, T. Eaton Memorial Church, Upper Canada Bible Society's Building (iron stairs), Foresters' Building (iron stairs), Customs House (iron stairs), General Post Office (iron work), several of the Bell Telephone Company's buildings (fire escapes) and the R. S. Williams Building (fire escape), all in Toronto.

Trade Notes

Owen clam shell buckets and material handling machinery are featured in a catalogue received from the Owen Bucket Company, Cleveland, Ohio. The lines manufactured by this company are constructed to withstand great strain and hard usage. The principles of operation are claimed to be unexcelled. The manufacturers claim that their clam shell bucket will ensure a bigger day's work than any other. A separate booklet is devoted largely to illustrating the possibilities of Owen buckets in operation.

"The Court Record of Five Witnesses" is a most original catalogue which is being distributed by the Ceresit Waterproofing Company, Chicago. In this catalogue, which is issued in five parts, the company's waterproofing is put on trial and five "witnesses"—Professor Scientist, Mr. Engineer, Mr. Builder, Mr. Owner and Mr. Demonstrator offer convincing testimony which results in a verdict in favor of the company. The individual story of each witness is told separately. Readers desirous of obtaining copies are requested to fill in the coupon contained in the firm's advertisement in this issue.

Parian ware, which is claimed to give "sunlight without glare" is described in Catalogue No. 35, issued by Gill Bros. Company, manufacturers of illuminating glassware, Steubenville, Ohio. Semi-indirect lighting, which is claimed to be the most advantageous kind, is held to find its highest expression of efficiency in Parian ware. The most beautiful globes and shades are illustrated in excellent half-tones in this catalogue and the effect produced by means of the ware would appear to be the same as though the light were filtered through a translucent piece of exquisite marble. Copies of the catalogue are well worth sending for.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Estevan, Sask.
Storm and sanitary sewer planned by Town Council. Sec.-Treas., P. J. Stephens. By-law submitted to ratepayers on Sept. 23rd.

London, Ont.
Sewers, cost $450,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineers, Chipman & Power, Mail Bldg., Toronto. Trunk sewer from Dundas street to River $400,000. Extension of sewer in Ealing District $50,000. Vote to be taken Oct. 16th.

Municipal paving plant contemplated by the City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant.

Montreal, Que.
Tenders received by Sec., L. N. Senecal, Board of Commrs., till noon, Oct. 3rd, for sewers on MacGregor St., Lacordaire St., Montsabre St., Turenne St., George V. Ave., King Edward VII. Ave., St. Catherine St., Lafontaine St., Adam St., Ontario St., Monkland St. Specifications, etc., at office of Engineer Superintendent of Sewers.

Oakville, Ont.
Council will have cement walks laid on Colborne, Bond and Kerr Sts., and sewer on Colborne street.

Ottawa, Ont.
Asphalt pavements, Clarence and O'Connor, planned by City Council. Mayor, J. A. Ellis. Time extended for receiving tenders until 4 p.m. Oct. 2nd. Specifications, etc., at office of Engineer, Archibald Currie.

Regina, Sask.
City Council contemplate addition to Sewage Disposal Works of another filter bed. Engineer, F. McArthur.

Stamford, Ont.
1,000 ft. concrete roadway, 16 ft. wide contemplated. Clerk, C. F. Munroe, Southend. Matter has been passed by Council.

Stratford, Ont.
Waterworks supplies. Separate tenders received by Sec.-Treas., W. H. Trethway, until Oct. 4th, for:—"A" 150 h.p. steel boiler to carry 120 lb. working pressure. Specifications, etc., to accompany offer, "B" Similar boiler, 150 lbs. working pressure. "C" 1 high duty reciprocating steam pump to deliver 1¼ million imperial gallons of water per 24 hours at 80 lbs. pressure. Preference given to pump doing this duty economically but capable of getting 120 lbs. water pressure when required for fighting fires. Specifications to accompany offers. To be delivered 6 weeks from acceptance of bid.

Toronto, Ont.
Sewers. Tenders received by Mayor H. C. Hocken, Chairman, Board of Control, until Oct. 7th. Plans at Dept. of Works, City Hall. Lightbourne, Chandos, Belsize, Morrison Ave., Wells Hill, Beach Ave., Esplanade and Woodville Ave. East Toronto Outlet. Esplanade Sewer Sanitary, Contract No. 87, Sec. 1. Earlscourt Drainage System No. 2. Danforth Ave. S. O. S. Sec. No. 1.

Pavements planned by Board of Control, Mayor H. C. Hocken. Tenders received until Oct. 7th. Plans at office of Dept. of Works. Asphalt on Beaumont, Bellair, Browning, Carlaw, Cumberland, Dunn, Elliott, Grange and Wolseley. Brick block on Symington. Bitulithic on Mavety. Concrete on lane north of First Ave.

Tenders received by Mayor, H. C. Hocken, until Oct. 21st for 20 and 36-in. cast iron pipe; 20 and 36-in. cast iron special castings; 20 and 36-in. stop valves. Specifications at Room 9, Dept. of Works, City Hall.

Works Commissioner Harris recommends grading the following streets: Glencairn Rd., Spring, Glenwood and Windermere Aves., cost $16,138. Glenholme Drive, $30,523, and pavements: Sunnyside, Gladstone, Herbert, Grenville, Hibernia, Logan, Homewood Place, Woodycrest, Quebec and Pendrith. Cost $56,432. Board of Control. Mayor, H. C. Hocken.

Five ft. cement concrete sidewalks on a number of streets. Estimated cost $70,000. Mayor, H. C. Hocken.

Brick block pavements on Wellington W. from Spadina to Portland. 42 ft. wide, estimated cost $28,328.

46 ft. pavement, Terauley St., treated wood block on 6 in. concrete foundation. Cost $31,000. Brick block pavement recommended for St. Clair from McRoberts Ave. to G. T. R. Cost $14,000. Board of Control. Mayor, H. C. Hocken.

Widening and grading planned by Board of Control. Mayor, H. C. Hocken. Poplar Plains Road widening from Macpherson Ave. to Clarendon Crescent, 50 ft. wide. Estimated cost $64,775. Dufferin St. from Temple to Springhurst, 91 ft. wide. Estimated cost $9,950.

Victoria, B.C.
By-law will be voted on October 2nd for acquiring and constructing the Sooke Lake Water Supply System. City Clerk, Wellington J. Dowler.

CONTRACTS AWARDED

Brantford, Ont.
Cement sidewalks, Aberdeen St. and Hamilton Road, planned by Twp. Council. Clerk, J. A. Smith, County Bldgs., Brantford. Engineer, A. M. Jackson, Temple Bldg., Brantford. General contractors, Royal Artificial Stone Paving Co., (Conely Bros., Guelph). 4,053 ft. of 4 ft. cement sidewalks, at 11½c. per sq. ft. 7,810 lin. feet, at 12½c. per sq. ft.

Dundas, Ont.
Cement walks, curbs, retaining wall and grading on King, McMurray and Foundry Sts., planned. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Govt. Insp. of Bldgs., Jas. Smith. General contractor, J. W. Dickson, Dundas.

Fort William, Ont.
Water mains, cost $53,000, Island No. 2. City is laying 14 in. and 16 in. water mains on Island, also across Mission River. Work done by day labor under City Engineer, Ray R. Knight.

North Battleford, Sask.
Sewage system planned by City Council. Engineer, A. Stirling. General contractor, Wm. Newman & Co., Ltd., 409 Ashdown, Winnipeg.

Oakville, Ont.
Paving, Dundas St., planned by Town Council. Chairman Streets Com., C. H. Cross. General contractors, Service Constr. Co., Guelph. Concrete pavement at 18 3-5c. per sq. yd., curbings at 38½c., catch basins at $12.50.

St. Eustache, Que.
Macadamizing roads planned by Municipal Council. Sec.-Treas., J. A. G. Belisle. General contractor, Alfred Villeneuve, Petite Riviere. St. Eustache and Adelard Charrette.

Winnipeg, Man.
Sewer, cost $4,543.31, on Ferry Lane, for Rural Municipality of Kildonan. Clerk, H. Thompson, 215 Chambers of Commerce, Winnipeg. General contractors, Thos. Jackson & Sons, Colony St.

Sewer (St. Mary's and St. Annes Rds.) for Rural Municipality of St. Vital. Sec.-treas., G. J. Charette, Grandvital P. O. General contractor, Thos. Jackson & Sons, Colony St., $162,000. 1¼ miles of trunk sewers.

Railroads, Bridges and Wharves

Bracebridge, Ont.
Extension to wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 21st. Plans, etc., at offices of J. H. Armstrong, Dist. Engineer, Midland, J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Postmaster, Bracebridge and at Dept., Ottawa.

Brantford, Ont.
City Engineer, T. Harry Jones, has been instructed to prepare plans for construction of dyke across property near foot of West Mill St., to be about ½ mile long.

Cap Chat, Que.
Extension to pier. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom.

Govt., Dept. of Public Works, till Oct. 22nd. Plans, etc., at offices of J. T. Bertrand, Dist. Engineer, Isle Verte, Que., Chas. Chapais, Dist. Engineer, Post Office Bldg., Que., Postmaster, Cap Chat, and at Dept., Ottawa.

Camrose, Alta.
C. P. Rly. have been authorized to construct 3 spurs, for Vernon Fruit Co., Provincial Telephone Co. and a branch line.

Calgary, Alta.
C. P. Rly. have been authorized to construct a spur into premises of Olgivie Flour Mills Co., Ltd.

Cariboo District, B.C.
G. T. P. Rly. Co. has approved of location of station at mileage 1179.2.

Dorenlee, Alta.
G. T. P. Branch Lines Co.'s site and station have been approved on the Tofield-Calgary Branch.

Haileybury, Ont.
The Temiskaming & Northern Ont. Rly. Commsn. propose to electrify Kerr Lake Branch, between Cobalt and Haileybury. Chairman, J. L. Englehart, Toronto street, Toronto.

Halifax, N.S.
Bridge planned for Dominion Atlantic Rly. Has been authorized to be constructed over Cambridge Brook 77.9 miles from Halifax.

Hamilton, Ont.
Freight shed, Main and St. Catharine Sts., planned for Dom. Power & Transmission Co. Supt., Geo. E. Waller. Work on new freight shed to be started shortly to replace one destroyed by fire.

London, Ont.
Breakwater, cost $25,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Date for submitting by-law to ratepayers has been changed to October 22nd.

Breakwater, cost $25,000, contemplated by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Ratepayers will vote on by-law Oct. 15th. Reinforced concrete, 1,800 ft. long.

Province of Manitoba
Branch line of C. N. Rly. Grosse Isle Branch location, through Twp. 25 has been approved.

Milton, Ont.
By-law passed to raise $40,000 to complete High Level Bridge over 16 mile creek near Oakville and paper mill bridge and dam near Georgetown.

Montreal, Que.
Freight sheds, cost $200,000, for Harbour Commrs. of Montreal. Engineer, F. W. Cowie, 57 Common St. Piling, Raymond Concrete Piling Co., New Birks Bldg. Tenders called in a week by Commrs. for steel. Two storeys, 112 x 485.

G. T. Rly. have been authorized to construct a siding into premises of the Dominion Textile Co., Ltd., and a spur into premises of the Grasselli Chemical Co., Ltd.

Moose Jaw, Sask.
C. P. Rly. have been authorized to construct a spur for Whitlock & Riddell.

North River Bridge, P.E.I.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 7th. Specifications, etc., at office of W. E. Hyndman, Dist. Engineer, Charlottetown. 260 ft. long, 30 ft. and 20 ft. wide, approach 180 ft. long, outer block, 80 ft. long x 30 ft. wide.

Red Deer, Alta.
C. P. Rly. has been authorized to construct bridge No. 93, Red Deer, Edmonton Sub.-Div.

Sault Ste. Marie, Ont.
Canal contemplated. Dom. Govt., Dept. of Railways & Canals, is expropriating land. Minister, Hon. Robt. Rogers, Ottawa.

St. Anne Des Monts, Que.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 22nd. Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Post Office, Que., J. L. Michaud, Dist. Engineer, Post Office Bldg., Montreal, Postmaster, St. Anne des Monts, and at Dept., Ottawa.

St. Catharines, Ont.
Welland Canal, Section No. 2. Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, till noon Oct. 15th. Plans, etc., at office of Chief Engineer of Dept., Ottawa, and Engineer-in-charge, St. Catharines.

Province of Saskatchewan
C. N. Rly. have authorized the construction of bridges at mileage 78.4, Moose Jaw, at mileage 3.2, Moose Jaw, Sub.-Div., at mileage 87.0, Rush Lake, Swift Current, at mileage 92.1, over Antelope Creek, Swift Current Section Western Div. at Swift Current Sub.-Div. have been authorized.

Smithers, B.C.
G. T. P. Rly. Co.'s location for station at Smithers, mileage 226.5, Prince Rupert East, has been approved.

Sturgis, Sask.
Stock yards planned by C. N. Rly. One pen, 2-car capacity, stock yard with platform and chute.

Toronto, Ont.
Canadian Pacific Railway Company has been authorized to construct a switching lead across lots 9 to 27 inclusive northerly of Vine St.

Concrete curbings planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Oct. 7th. Plans, etc. at Dept. of Works. Avondale, Beaumont, Bellair, Dufferin, Elm Ave., Nanton, Symington, Wolseley. Grading Rosemont from Alberta to Oakwood.

Street car barn, cost $14,000, Bracondale, near Benson, planned. Mayor, H. C. Hocken. Work will probably be done by day labor. One storey, steel and brick construction, brick and concrete foundation.

Vancouver, B.C.
Car barns, cost $300,000, 13th Ave., for The British Columbia Electric Rly. Co., 425 Carrall. Two storeys, reinforced concrete construction. Plans prepared.

Wood Islands, P.E.I.
Extension of breakwater. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, till Oct. 7th. Plans, etc at office of W. E. Hyndman, Dist. Engineer, Charlottetown. Extension 100 ft. long x 40 ft. wide, close-faced timber cribwork, interior filled with granite limestone or other imported hardstone.

Weyburn, Sask.
C. P. Rly. Co.'s location of stations at Melavel, Readlyn, Woodraw and Lafleeche on the Weyburn westerly branch has been approved.

Winnipeg, Man.
Board of Control contemplate the construction of a concrete bridge over Assiniboine River at Arlington Street. Secretary, M. Peterson.

CONTRACTS AWARDED

Annapolis Royal, N.S.
Piers, cost $34,700, planned for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Reid & Archibald.

Twp. Bentinck, Ont.
Bridge, cost $3,500, planned by Twp. Council. Clerk, J. H. Chittick, Lamlash, Ont. Cement work, Joseph Cope, Chesley, Ont. Steel work, Corbett Co., Owen Sound.

Kingston, Ont.
Underground conduit, King and Princess Sts. Gen. Mgr. Civic Utilities, C. C. Folger. General contractors, Dietrich Co., Montreal, Que. Contract for supplying and laying 5,000 ft. of duct, $11,887.

London, Ont.
Steam railway line to Port Talbot planned. General contractors, Canadian Stewart Co., C. P. R. Bldg., Toronto. Surveyor in charge, Engineer S. Wilson.

Ottawa, Ont.
Booster building, cost $6,000, Nelson St., for Ottawa Elec. Rly. Supt., Fred. Burpee. Architect, J. Albert Ewart, 193 Sparks St. General contractor, Geo. Crain, Clemow Ave.

St. Malo, Que.
Car shop repair plant, cost $1,500,000, planned by Commrs. Transcontinental Rly. Sec., P. E. Ryan, Ottawa. General contractor, Jos. Gosselin, Levis, Que. Cast iron pipes, etc., L. H. Gaudry, 76 St. Pierre St., Que. Sub-contractor for some of supplies, Canada Iron Corporation, Ltd., Mark Fisher Bldg., Montreal.

Toronto, Ont.
Car shed addition, cost $9,000, Connaught Ave., for Toronto Street Rly., King and Church. Architect, H. G. Salisbury, 10 Adelaide E. General contractor, Owner. Supt. in charge, G. Fleming. Two storeys, 30 x 60, brick and steel construction, brick foundation, felt and gravel roofing.

Waterford, Ont.
Bridge, Pond Road. Clerk, James Ross. General contractors, The Maple Leaf Paving Co., Simcoe.

Public Buildings, Churches, Schools, etc.

Barrie, Ont.
Armoury, Queen's Park, planned by Dom. Govt. Dept. of Militia and Defence.

Sec., E. F. Jarvis, Ottawa. Site chosen, has been approved and tenders will be called shortly.

Battleford, Sask.
Collegiate planned by City Council. Sec.-treas., H. Basil Thompson. By-law for the expenditure of $55,000, to finish and furnish school was passed.

Berlin, Ont.
Church, cost $40,000, Benton and Church Sts., planned for St. Matthews Lutheran Church. Tenders received by Chairman Building Committee, A. Sippel.

Brantford, Ont.
Tenders received by Sec., H. F. McNaughton, Parliament Bldgs., Toronto, Prov. Govt. Dept. of Public Works, until Oct. 6th for heating, plumbing and electric wiring in Institute for the Bland. Plans, etc., at Institution and at Dept., Toronto.

Canora, Sask.
Plumbing and heating for school. Tenders received by Sec.-Treas., till Oct. 4th. Plans and specifications at office of Sec.-Treas., H. M. Sutherland. Architect, F. R. Evans, Somerset Block, Winnipeg.

Fisher River, Man.
Residence. Dom. Govt. Dept. of Indian Affairs. Sec., J. D. McLean, Ottawa. Residence will be in Agency Ground in Peguis Indian Reserve at Fisher River. Plans, specifications, at offices of Indian Affairs at Winnipeg, Selkirk and Portage la Prairie, also at Post Offices at Teulon, Arborg and Stonewall. Tenders received by Sec., till noon Oct. 15th, 1913.

Fort William, Ont.
Customs house, cost $100,000, May & Leith, planned by Dom. Govt. Dept. of Public Works. Tenders close with Sec., R. C. Desrochers, Ottawa, Oct. 14th. Three storeys, 100 x 80, reinforced concrete, stone, steel, hollow tile and brick construction, concrete and pile foundation, felt and gravel roofing, electric lighting, steam heating, oak floors, plumbing, terrazzo tiling, plate glass, galvanized iron, ventilators, cornices, architectural iron stairs, vaults, passenger elevator.

Fredericton, N.B.
Central fire station, King st., planned by City Council. Clerk, J. W. McCready. Architect, Kenneth R. Campbell. Foundation, J. Fred Ryan, $1,565. Foundation to be completed by October 1st. Tenders for other trades to be called. Three storeys, freestone and tapestry brick construction.

Guelph, Ont.
Hockey rink, cost $10,000, for Ontario Agricultural College. Plans will be prepared.

Kingston, Ont.
Rifle range planned by Dom. Govt., Dept. of Militia & Defence. Secretary, E. F. Jarvis, Ottawa. Tenders received by Director of Contracts, Ottawa, until noon, Oct 11th. Plans, etc., at offices of Officer Commanding 3rd Division Area, Kingston, and Director-General of Engineer Services, Ottawa.

L'Epiphanie, Que.
College, cost $125,000, for R. C. School Commissioners, L'Epiphanie. Tenders received by Architects, Viau & Venne, 76 St. Gabriel St., Montreal, after Oct. 31st. Three storeys, 150 x 60.

Melville, Sask.
Convent, cost $15,000, contemplated for Order of Benedictine Nuns. This work will not be commenced nor arrangements made until 1914.

La Pas, Man.
Church for Methodist Congregation. Pastor, Rev. D. Howland, B.A. Have purchased a site and plans will be prepared.

Montreal, Que.
Club house contemplated, Cherrier, for National Amateur Athletic Association, care A. L. Caron, Caron Building, Bleury street. Architect not chosen.

Golf club house, cost $3,000, for Beaconsfield Golf Club, c/o Mr. R. J. Tooke of R. J. Tooke & Co., Ltd., Montreal. Architects, Brown & Vallance, Canada Life Bldg., Montreal. Field stone foundation, roughcast construction. Tenders in.

Library and club rooms, Mountain, for Natural History Society of Montreal. Secretary, Mr. Griffin, 365 Mountain St. Plans in progress.

College, cost $400,000, for Loyola College, 68 Drummond St. Architects, Peden & McLaren, 20 St. Alexis. Excavating, A. D. Masson, Quebec. Tenders will be called as work progresses 180 ft. with wings, concrete foundation, Indiana or local stone and fireproof construction.

Oshawa, Ont.
School contemplated by the Board of Education. Chairman, Mr. Everson. Committee will have plans prepared and receive estimates.

Orangeville, Ont.
Remodelling Town Hall contemplated by Town Council. Architect, Chas. King. Plans being prepared. Tenders will be called.

Ottawa, Ont.
National library contemplated by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Propose to build library on site of present printing bureau.

Dom. Govt., Dept. of Public Works, plan enlargement of archives building to twice its present size. Secretary, R. C. Desrochers.

Point Grey, B.C.
University for Prov. Govt., Dept. of Public Works. Architects, Sharpe & Thompson, London Bldg., Vancouver. Engineer, J. E. Griffith. Plans in progress.

Prince Albert, Sask.
By-law to raise money for the construction of a public library passed. Plans will be prepared.

Regina, Sask
Police Station, cost $150,000, planned by City Council. City Commissioner, L. A. Thornton. Architects, Clemsha & Portnall, 1721 Scarth St. Work will be postponed till next spring.

Renfrew, Ont.
Curling Rink contemplated. President, H. A. Tofield. Architect, J. D. McNicoll. Committee has been appointed to look into matter of securing site, comprising Messrs. Tofield, D. H. McAndrew, J. D. Cameron, G. G. McNab & H. W. Airth. Two storeys, 34 x 17, brick construction, shingle and building paper roofing.

St. John, N.B.
Tuberculosis hospital, Merritt, contemplated by Board of Hospital Commissioners. Chairman, H. B. Schofield, City Hall. Architect, F. Neil Brodie, 42 Princess St. New sketches approved, new plans to be drawn at once.

South Vancouver, B.C.
Post Office planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Appropriation of $20,000 made by government for site, which has been secured.

Toronto, Ont.
Addition and alterations to theatre, Queen St. W., for Geo. Dodds, 604 Queen St. W. Plans will be prepared.

Gateway, cost $4,000, High Park Ave. and High Park, planned by Board of Control. Tenders received by Chairman, Mayor H. C. Hocken, until 12 o'clock noon, Oct. 7th, for erection of ornamental stone and iron gateway. Specifications, etc., at office of Parks Dept., City Hall.

Masonic Temple, Spadina, contemplated. President, J. Ross Robertson. Competitive designs will be received up to noon, January 20th, 1914. Full information from W. H. Best, 181 Avenue Road.

Theatre, cost $14,000, Roncesvalles & Galley, for Wilson Lumber Co., 1 Spadina Ave. Architect, A. H. Start, 105 Melville. Tenders received by owner now. Two storeys, 26 x 110, brick and steel construction, stone foundation.

Vancouver, B.C.
Immigration building, cost $300,000, Foot of Victoria Drive, for Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Five storeys, 220 x 64, reinforced steel beam construction, elevators. Tenders will be called in about two weeks.

Post office, cost $100,000, Mt. Pleasant, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, A. Campbell Hope, 603 Hastings St. W. Fireproof, stone, pressed brick and marble construction. Tenders wil lbe called shortly.

Victoria, B.C.
School, James Bay. Secretary, W. T. C. Pope, 1127 Catherine St. Architect, J. C. M. Keith, 416 Sayward Bldg. Four rooms. Plans in progress.

Twp. West Flamboro, Ont.
Heating system contemplated by Methodist Church Congregation. Pastor, Rev. H. L. Merner, Copetown. Plans will be prepared.

Winnipeg, Man.
Athletic headquarters, cost $15,000, Sargent Ave. Park. Tenders called for construction of foundation and walls up to second floor. Board of Control, Secretary, M. Peterson.

CONTRACTS AWARDED

Blackstock, Ont.
Drill Hall, cost $12,500, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa.

General contractor, W. A. Tom, Collingwood. Foundations in.

Brampton, Ont.
Drill Hall, cost $16,000, planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractor, W. A. Tom, Collingwood. Cement work not yet awarded.

Collingwood, Ont.
Nurses' home, cost $6,000, for General & Marine Hospital Board, Peel St. Chairman Hospital Trustees, H. Y. Telfer. Architect, John Wilson, Hurontario St. Builder, Mr. Thos. Long.

Dundas, Ont.
Sunday School for St. James Church Congregation. General contractor, F. A. Nelson. Contract for heating and electric lighting in Sunday School. Electric lighting for church will be considered shortly.

Fort William, Ont.
Alterations to church, cost $2,500, Pruden, for St. Andrews Pres. Church. Architect, M. H. Bradin. General contractor, Peter Sell. Brick veneer construction, concrete foundation.

Halifax, N.S.
Extension to College, cost $45,000, Windsor street, for R. C. Corporation. Archbishop of Halifax, Rev. Dr. McCarthy, Dresden Row. Architect, H. E. Gates, Dennis Bldg., Granville St. General contractors, S. A. Marshall & Son, Keith Bldg. Plumbing, G. A. Perrier, 33 Granville St.

Kingston, Ont.
Church, cost $23,620, for First Baptist Church Congregation. Pastor, Rev. Douglas Laing, Johnson St. Architect, Arthur Ellis, King St. General contractor, J. M. Litton, 81 Frontenac St. Elec. wiring and fixtures, The H. W. Newman Elec. Co., 70 Princess St. Pews will be supplied by the Valley City Seating Co., Dundas, Ont.

Melville, Sask.
School, cost $20,000, for Melville School Dist. No. 2187. Secretary, A. B. Bargmann. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg, Regina. General contractor, carpentry, iron and steel and roofing, A. B. Cunningham. Heating and plumbing, J. Dawd, 2nd Ave. Painting and interior fittings not yet let. Four rooms, brick construction and foundation.

Montreal, Que.
Hall alterations, cost $5,500, Hutchison and Sherbrooke, for Royal Guardian Society, 227 Sherbrooke W. General contractor, W. M. Irving, Guy Block. 4 storeys, 50 x 70, felt and gravel roofing. Portion of front wall and side to be taken down and rebuilt. General repairs to be made.

Grenadier Guards Armoury, Esplanade planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, D. G. Loomis, St. Patrick St.

Oakville, Ont.
Addition to Sunday School for St. Jude's Anglican Church. Pastor, Rev. H. F. Woodcock. General contractor, A. F. Ford.

Preston, Ont.
Post office, cost $45,000, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor and carpenter, Geo. A. Proctor, Sarnia. Mason, Edward McDonald, Sarnia. Painting, Simpson & Carter, Sarnia. Heating and plumbing, Brown & Semple, Brockville. Three storeys, red pressed brick construction, galvanized iron, felt and gravel roofing. Foundations in.

Roseisle, Man.
School. Sec.-treas., W. D. B. Voyd. Architect, E. T. Tuttle, 701 McArthur Bldg., Winnipeg. General contractor, Fred Krauer, Roseisle or 334 Edmonton St., Winnipeg. One storey and basement frame construction, concrete foundation.

Toronto, Ont.
Alterations to building for theatre, 593-5 Yonge St., for Amalgamated Picture Shows Ltd., 603 Traders Bank Bldg. Architect, Neil G. Begg, Cosgrave Bldg. General contractor, A. H. Garrett, Peterkin Bldg.

Theatre, cost $6,000, Bathurst and Alcina. Owners and general contractors, Allen & Ryan, 654 Annette St. Architect, E. R. Conlan, 73 Glendale, will sublet. Two storeys, 28 x 108, steel and brick construction, stone foundation. Store fronts, heating.

Enlargement of school, cost $5,000, Parkdale. Mason and carpenter, Forbes Slater. Roofing, J. T. Flowers, 200 Markham St. Plastering, G. White, 688 Kingston Rd. Painting and glazing, Jas. Casey, 30 Dalhousie. Board of Education. Sec.-treas., W. C. Wilkinson, City Hall.

Winnipeg, Man.
Alterations and addition to club, cost $50,000, Broadway, for Adanac Club, Main St. S. Architects, Pratt & Ross, Electric Railway Chambers. General contractors, National Construction Co., 307 Donalda Bldg.

Addition to grain exchange, cost $500,000, Lombard St. for Traders Building Association, Grain Exchange Bldg. Architects, Jordon & Over, Canada Life Bldg. General contractors, Carter-Halls-Aldinger Co., Union Bank Bldg.

Business Buildings and Industial Plants

Beebe, Que.
Hotel contemplated by J. E. Perkins, Rock Island, Que. Plans will be prepared.

Calgary, Alta.
Laundry planned for Ontario Steam Laundry Co., 5th ave. and 2nd street. Proprietor, Christie Bros. Architect, D. S. McIlroy, 118a 8th Ave. W. Tenders will not be called immediately.

Chatham, Ont.
The Chatham Mfg. Co. has taken over business of the Chatham Malleable Iron & Steel Mfg. Co. and will build large addition to plant in near future.

Fenelon Falls, Ont.
Sash and door factory contemplated for Dyment & Mickle, lumber merchants. Plans will be prepared, also three or four workmen's houses.

Joliette, Que.
Bank bulding planned for Canadian Bank of Commerce. Further information from M. Durand, Joliette.

London, Ont.
Addition to factory, cost $20,000, contemplated for London Foundry Co. Manager, W. Grobb. Architect to be selected. Work may be started this fall. Machinery required for manufacturing churns, wheelbarrows, etc. Two storeys, white brick construction.

Magog, Ont.
Business block planned for Hamel & Leduc. Foundation, M. Thomas. General contract not awarded.

Montreal, Que.
Loft building, ten storeys, Alexander and Mayor, contemplated for Commerce Freehold Investment Company. Manager, S. A. Grant, 75 Bleury. Building to be built next summer when present leases expire.

Garage, cost $3,000, Belvedere Road, for F. C. Wilson, 46 Belvedere Rd. Tenders received by architects, Saxe & Archibald, 59 Beaver Hall Hill. Two stys., 25 x 35, concrete foundation, concrete & brick construction.

Ogena, Sask.
Hotel, cost $20,000, for Mr. West. 3-storeys, 100 x 90, frame construction. Plans ready.

Ormston, Que.
Milk factory for Borden Condensed Milk Co., Huntingdon, Que. Plans in progress.

Ottawa, Ont.
Printing Bureau building planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Government propose to tear down old building and replace it by larger building on another site.

Pitt Lake, B.C.
Rock crushing plant, cost $100,000 planned. The British Columbia Transport Co. are spending $100,000 improving and adding to its plant.

Sarnia, Ont.
Match factory, cost $30,000, for Sommers Bros., Saginaw, Mich. Plans will be prepared.

Factory, cost $150,000, Christina and Clifford, contemplated for Perfection Stove Co., c/o Cleveland Foundry Co., Cleveland, Ohio. Site purchased, ten acres, 3 buildings. By-law will be submitted.

Toronto, Ont.
Hotel and restaurant, 111-3 Bay St., contemplated for E. G. McConkey, 20 King. W. Board of License Commissioners will grant transfer of license. Work to start by December 1st.

Fertilizer, cost $15,000, Syme Road, planned for Gunns Ltd., Gunns Road, West Toronto. Tenders now open for galvanized iron fertilizer. Particulars from E. N. Brown.

Store and residence, cost $3,000, Lamb and Mt. Joy, planned for H. Rowe, 6 Ivy ave. Two storeys, 18 x 42, brick and steel construction, brick foundation, felt and gravel roofing.

Vancouver, B.C.
Warehouse, cost $7,000, for Royal

(Continued on page 73)

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Repairs to Eastern Pier at Newcastle, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 15. 1913**, for the Repairs to Eastern Pier at Newcastle, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmasters at Kingston, Ont., and Newcastle, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46374. 39-40

Sealed tenders addressed to the undersigned and endorsed "Tender for Examining Warehouse, Fort William, Ontario," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Mr. H. E. Matthews, Superintending Architect of the Dominion Public Buildings, in the Province of Manitoba, Winnipeg, Man.; W. P. Merrick, Esq., District Engineer, Fort William, Ont.; at the office of the City Clerk, Fort William, Ont.; and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47782. 39-40

Stratford's Water Commissioners Invite Separate Bids for the Supply of

(a) A 150 h.p. steel boiler to carry a 120 lbs. working pressure. The offer to be accompanied by full specifications and drawings showing the type, sizes, fittings, foundation and setting.

(b) Also, for a similar boiler capable of 150 lbs. working pressure.

(c) Also, for one high duty reciprocating steam pump, to deliver 1¼ million imperial gallons of water per 24 hours at 80 lbs. pressure. Preference will be given to a pump that could do this duty economically, and yhe when required for fighting fire, could get 120 lbs. water pressure. This offer to be accompanied by full specifications and drawings that show the foundation.

The Commissioners will be at the cost of putting in all foundations and steam pipes, but not of steam shut-off valves for each. All metal work must be put together by the contractor, and delivered here f.o.b.

Time for delivery—from acceptance of bid—six weeks.

Bids to be in on or before the 4th of October, 1913.

The lowest or any bid not necessarily acaccepte.

W. H. TRETHEWEY,
39-40 Sec.-Treas. Water Commissioners.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf Extension and Warehouse at Barcebridge, Ont.," will be received at this office until 4 p.m. on **Tuesday, October 21, 1913**, for the construction of a Wharf Extension and Warehouse at Bracebridge, District of Muskoka, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. H. Armstrong, Esq., District Engineer, Midland, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Bracebridge, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. Desrochers, secretary.
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47003. 39-40

Department of Militia and Defence

Kingston, Ont. – Rifle Range

Notice to Contractors

Sealed tenders, marked on the envelope "Tender for additions to Rifle Range, Kingston, Ont." and addressed to the Director of Contracts, Militia Headquarters, Ottawa, will be received until noon, 11th October, proximo, for the construction of an extension to the Rifle Range at Kingston, Ont.

Plans and specifications may be seen and full information obtained at the offices of the Officer Commanding the 3rd Divisional Area, Kingston, Ont., and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on forms supplied by the Department and each tender must be accompanied by an accepted cheque on a Canadian Chartered Bank for 10 per cent. of the amount of the tender, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into or if the Contractor fails to complete his contract in accordance with the tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET, Colonel
Deputy Minister.

Department of Militia and Defence,
Ottawa, September 18, 1913.

Newspapers will not be paid if they insert this advertisement without authority from the Department.
H.Q. 18-114-2.—48030. 40

Sealed tenders addressed to the undersigned, and endorsed "Tender for Examining Warehouse, Port Arthur, Ont.," will be received at this office until 4 p.m., on **Tuesday, October 14, 1913**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of the City Clerk, Port Arthur, Ont.; F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; H. E. Matthews, Esq., Superintending Architect of the Dominion Public Buildings, Winnipeg, Man.; Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47781. 39-40

Tenders for Cast Iron Pipe, Valves, and Special Castings

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on

TUESDAY, OCTOBER 21st, 1913,

for 20-inch CAST IRON PIPE, 36-inch CAST IRON PIPE, 36-inch and 20-inch STOP VALVES, and 36-inch and 20-inch CAST IRON SPECIAL CASTINGS.

Specifications and tender form for the foregoing may be obtained upon application at Room No. 9, Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the name of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
City Hall, Toronto, Sept. 24, 1913. 40

ARCHITECT

For an experienced, up-to-date architect, an excellent proposition is offered, by an established Consulting Engineering & Architectural Corporation, based on a co-operative plan, offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man who is thoroughly capable of handling an architectural department independently, both inside and outside work. Highest references and $1,500 investment required. Contract with salary, commission and interest in business guaranteed. Answer, "Architect," Contract Record, Toronto. 40

TO ARCHITECTS

Masonic Temple, Toronto

Competitive designs for the above will be received up to noon on the **20th day of January, 1914**. The conditions of competition have been prepared by a competent professional adviser who will also report upon the merits of the various designs. For copy of Conditions apply to Mr. W. H. Best, No. 181 Avenue Road, Toronto. 40-41

Debentures for Sale

$17,955.98. Town of Pembroke 4½ per cent. Bonds. Viz.:—

$8,500 for extension of waterworks system, maturing 20 years from September 6th, 1912, interest payable annually at Bank of Ottawa, here.

$5,000 for bonus to manufacturing industry, payable in 20 annual instalments from February, 1913.

$4,455.98 for local improvements, due in ten years from July, 1913, interest payable annually.

Offers for the purchase of above debentures, including accrued interest, addressed to W. H. Bromley, Esq., will be received up to October 15th. Delivery of Bonds at Bank of Ottawa here.

A. J. FORTIER,
Town Clerk.
40-41

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Business Buildings and Industrial Plants

(Continued from page 71)

Crown Soaps Ltd., 308 Harris. Plans ready.

Bank building, Pender and Main, contemplated for the Canadian Bank of Commerce. Have purchased site and plans will be prepared.

Winnipeg, Man.

Store, cost $2,800, for A. Dagdick, 79 Euclid. One storey, 33 x 45, brick construction, cement foundation. Plans ready.

Garage, cost $4,000, Wellington Cres., for H. W. Hutchison, Wellington Cres. Two storeys, 23 x 34, brick construction, cement foundation. Plans ready.

CONTRACTS AWARDED

Amherst, N.S.

Alterations to bank, cost $6,000, Victoria, for Canadian Bank of Commerce. Architect, J. L. Allen. General contractor, J. E. Lusby. Heating, J. L. Allen, Stone and brick front, metal cornices, vaults, bank fixtures.

Berlin, Ont.

Shoe factory for Gourlay & Co., Kaiser St. General contractors, Secord & Sons, Brantford. Foundations in.

Berlin, Ont.

Wholesale grocery warehouse for J. Sloan Co., Church St. Architect, C. Knechtel. Mason, J. Baetz, Mill St. Carpenter, G. Bucher. Work to start at once.

Brantford, Ont.

Factory core room, cost $8,000, So. Market St., for Massey Harris Co., Ltd., Manager, F. Grobb. General contractor, A. J. Cromar, 448 Colborne. Three storeys, 42 x 92, brick construction, concrete foundation, reinforced concrete roofing and floors, steel joists and rafters.

Calgary, Alta.

Office building for Imperial Oil Company, 401-2 Alta. Loan Bldg. District Manager, P. W. Gordon. Architect and general contractors, The Alliance Investment Co., 711 1st street west.

Edmonton, Alta.

Office building for E. S. McQuaid, 507 Stephen Ave. Architect, E. C. Hopkins, 32 Jasper ave. General contractors, Dunlop Johnson Construction Co., 205 Hart Bldg. Building to be completed by the spring. Excavating done.

Store and apartments, cost $6,000, 1st street. Owner and general contractor, R. J. Dykes, 1st and Clara. Architect, J. Grant. Frame construction. Foundations in.

Warehouse, cost $70,000, 8th St. and Peace Ave., for Nicholson & Bain, 656 3rd street. General contractors, Fyshe, McNeil, Martin & Trainer, Dominion Bank Bldg., Calgary. 50 x 134, concrete, pressed brick and mill construction.

Livery stable, cost $4,000, Queens. Architect and general contractor, L. J. Auten, 838 Government St. Two storeys, 33 x 110, frame and brick veneer construction. Foundations in.

Edgeley, Sask.

Barn, cost $9,000, for Mrs. A. K. Larsen. General contractor, J. Inglis, 1305 Montague St., Regina. 94 x 118, electric lighting.

Store, cost $3,000, Alberta ave. Architect and general contractor, W. J. Ross, 2040 Charles St. Two storeys, 26 x 50, frame construction. Foundations in.

Store and apartments, cost $23,000, 24th

St., for C. A. Law, 112 C. P. R. Bldg. Architects, Barnes & Gibbs, Imperial Bank Bldg. General contractors, Read, McDonald & Brewster, Tegler Block. Three storeys, 50 x 50, brick and stone construction, concrete foundation. Excavating started.

Fort William, Ont.
Warehouse, Donald St., for A. McDonald Co. Architect, W. A. Irish, 219 Kennedy Bldg., Winnipeg. General contractor and painting, G. H. Archibald & Co., Union Bank Bldg., Winnipeg. Cut stone, John Ross, Fort William. Metal forms for foundations, Concrete Forms Company, 212 Carlton Bldg., Winnipeg. Steel work, Manitoba Bridge & Iron Works Ltd., Logan Ave. W., Winnipeg. Roofing, Wells & Dibblin. Metal doors, etc., W. T. Grose, 905 Electric Railway Chambers, Winnipeg. Mill work, Geo. A. Matthews Sash & Door Co.

Halifax, N.S.
Stable, cost $30,000, Albermarle, for Moir's Ltd., Argyle St. Builder, Anglin's Ltd., 65 Victoria St., Montreal and Woodside, Halifax Co., N.S. Engineer, Mr. Morriscey, Woodside. General contractor, masonry and carpentry, builders. Two storeys, 125 x 60, cement foundation, reinforced concrete construction, Excavating done.

Hamilton, Ont.
Alterations to bank, cost $7,000, King St. E., for Metropolitan Bank, 74 James St. N. Architects, Watt & Blackwell, Lister Chambers. General contractor, R. Campbell, 117 Duke St. Brick construction, slate and tile roofing.

Three factory buildings for Grasseli Chemical Co., Ottawa St. General contractor, F. Kruse, c/o company. Frame construction, brick and concrete floors, tar and gravel roofing.

Addition to foundry, cost $5,000, for Sawyer-Massey Co., Wellington St. N. General contractor, Geo. E. Mills, 614 King St. E. Brick, concrete and iron construction, felt and gravel roofing.

Store, cost $5,000, King St., for B. H. Webster, Wentworth & King Sts. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. General contractor, Stanley Kerr, 408 Garth St. One storey, 24 x 80, pressed brick construction.

Stores and apartments, cost $10,000, for T. W. Hand, 584 King St. W. Architects, J. A. Armes & Walter Scott, Federal Life Bldg. Mason, W. Inrig, 140 Flatt Ave. Carpentry, W. Whittaker, 17 William St.

Stores and hall, cost $25,000, Main St. E., for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Mason, Geo. E. Mills, 614 King St. E. Carpentry, J. Evans, 237 Hunter W.

Two stores and apartments (alterations) cost $4,000, for Lees, Hobson & Stephens, Bank of Hamilton. Builder, R. G. Wilson, 4 Rutherford ave. Three storeys, store fronts and fixtures.

Lake Megantic, Que.
Broom factory for P. Cliche. General contractor and mason, D. J. Bonin. Carpentry, Ely Dion. Stone foundation, red brick construction. Excavating done.

Medicine Hat, Alta.
Extension to mill, cost $2,500. Architects and general contractors, Alberta Rolling Mills, Pacific Ave. 1½ storey, 40 x 45, structural steel and iron construction. Foundations in.

Montreal, Que.
Stables, cost $10,000, for Toilet Laundry, 423 Richmond St. Architects, Hutchison, Wood & Miller, 50 Royal Insurance Bldg. General contractor, A. F. Byers, 340 University. Tenders will be called about Oct. 15th for roofing.

Office repairs, cost $6,000, 231 St. James, for American Express Co., McGill St. Architect, H. Harwood, c/o Freeman's Hotel. General contractor, Geo. Roberts, 79 Lagauchetiere. Required, quartered oak, oxidized and ord. brass.

Office building for Sun Life Assurance Co., 142 Notre Dame W. Architects, Darling & Pearson, 2 Leader Lane, Toronto. Excavation and foundation, Jno. Quinlan & Co., 4412 St. Catherine.

Stove foundry, cost $60,000, St. Laurent, for Can. Stove and Furniture Co., Ltd., Delorimier ave. Architect, W. A. Mahoney, Guelph, Ont. General contractor, Jas. Shearer Co., 225 St. Patrick. Heating and plumbing tenders received by owners.

Factory addition, cost $5,000, for Frisco Soda Water Co., 1514 Clarke St. Builders, owners. Addition of second storey, 40 x 100, frame and brick construction.

Warehouse, cost $10,000, for Canada Sugar Refining Co., 150 Montmorency. General contractors, Jas. Shearer & Co., 225 St. Patrick. Pile driving, W. A. Wood, 246 Pine W. One storey, 50 x 100, concrete foundation, brick construction, felt and gravel roofing.

Ottawa, Ont.
Stables and garage, cost $10,000, St. Andrew, for A. E. Rae Co., Ltd., Rideau St. Architects, Ross & MacDonald, 1 Belmont St., Montreal, Que. General contractors, Doran & Delvin, Rae Bldg., Ottawa. Solid brick construction, stone and concrete foundation.

Rouleau, Sask.
Business block, cost $5,000, for W. F. Krauss, Main St. General contractor, E. E. Poole, Railway ave. 2½ storeys, brick construction, concrete foundation.

Regina, Sask.
Boot and shoe warehouse, cost $45,850, for W. G. Downing Shoe Co. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. General contractor, Thos. Barnard, 211 Westman Chambers. Foundations in.

St. John, N.B.
Warehouse, cost $15,000, Union, for M. E. Agar, Commr. Public Works, City Hall. Work being done by day labor. Foundations in.

Bank building, Main, for Royal Bank of Canada. Manager, J. B. Blair, King St. Architect, K. G. Rae, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Granite and freestone work, British American Construction Co., Prince William St.

Sydney, N.S.
Warehouse and office, cost $7,000, for Chappell Bros. & Co., Ltd., Brooklyn St. General contractors, masonry, carpentry and interior fittings, owners. Painting, heating, plumbing and electric not awarded. Three storeys, 45 x 40. Foundations in.

South Edmonton, Alta.
Stores, cost $10,000. General contractors and architects, Canadian West Commercial Co., 24 1st street. Two storeys, 33 x 80, brick construction, concrete foundation. Excavating done.

Ste. Anne De La Pocatiere, Que.
Stables for Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractor, Fortin Freres & Mercier, St. Henri, Levis Co. Stables at Experimental Farm.

Toronto, Ont.
Four attached stores and residences, cost $12,000, Bathurst and Alcina. Owners and general contractors, Allen & Ryan, 73 Glendale ave. Architect, E. R. Conlan, 73 Glendale. Two storeys, 72 x 54, steel and brick construction, stone foundation, felt and gravel roofing. Excavating started.

Bank, cost $7,000, Parliament and Gerrard, for Merchants Bank of Canada, Wellington St. W. Architect, C. J. Gibson, 53 Yonge St. Mason, J. W. Gratton, 488 Clinton St. Two storeys, 26 x 42, brick and steel construction, brick foundation.

Warehouse, Hagerman. Owner and general contractor, M. Sigal, 83 Elizabeth St. Architect, H. S. Kaplan, 41 Wolesley St. Owner buys material, work

BOILERS

of all kinds

"Inglis" Boilers with proper care will
last a life time.

Write us for prices, Photos, &c.

Canadian Manufacturers of Erie City Water Tube Boilers.

The John Inglis Company

Limited

Engineers and Boilermakers

14 Strachan Avenue - Toronto, Canada

x 51, white brick construction, concrete foundation. Plans drawn.

Montreal, Que.
Residence, cost $10,000, Dorval Island. Tenders received by architects, Blanchard & Conrad, 3 Beaver Hall Sq., Montreal. Specifications not ready yet. Stone foundation, frame construction. Probably private electric motor run by gasoline engine will be used for electric lighting.

Ottawa, Ont.
Residence, cost $10,000, Main, for A. Chapentier, 141 Main St. Brick veneer construction, stone and concrete foundation. Plans in progress.

Residence, cost $4,500, Anderson, for Harry Cheetham, 73 Anderson St. Two storeys, brick veneer construction, stone foundation. Plans in progress.

Toronto, Ont.
One detached residence, cost $6,500, for Alex. Hunter, Alexandra Blvd. 2½ stys. 26 x 32, brick construction, stone foundation. Plans ready.

Vancouver, B.C.
Residence, cost $75,000, Shaughnessy Heights, for A. E. Tulk, Canada Life Bldg. Architects, Maclure & Fox, Pacific Bldg. 2½ storeys and basement, brick and stone construction, steel casements. Permit issued.

Residence, cost $30,000, for H. Bingham, 2063 Grant. Architect, G. B. Kauffman, Davis Chambers. Hollow tile, frame and stucco construction. Tenders called.

Wininpeg, Man.
Two residences, cost $10,000, Ethelbert, for L. J. Hall, 98 Sherbrooke. 2½ storeys, 27 x 33, brick construction, stone foundation. Plans ready.

CONTRACTS AWARDED

Davidson, Sask.
Residence, cost $5,000. Owner and general contractor, R. A. Norris, Garfield St. 2½ storeys, brick and frame construction, brick foundation. Excavating done.

Edmonton, Alta.
Residence, cost $5,000, for Dr. W. A. Wilson, 640 13th. General contractor, J. Hay, 152 Henry St. Two storeys, 30 x 32, frame and brick construction, concrete foundation. Excavating done.

Residence, cost $17,500, Riverside Drive. Architect and general contractor, Mrs. L. Frederick, Capital Hill. 1½ storeys, 32 x 52, frame construction, concrete foundation. Excavating done.

Apartments, cost $20,000, 12 street, for Miss L. Grice. Architect and general contractor, S. H. Muttart, Muttart Block. Two storeys, 44 x 85, frame construction, brick foundation, felt and gravel roofing. Excavating done.

Hamilton, Ont.
Residence, cost $5,000, Westmoreland, for H. F. Blain, Sherman ave. Architect, F. W. Warren, Room 808, Bank of Hamilton Bldg. Mason, J. C. Zimmerman, Burlington. Carpentry, R. C. Jones, Maple ave. Two storeys and basement, 40 x 26, pressed brick construction.

Montreal, Que.
Flats, cost $30,000, Verdun (1st ave.) Architect, builder and general contractor, J. A. Leclair, 276 Church Ave. Work to start about Oct. 1st. Owner wil lsub-let some trades. Three storeys, 150 x 40, brick construction, concrete foundation.

Flats, cost $5,000, Orleans. Owner and general contractor, Jos. Parenteau, 3527 De Souligny, Parc Terminal. Three storeys, 22½ x 40, concrete foundation.

Apartment house, cost $20,000, St. Luke. Architect and general contractor, Z. St. Pierre, 101 Chomedy Apt. 3. Three storeys, 37 x 42, concrete foundation, solid pressed brick construction. Excavating done.

Eight flats, cost $10,000, Maisonneuve, (Girard). Owner and general contractor, W. Pitre, 113 Bourbonniere. Three storeys, 45 x 55, concrete foundation, brick construction. Excavating done.

Three flats, cost $7,500, Maisonneuve (14th ave.). Owner and general contractor, E. Varin, 282 2nd ave. Three stys., 27 x 50, concrete foundation, felt and gravel roofing. Permit granted.

Six flats, cost $10,000, Orleans. Owner and general contractors, O. Borduas & P. Richard, 1197 Boyer St. and 151 Stadacona. Three storeys, 45 x 43, concrete foundation, brick construction, felt and gravel roofing.

Ottawa, Ont.
Residence, cost $5,500, Hastey ave., for Geo. E. Preston, 280 Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, R. W. Hamilton, 81 Echo Drive. Double brick veneer construction, stone foundation.

Residence, cost $6,000, Nelson St. Owner and general contractor, Walter J. Martin, 392 Nelson St. 2½ storeys, 36 x 46, double brick veneer construction, stone foundation. Excavating done.

Residence, cost $8,000, for Col. Sherwood, Daly Ave. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Edward. Painting, Geo. Higman & Son, 176 Rideau. Heating and plumbing, McKinley & Northwood, Rideau St. Electric, J. A. Ellacott, Bank St. Plastering not awarded.

Troonto, Ont.
Two pair residences, cost $10,000, Logan ave. Owner and general contractor, W. W. Hiltz, 682 Broadview ave. Owner sublets. 2½ storeys, 38 x 44, brick construction, stone foundation.

One pair residences, cost $5,000, St. Clair. Owner and general contractor, W. Pennock, 5 Burlington Cres. 2½ storeys, 36 x 42, brick construction, stone foundation.

Two detached residences, cost $6,000. Owner and builder, J. Richards, 75 Pleasant Blvd. 2 ½storeys, 20 x 42, brick construction, stone foundation. Excavating done.

Eight pair residences, cost $32,000, Beresford. Owners and general contractors, S. Solodinsky, 2122 Dundas street. Tenders received by owner for plumbing and wiring at once. Two storeys, 23 x 42, pair, brick construction, stone foundation.

Power Plants, Electricity and Telephones

Fenwick, Ont.
Electric lighting planned for Pelham Twp. Clerk, A. N. Armbrust, Ridgeville. To be lighted by Welland Electric Light Co.

Winnipeg, Man.
Motors and electrical apparatus, cost $26,500, Transcona, for Grand Trunk Pacific Railway. General contractors, Canadian Crocker Wheeler Co., St. Catharines, Ont. Apparatus for company's car shops.

Miscellaneous

Winnipeg, Man.
Lumber. Tenders received by Board of Control till Oct. 2, 1913, for 1,000,000 ft. B.M. lumber. Specifications at office of Engineer, H. N. Ruttan, 223 James Ave.

Business Notes

Amherstburg, Ont.
Ice house and sheds of Lake Erie Fish Co., Malden St., totally destroyed. Loss $10,000, partly covered by insurance.

Assiniboia, Sask.
Club cafe owned by J. MacDonald burned. Loss $6,500.

Brooks, Alta.
Cold storage warehouse owned by Pacific Cold Storage Co. destroyed by fire. Loss $7,500.

Durham, Ont.
Two stores owned by McFarlane & Co. burned. Occupants, McFarlane & Co., drug store; Black's hardware store. Total loss about $25,000; insurance $12,000.

Milestone, Sask.
Elevators of International Elevator Co. & C. K. Wilson burned, loss $11,000.

Roblin, Ont.
Stores and residences burned. Owners, John Hughes and R. E. Thompson. Several smaller buildings also destroyed. Loss $15,000, insurance $5,000.

Tavistock, Ont.
Presbytery of R. C. Church Congregation burned. Priest, Rev. Father Cantillon, Pickering. Loss $3,500; insurance $1,200.

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock	net$1.85
No. 4½ Fuller's	net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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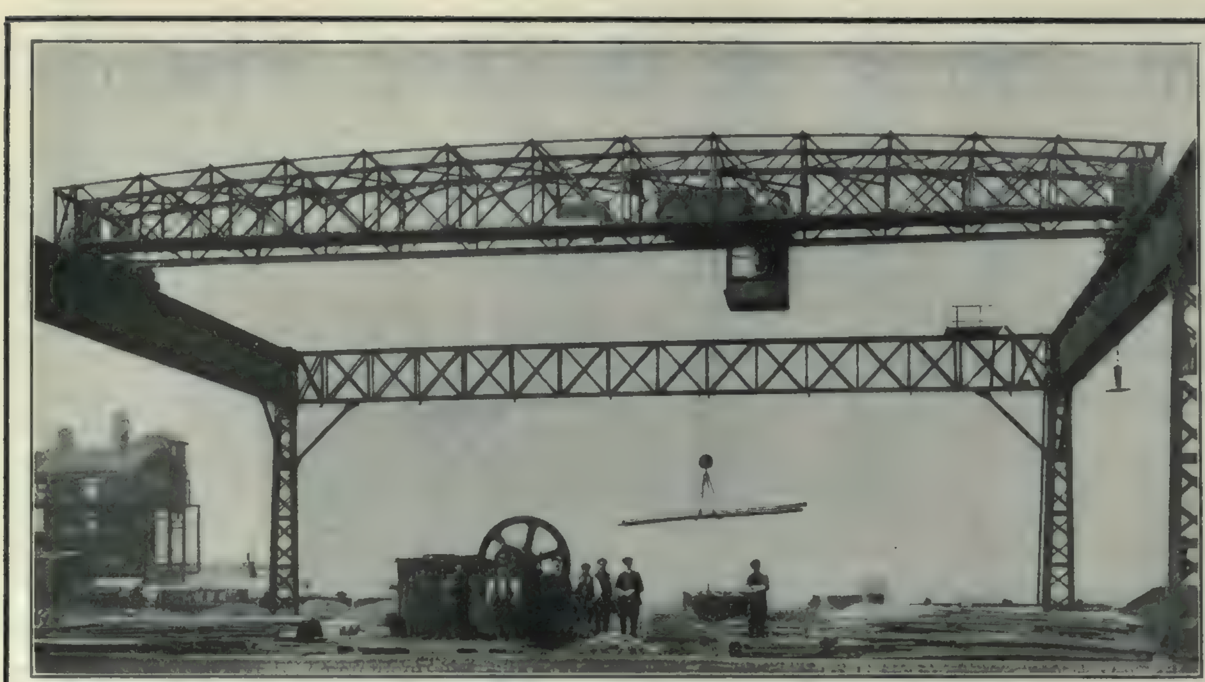

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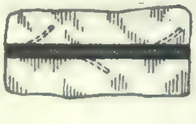
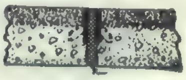
Our booklet on concrete pavements illustrates and describes pavements in many different cities, giving cost data and describing in detail the methods used. Complete specifications for the ideal concrete pavements are included as well as instructions for installing Baker plates. This booklet is sent without charge to responsible engineers contractors and highway officials.



Longitudinal Section Showing Joint.



Cross-Section of Pavement Showing Expansion Joint.

Wayne County's 70 Miles of Concrete Roads Prove that the Baker Plate Has Solved the Expansion Joint Problem.

"The only surface repair required on our concrete roads has been on the roads first constructed, where the joints were not protected with the 'armor' plates."

Extract from Sixth Annual Report of the Board of Country Road Commissioners, of Wayne County, Mich., Sept. 30th, 1912.

Our new system of installing Baker Armor Plates is simplicity itself, and holds the joint to perfect line and grade.

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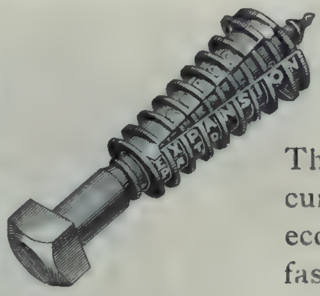

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ESTABLISHED 1886

Contract Record and Engineering Review

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Alphabetical Index of Advertisers
Page 16

Vol. 27 October 8, 1913 No. 41

The Status of the Engineer

THE part of the engineer in the public health movement was outlined in an interesting paper submitted recently to the Canadian Public Health Association by Mr. J. Antonisen, Superintendent of the Brandon Street Railway. While giving due credit to the medical men for their achievements, Mr. Antonisen showed that the civil engineer had it in his power to make or mar the whole question of public health.

It is the engineers who are the real doctors of the community. Their responsibilities in connection with water supply, sewerage and the disposal of refuse are paramount. Mr. Antonisen's paper constituted a plea for the better recognition of the municipal engineer and for his more adequate remuneration.

We are reminded of the procedure in appointing an engineer in the average town and city, particularly in the west. When a vacancy occurs, a number of candidates are obtained, either by advertisement or application, and finally an appointment is made—at a bare living salary—and the fortunate candidate is expected to have—or to assume—an expert knowledge of all branches of civil engineering and to shoulder cheerfully the responsibilities of public health and safety. Also he must show an all-round knowledge of design and construction or fall into disrepute. He must be able to converse freely about waterworks and sewerage systems, sidewalks and streets, bridges, sewage disposal plants, refuse destructors, reservoirs, water towers, and all the rest of the olla podrida of municipal construction.

As long as the town is small, it is content to pump the water from a river or lake, using it without any kind of treatment. It is considered all right to discharge raw sewage into the creek, or river, or lake, as long as the waterworks intake pipe is up-stream and the sewer outlet down-stream—or in the case of a lake supply, a couple of miles apart. But when the death rate rises up to uncomfortable figures, then the first question asked is: have we got a pure water supply? The overworked busy city engineer has worried over this question in idle moments, between midnight and sunrise generally, and has perhaps formed an opinion of what steps should be taken to safeguard against contaminating an existing pure supply or procure a better supply than one already contaminated.

The larger problems of municipal engineering life are outside the pale of the duties of the city engineer and the council should be brought to see the wisdom of employing a consulting engineer. The average city engineer cannot be regarded as an expert in the true sense of the word. The very demands of his position make him a jack-of-all-trades. Municipal engineers are ill-advised to tamper with such problems as the treatment of sewage. To treat sewage in such a way as to render it harmless is one of the greatest engineering problems of the day and a plant designed upon wrong principles is worse than none at all.

A point which received special emphasis at the hands of Mr. Antonisen was the importance of the subject of city planning in the education of the municipal engineer. Last year the city of Moose Jaw sent Mr. Antonisen, then city engineer, as a delegate to the Winnipeg city planning convention and he was practically the only official of his kind in attendance. Certainly this branch of engineering should receive careful consideration in a country which is developing so rapidly as Canada, and whose rapid development in itself affords a field for expert specialization. Generally the town engineer has to pass all the sub-division plans and in a few years his mistakes may be difficult to rectify except at enormous cost.

The tenor of the whole is co-operation. If city councils, health authorities and others were to substitute a measure of co-operation for much of their criticism, far greater efficiency would be obtained from our engineers. And the co-operation should extend into the financial side. Less grudging assent should be given to the employment of consultants on special work. There is enough work of a purely executive character for the engineer in the rising Canadian municipality, without saddling him with responsibilities which are altogether disproportionate to the salary he is earning.

Good Roads to the Fore

The Ontario Provincial Highway Department is prepared to keep the educational value of their work before the public. A movement has been started to utilize the assemblies of people at the annual fall fairs of the province, to show what is being done to their highways, the demands of individual constituencies and the more scientific methods of coping with them. This new venture was tried out first by means of an exhibit at the Windsor Exhibition just closed. Here an unusually large and instructive display of model roadways was prepared under the authority of the government and set up for the public enlightenment. The idea contained did not refer to the planning of the new highways commission, but served as a demonstration of the county system now under way.

Principles versus Practice in the Teaching of Engineering

THE increasing influence of the specialist in modern professional life is being felt in institutions of higher engineering education to a degree which warrants a note of warning against a possible neglect of fundamental principles in the intense pursuit of current practice which is found in so many classrooms as the natural result of employing the so-called laboratory method in up-to-date instruction. Interest in concrete problems and apparatus naturally is felt by the student of engineering. The majority of undergraduates prefer to be taken through a large plant on an inspection trip or to be allowed to perform minor tasks in connection with some test or construction work of commercial value than to "bone down" to principles and mathematics bearing upon the theoretical side of present-day practice. Abstract problems appeal only to the minority in every walk of life. Just as the present civilization cannot be correctly interpreted without a reasonable knowledge of the past, so must the most enduring progress in the engineering profession rise from the great fundamental principles which are virtually fixed in comparison with the ephemeral practice of the moment. Little danger exists that practice will be ignored in schools responsive to the spirit of the laboratory, but there is some doubt whether the fascination of studying the latest vogue in different engineering specialties may not at times obscure to both teachers and students the profound importance of fundamentals.

Experimentation without thorough grounding in principles may uncover valuable finds now and then, but it will not further the most efficient work. The limitations of current practice are very much greater than most people realize, and many a young engineer has learned this to his sorrow when he has tried to meet new conditions with handbook formulae of restricted scope. It has often happened that results of enduring value have come about through the work of so-called theorists upon empirical data and designs which alone have failed to solve the problem in hand—and which probably never would have solved it without the help of the expert in principles. This point was illustrated by Dr. James Douglas in his commencement address last spring before the Colorado School of Mines, upon the "Larger Importance of Principles than Practice in Technical Education." He showed that the effect of the injection of air into molten metal was perfectly understood before Bessemer brought mechanical ingenuity as well as chemical science to bear upon the solution of the pneumatic method. The practicability of extracting the carbon to the exact point at which pig iron is converted into steel proved to be so difficult that the Bessemer process would probably have had a limited range of usefulness had not the suggestion of another chemist been adopted—to oxidize all the carbon, then readd to the charge the specific amount of carbon to recarbonize the iron, while the manganese absorbed any dissolved oxide of iron. The whole success of this momentous improvement, which was no discovery at all, depended upon the application of known facts to meet certain practical conditions.

Insufficient knowledge of principles spells disaster for the engineer who attempts to rely upon current practice alone in contributing to the real advancement of the industry. In the electrical field, new methods and applications are coming so rapidly into use that the practitioner without a deep-rooted understanding of the laws which underly it finds himself hard put to keep in sight of the "tail-end" of progress; he loses time in grasping the significance of specific developments and undertakes original and responsible work at no small risk to his reputation. Without a knowledge of stresses and strains, he designs a steel tower transmission line at his peril; without keen comprehension of the phenomena of inductance he locates and spaces conductors with the chance that the resulting voltage drop will be perhaps 30 per cent. greater than is warranted; and without an understanding of all the complex electrical considerations influencing the power-factor and the load-factor, he copies his neighbor's practice at the risk of financial ruin. All the construction drawings of concrete reinforcement that can be crammed into a single desk after being brought home from other jobs are of little value if the designer confronted with a new set of conditions is weak on figuring his own stresses. In the field of power-plant design the engineering executive whose word is final in the selection of machinery may not be familiar with all the latest practical appliances for corralling the elusive heat unit between the furnace and the feed-water heater, but he must possess a knowledge of the fundamental laws of steam engineering.

This side of the subject of professional education is apt to be overlooked by the young fellow whose enthusiasm is rightly stimulated by frequent observation of the triumphs of the men in the field, but he will realize it soon enough if he associates with less well-grounded workers after graduation. It is surprising how flexibly one can meet new demands year after year, given sound and extensive preliminary training in main principles, supplemented by constant hard work in their varied application. There is no need to discuss here the relative benefits of class-room and laboratory instruction or the comparative value of machine design and machine testing; for all these phases of education have their place in a well-planned curriculum. But in the last analysis, manual skill belongs to the artisan rather than to the engineer, and a knowledge of principles is of more value to the latter than familiarity with engineering equipment. Even the engineer's acceptance of principles, outside of mathematics, should be held as open to modification, but in the main the fundamental laws of physics and chemistry should be appreciated in all their inclusiveness as the primary working tools of the profession, and as such should receive the first consideration of instructors, whose lives are largely devoted to sending properly qualified recruits into the ranks of modern industry.—Engineering Record.

Temporary wing dams made of refuse piling and cheap lumber will be constructed to check the erosion taking place on the shore of Limon Bay, immediately to the west of the west channel of the Panama Canal.

A considerable section of the shore at this point, according to the "Canal Record," has been worn away, and erosion will probably continue unless preventive measures are taken. As it is not definitely known whether the adopted method will check the wave action sufficiently to warrant the construction of permanent dams, these temporary structures, expected to hold together for at least a year, will now be erected at a cost of about $2,000. During that period opportunity will be afforded for studying their effect on the shore line, to determine whether permanent structures will be suited.

Suggestions for City Engineers

SUGGESTIONS for the development of a typical city with regard to buildings, sewers, waterworks, pavements and electrical distribution formed the basis of a paper by Col. H. N. Ruttan, city engineer of Winnipeg, presented before the recent meeting of the League of American Municipalities. The following notes embody some of Colonel Ruttan's recommendations:

Limits for building should be fixed within which only fireproof materials should be used. As the difference in cost between fireproof material and wood is rapidly lessening, the fireproof limits should be ample, including, in addition to business areas, all first and second-class residence districts. All schoolhouses should be fireproof and long, crowded lines of wooden residences should not be tolerated.

Inasmuch as present facilities for passenger traffic have eliminated the necessity for extremely congested centers and high buildings, laws should be enacted to limit the height of buildings and the distances from the street lines. A simple method is to determine the vertical angle at the center of the street beyond which no structure shall project. In residence districts this angle should be sufficiently flat to prevent injury to ordinary dwellings by the erection of massive apartments or tenements.

In computing sewer sizes for growing cities full allowance should be made for an extended paved area, as it is much better that the sewers prove too large than too small. Manholes on pipe sewers should seldom be more than 250 ft. apart. On large sewers which can be traversed by men this distance may be increased to 400 or 500 ft.

Flush tanks should be placed at the heads or dead ends of all sewer branches. An automatic type which has quick-flushing capacity and which can be readily turned on and off is recommended in order that the intensity of the flushing may be regulated to suit the requirement of different parts of the sewer system.

Connecting Y branches on both sides of the sewer at intervals of 25 ft. in congested districts will be found to offer all necessary facilities without the necessity of installing new junctions.

A universal meter system is the only sure and economical means of waste prevention. In order to insure the use of sufficient water for sanitary purposes, a flat rate should be charged the consumers for what is determined upon as a sufficient quantity for each size of house, and the meters used to determine excess, which should be charged for at a substantially higher figure than the flat rate.

Business and residence districts differ in requirements for pavements. Business streets should be paved full width between the sidewalks and should be capable of carrying loads of 5 tons per wheel. On residence streets full traffic facilities will be afforded by pavements 24 ft. in width, capable of carrying 5 tons on a four-wheeled truck, or a 10-ton road roller. Pavements can be so arranged that under growing traffic they may be readily widened and increased in thickness without harm. Where it is necessary to haul heavy loads through residence districts a heavy traffic road can generally be arranged so that the heavy traffic can be kept off the light roadways. On residence streets the most pleasing arrangement of street improvement is that where the pavement in the center is flanked by two broad grass plots, with the sidewalks on the property lines.

The curbs on street-crossing corners should have radii of at least 15 ft. Broad curves are more pleasing and offer much less obstruction to vehicular traffic than sharp corners.

At sidewalk crossings the pavements should be kept near the walk level; 6 in. or less should be the maximum height of steps. This necessitates the placing of the sewer catch-basins in the center of the blocks, not at the intersections.

The system under which the grass and trees on the streets are kept in order by a public department is much to be preferred to any plan which involves the property owners as caretakers.

To avoid crowding and danger it is suggested that in business districts an additional sidewalk at the level of the first story of the buildings be constructed. The protection of the lower sidewalk from sun and weather, the added value for business purposes of the floor at the level of the new walk, and the enhancement of the uniformity and beauty of the streets are also suggested as advantages.

Communication between the two decks would be by stairways or elevators at convenient points and through the business premises fronting on them. Access to buildings at different levels would be by steps or inclines. Protected by a substantial railing on the street side, the upper deck would be an ideal promenade.

While underground electrical distribution is desirable, care should be taken not to extend conduit system beyond points where the revenue is sufficient to meet the extra cost of this system of distribution. It is estimated that only one-tenth to one-fifth of the distribution area will stand the cost of conduits.

An ideal system in large cities would be to carry the sewers, water and gas mains, electric cables, etc., in large conduits occupying the spaces under the sidewalk. Not only would they be accessible, but this system would put a stop to the cutting up of the street surfaces in making connections and in similar work.

Handling proportional concrete in wagon loads has been found economical in some instances. The cement, sand and stone are placed in a dump wagon in the proper proportions, hauled to the mixer and the horse unhitched. A locomotive crane lifts the wagon to a point directly over the mixer, when the wagon is dumped.

Puntledge Hydro-Electric Power Plant

An Ultimate Development of 19,000 h.p. which will Supersede Separate Steam Plants Used for the Operation of Coal Mines at Vancouver Island

CANADIAN Collieries (Dunsmuir), Limited, owns and operates a group of coal mines in the vicinity of Union Bay, Vancouver Island, B.C. The power for the operation of these coal mines has been generated heretofore by separate steam plants located at the various mines. About three years ago the problem of renovating and expanding some of these steam plants presented itself for solution.

General estimates were made of the capital cost of such improvements and also of a central steam-electric power station with a distribution system to the respective mines. At the same time surveys were made to determine the cost of hydro-electric power for the same purpose. Comparative estimates showed that with coal possessing a calorific value of 14,000 B.t.u. at $2.50 per ton delivered at the power station the cost of installation and operation was greatly in favor of the hydro-electric development, which method was accordingly adopted, resulting in the construction of a hydro-electric plant on the Puntledge River from specifications and detail designs prepared by the firm of H. K. Owens-A. V. Bouillon, civil and mechanical engineers, of Seattle.

General Layout of Plant

This river is the outlet of a lake of the same name with an area of approximately 9 sq. miles and a low water surface elevation of 420 ft. above sea level, its outlet being about 8 miles from tidewater. Puntledge River has an observed flow ranging between 330 and 3,500 sec.-ft. and by building an impounding dam at the outlet of the lake to raise the water 23 ft. and cutting the bottom of the outlet to a depth of 5 ft. below low water an available storage capacity of 23 ft. of depth is obtained, which is equivalent to about 132,000 acre-ft. Considering with this the regimen of the river as recorded during the short period of observed flow, it is estimated that a constant flow of at least 800 sec.-ft. can be maintained for use in the development of power. The rated capacity of the ultimate plant will be about 19,000 h.p. at the turbine shaft. This being in excess of the requirements for the owner's own industries, the spare power is intended to supply other industries either established or contemplated in that vicinity.

From the impounding dam the water flows in the natural bed of the river to an intake reservoir formed in the bed of the river by a diversion dam about 2½ miles below the lake. This dam consists of a spillway and an intake with head gates, which divert the water for power development into a canal and flume line 3,400 ft. long, the latter discharging into a forebay forming the intake of the penstock system.

From the forebay the water is carried in a wood stave pipe 8 ft. in diameter and 5,380 ft. long to a Y structure with two outlets for pipes 6 ft. in diameter fitted with gate valves. Only one-half of the ultimate penstock system is now built from this Y to the power house, and the next section of the present system consists of one line of 6 ft. stave pipe, which is to be duplicated at some future time. This pipe is 4,500 ft. long and leads to a junction structure having inlets for the two 6-ft. pipes and outlets for four 50-in. penstocks, the interior of the structure forming a chamber common to all connected pipes. Gate valves are installed here at both the inlets and the outlets. There are to be four penstocks in the completed system, but only two are constructed for present purposes. These 50-in. pipes are built of wood staves and steel bands for a distance of 3,170 ft.; for the remaining distance of 660 ft. to the power house the pipes are built of steel. Only one-half of the projected generating machinery has been installed, consisting of two reaction-type turbines with horizontal shafts direct-connected to generators of the alternating-current, revolving-field, twenty-five-cycle, three-phase type.

The plant differs but little in general outline from the usual scheme of any similar hydro-electric development, but in detail there are some features which are of unusual design.

Impounding Dam

The impounding dam is approximately 300 ft. long, with a crest elevation of 445 ft. and a gate sill elevation of 416 ft. The gateways in this dam, together with spillways aggregating 100 ft. long, give a capacity of flood discharge of 10,000 sec.-ft., which is in excess of the highest recorded outflow from the watershed. In general type the structure is a buttressed wall of concrete partly reinforced. A special feature of the dam is a log sluice required by the Government regulations. This was accomplished by omitting the wall in one of the panels and substituting stoplogs laid one over the other and readily removable one at a time to obtain the necessary depth for the passage of logs at any stage of water elevation. The storage of water and its flow over the spillways are controlled by wooden needles closing the spillway wickets, and are so made and installed as to be readily removed in time of flood. These needles are made of 3 x 4 in. lumber, 12 ft. long, dressed to 2⅝ x 3⅝ in. and fitted with forged ends for protection and handling.

There are six gateways, each 5 x 6 ft., controlled by steel gates of the butterfly type with vertical axes. The gates are stepped in bearings, set in the sill and the spindle extends to the gallery at the top of dam and through a cast-iron pedestal frame which carries the weight of the gate and spindle and a worm-operating gear fitted with double hand cranks. The gates fit loosely into the sluiceways, as there is no intention to obtain water-tightness, and their vertical position is adjustable at the overhead thrust bearing.

The dam is built on solid rock. The concrete is composed of ordinary aggregates in the proportion of 1 Portland cement, 2½ sand and 5 gravel, with approximately 10 per cent. of hydrated lime added to the cement as a neutral filler to obtain watertightness. To insure against uplift of the structure from pressure in horizontal seams, which might exist in the underlying rock, a number of weep holes were drilled in the rock and were fitted with pipes leading up and out to the downstream face of the dam.

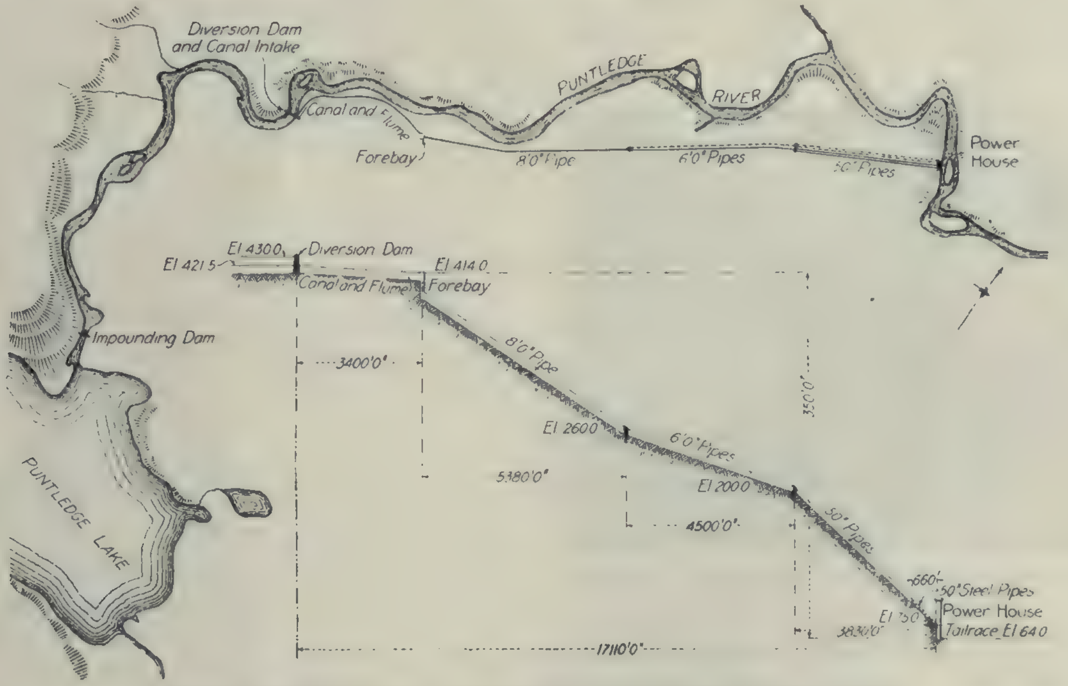
Diversion Dam

The diversion dam is also of concrete, partly reinforced at the intake end. The spillway is 100 ft. long.

As the Government regulations required a fish ladder, one was built in one of the concrete abutments so as to be protected from damage in time of flood. There are two 6 x 7 ft. gateways in this dam. The gates are of steel plates rivetted on steel channel frames and are fitted with rollers. Watertightness is obtained by flexible diaphragm strips bearing upon the face of the gateway along the sides and top and by a cushion on the bottom, which is seated on a steel channel sill laid inverted in the concrete floor. The gateways are protected by sectional steel screens designed for convenient handling and upkeep. The lifting gears for the gates are of the rising screw-stem type, the stems being 2½ in. in diameter with bevel-geared operating stands and hand cranks located on an overhead working platform.

Canal and Flume

This part of the work has alternating sections of canal and flume, in which there are many sharp curves, necessitated by the broken nature of the ground. The canal sections occur in solid rock, sand, gravel and clay, all being lined with concrete except some parts cut through impervious clay. The intermittent sections of canal are connected by a wooden flume built of staves laid on steel suspension rods carried by and between side girders laid on bents placed 16 ft. center to center.



Plan and profile of the Puntledge River hydro-electric power plant.

The flume is approximately semicircular in shape, 12 ft. wide and 7 ft. deep; the staves are made of 3 x 6-in. lumber, dressed to 2 9/16 x 5 7/16 in.; the suspension rods are ¾ in. and are adjustable over each girder by screw ends, with nuts over specially designed washers. These suspension rods are spaced 24 in. center to center. The girders are built up of double fir timbers 8 x 16 in., with space between fixed by separators and through which the suspension rods pass. The flume bents are built on concrete piers, except across a swamp, where the flume is carried on piles driven to solid bottom.

The canal and flume line terminates with a short section of reinforced-concrete canal, the shape of which is gradually adjusted for proper entrance into the forebay structure, and before reaching the forebay one side of the canal is formed into a spillway of capacity sufficient to carry away the entire flow to this point. A rotary balanced steel gate of the Tainter type and operated by a hand gear is installed at the canal entrance to the forebay to regulate or to shut off the supply from the canal and flume line. This gate is 12 ft. wide and approximately 10 ft. high. It consists of two main arms made of steel channels gusseted to the gate frame. The gate is balanced by a cast-iron beam of heavy section, fitted as a spreader at the end of the supporting arms which extend from the trunnion bearings within the forebay for this purpose. Watertightness of this gate is obtained by flexible diaphragm strips fastened to the sides of the gate and sliding in grooves formed in the side walls of the canal. The seats for the strips are brass bars laid in the grooves and secured in the concrete. The bottom of the gate is fitted with a soft cushion which seats on the concrete floor of the canal; and while it was not intended to have this gate absolutely watertight it is found to be practically tight in actual service, and it works well in other particulars.

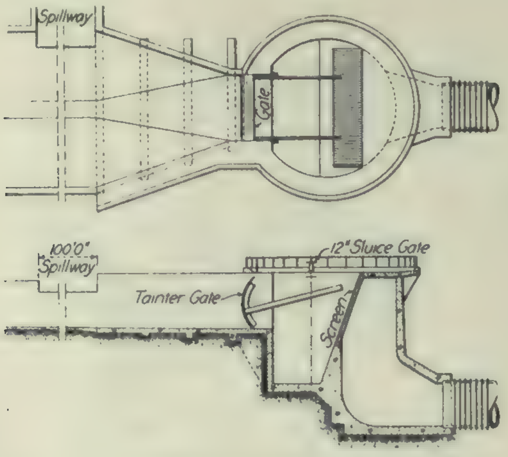
Forebay

Essentially, the forebay structure is a vertical reinforced-concrete cylinder, with the canal entrance on one side and the pipe intake on the opposite side. The basin formed by this structure is divided into two sections, which are separated by a weir and screens. The section into which the canal discharges forms a sedimentation basin with floor sloping to a sluicegate; the other section forms the intake of the penstock pipe and is completely inclosed.

The concrete in this structure is composed of the same aggregates as already specified for the impounding dam, including the same proportion of hydrated lime, and it is found to be watertight in service. The outlet connection of the 8-ft. pipe is funnel shaped, 12 ft. in diameter at the inner end and tapering to 8 ft. in diameter in 7 ft. of length. For connection with the wood-stave pipe a cast-iron ring was laid and anchored in the concrete at the mouth of the outlet, the cross-section of which forms a rabbet for the pipe staves with tapering clearance which provide calking spaces all around the pipe outside and at the end of the staves inside. The calking materials used are oakum and lead wool, and the joint thus obtained is very satisfactory.

Stave Pipes and Shoes

The staves in the 8-ft. pipe are made of lumber 4 x 6 in. finished to a thickness of 3 9/16 in. and an outside width of 5 9/16 in., there being fifty-eight staves in the circle. The staves for the 6-ft. and 50-in. pipes are made of lumber 3 x 6 in. and are planed to a thickness of 2 9/16 and 2½ in. respectively and maximum widths of 5⅝ in. for the 6-ft. pipe and 5 9/16 in. for the 50-in. pipe, forty-three staves forming the full circle of the former and thirty-one staves the same in the latter. These staves are all made of Puget Sound or Douglas fir, in the specifications for which clear lumber was required and sap excluded. The stave ends are grooved for a steel tongue ⅛ in. thick and 2 in. wide, which provides watertightness at the stave joints. The bands as adopted for all pipes are uniformly 1 in. in diameter, the maximum spacing being 12 in. center to center; but this spacing occurs at the upper end of the 8-ft. pipe only; the minimum spacing is 2 in. center to center, which is as close as bands and shoes of the size adopted can be laid, and where the load is reached requiring spacing below said minimum the size of the piping is changed. It was this feature of the design which determined the lengths of pipes of the respective sizes in the penstock system, according to the brief description first given.

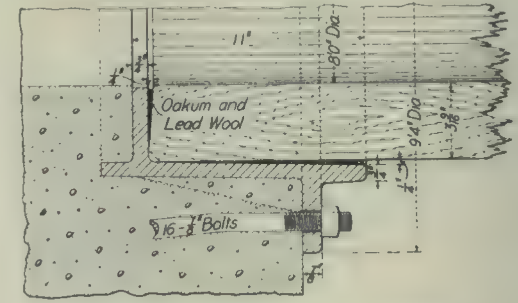


Detail of forebay.

The bands are made in two sections, one having threaded ends and the other button-head ends. The threads are rolled on. Each band has two coupling shoes of malleable iron. A great deal of study was given to the design of the shoes or couplings for pipe bands and a number of standard shoes offered by manufacturers were examined, and some were tested with a view to their adoption, but none of the ready-made shoes offered was found satisfactory, it being apparent that the types of the larger sizes of shoes offered were mere expansions of original designs of shoes for bands and pipes of comparatively small sizes, without adequate provision or increase in scantlings having been made to balance the increases in sizes of either pipes or bands. The shoes used on the various pipes of this system were therefore designed especially to meet the actual requirements. In testing some of the ready-made shoes offered it was found that the threaded end with nut and washer would easily slip off when under stress, even before any noticeable deformation of the shoe would take place, and some of them had such a narrow margin of safety in this particular that they would not be safe to use on pipes of any considerable size. Careful attention was therefore given to this feature of the design of the shoes.

On the shoes for 50-in. pipe a declivity as well as a dish is provided in the face of the lugs to securely hold the band end; this was considered safe for the pipe of this size and curvature of band, but for the pipes of the larger sizes, the curvature of the bands being less and the tangent end longer, it was deemed necessary to provide more declivity in the face of the lugs and to use tapered cast washers, which lock the ends in place. Shoes of each size were made from preliminary patterns, and tested and guided by the results of these tests the patterns were modified slightly as deemed advisable until shoes were obtained in which the strength developed equalled the average elastic limit of the bands. The weights of the respective shoes was held, at the same time, to the minimum curvature with their strength as thus determined. In other words, the shoes of the three sizes as designed for these pipe lines are proportioned to withstand without any deformation the load which the band is capable of carrying to its elastic limit.

Manholes are fitted to the wood-stave pipes at intervals, and particularly at summits, where they are provided with automatic air valves for the outlet of air during service as well as for the inlet of same when the pipes are to be emptied. The manholes consist of cast-iron saddles with lugs designed to receive the band heads, but the extreme side bands pass over the saddles, thus acting to clamp them on the pipe, no other means being used to secure the castings to the pipe. The manholes are closed with cast-steel covers bolted on the facings of the saddles. The stave pipes are laid in a shallow trench for practically the whole length, although in a depression for a distance of 820 feet it was deemed more advantageous to hold the grade line elevated and to place the pipe on concrete piers. This section occurs on pipe 6 ft. in diameter, and the general design of the reinforced-concrete piers, which are placed 16 ft. between centers, is shown in one of the illustrations.



Wood pipe junction with forebay

Y Junctions

Several designs were considered for the structures forming the junctions between the pipes of the different sizes. The first design was for structures built of steel plates rivetted in alternative forms of wyes and cylindrical headers; but after considering the size of the structures, range and nature of the stresses introduced by attaching to them stop valves in the penstocks, the designs of rivetted plates were set aside as unreliable, although the element of cost as between that type of structure and the design finally adopted was another factor in favor of the latter. The next design considered was for structures of cast steel, with the idea that steel castings could be made more rigid than the rivetted steel structures and could easily be provided with suitable means for anchorage; but the cost of such structures, including the necessary foundations for support and anchorage, was also found to be excessive. The design adopted was one in which foundations and anchorage were most conveniently combined, and the design to which the structures have been built is reinforced concrete, a type of construction believed to be unusual for such high-pressure work. The junction between the 8-ft. pipe and 6-ft. pipes was designed for a maximum internal pressure of 115 lb. per square inch, and that between the 6-ft. and 50-in. pipes for a corresponding pressure of 160 lb. per square inch. The 8-ft. pipe connects directly with the first-mentioned structure, and the joint is made in a cast-iron ring set in the concrete forming a bell end for the wood pipe. Watertightness at the joint is obtained by the same means as described for the joint made where the same pipe leaves the forebay structure.

All other pipe connections with these concrete structures are made by means of flanged cast-iron sleeves set in the concrete to which gate valves are attached. The purpose of these gate valves is to enable the isolation of any one of the connecting pipes and the operation of the plant with one or other of the 6-ft. penstocks and any one or all of the four 50-in penstocks, which explains the reason for making the lower-junction structure a chamber common to the two inlet pipes, the four outlet pipes thus providing a by-pass connecting all sections of the penstock system. But, as will be readily understood, the introduction of stop valves in the penstock complicated the problem presented for solution in the design of these junctions, as forces of magnitude are thus developed which are not encountered in open-way penstocks, and it was the adaptability of reinforced concrete to designs meeting all conditions that prompted its adoption for such unusual duty.

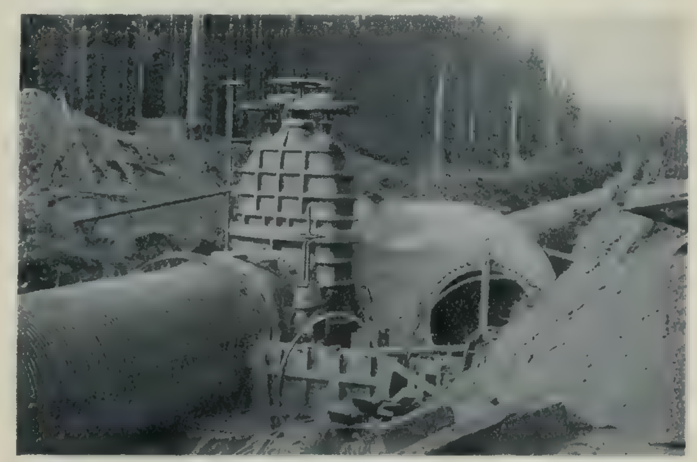
The branches from these junction structures leave at an angle to the axis of the pipe line and the alignment of the stave pipe parallel to such axis is restored at a short distance below each respective structure by means of cast-iron pipe bends laid next and bolted to the valves and which are fitted with manholes, air valves and relief valves, the latter consisting of a flanged gate valve bolted to a facing on the side of the cast-iron bend with a bursting-plate cover bolted to the outlet.

Bursting Plates

The bursting plates consist of cast-iron flanges, or rings, within which is a cast-iron plate turned to such size as to leave an annular space of about ⅛ in. The inner edge of the flange or ring and the outer edge of the plate are made with a groove which is narrower in the edge of the plate than that in the edge of the ring. The annular space, which, together with the grooves, forms a cross of irregular shape in section, is filled with lead calked watertight, the idea of the design being to shear the tongue of lead formed by the groove in the edge of the plate and thus to release the latter in the event of unexpected excessive load. To accomplish this without undue friction the edge of the plate is turned with a taper, as shown in the drawing. The thickness of the inner tongue of lead is 3/16-in. in both sizes of plates, this having been determined after tests were made to ascertain the average shearing strength of the tongue under such conditions automatic air valves are fitted at these structures both for escape and inlet, the latter being essential to prevent a vacuum forming in and possible collapse of the pipe in the event that it should be emptied rapidly.

Waterproofing

Watertightness of the concrete structures was obtained by building the walls proper to within a thickness of 2 to 3 in. of the inner surface of rich Portland cement concrete, composed of fine aggregates of measured density, weight tests having been made to determine the proper proportions of the available aggregates for maximum density; and great care was exercised throughout to insure uniformity of mixture. The proportions in this concrete averaged 1 cement, 1 sand and 2 gravel, the latter varying from pea size to 1 in. The inner thickness of 2 to 3 in. was made up of Portland cement mortar of the composition of 1 part cement to 1½ parts of sand, the inner surface of this mortar coating being covered with several coats of asphalt hot. In the chamber of the structure for the junction of the two 6-ft. penstocks with the four 50-in. penstocks, only one-half of which is being utilized for the partial plant now built, the side which is not connected up is separated from the other by a removable wooden bulkhead, provision for which was made in the structure in the way of rabbets armored with steel shapes set in the concrete. This feature of the design was provided on both sides in order that similar isolation of one side or the other can be readily effected at any time in the future should such be necessary. As indicated by the design, the anchorage of the concrete structures is accomplished by means of reinforced walls, approximately 7 ft. deep, buttressed to the wye structure and to the apron which forms the foundations for the valves and heavy cast-iron connections, the design providing amply against the overturning moment, as well as against sliding. The apron referred to constitutes also the floor of a drainage basin for the relief valves, the outlet of which is an open ditch to lower ground, with natural drainage to the river.



Upper Y, where 96 in. pipe branches into two 72 in. pipes.

Lower End of Penstocks

Where the minimum spacing of bands is reached the type of construction is changed to steel pipes connected to the stave pipes by means of rivetted steel tapered sections joined with the wood-stave pipes in a bell end provided in the steel section for the wood staves, of such shape as to allow calking at the outer end of the steel section, as well as against the inner ends of the staves. This steel section has angle-bar anchorage rings rivetted on and is set in a concrete anchorage block forming the base of a chamber giving access to a manhole fitted on this section. The steel pipe, which is of the lock-bar type, is rivetted to the special steel section just described. Each of these steel-pipe penstocks is 660 ft. long, their thickness varying from ⅜ in. at the upper end to 7/16 in. at the power house. The steel pipes are laid in trenches, much of which is in solid rock, and at about the middle of their length there are expansion joints, consisting of steel castings and of the usual packed slip-joint design. These joints are laid each in a concrete chamber and the steel pipe is laid in tarred felt through the walls of this chamber, leaving it free to slip. The lower ends of the steel penstocks are anchored near and at the power-house foundation and terminate within the building, with a cast-iron closing piece connecting them to hydraulic shutoff valves installed at the respective turbines.

Power House

The power house is built of reinforced concrete on a rocky site at the river's edge. Approximately one-half of the principal building contemplated has been erected for the accommodation of the present units, but the annex section of the building, which contains the switching and other electrical apparatus and the wire outlets, is built complete. Provision has been made in the design for extension of the main body of the building to house the remaining units without disturbance to the operation of the present plant.

The annex section, which is three storeys high and has a 18½ x 65½-ft. floor area, has the upper floors of concrete supported by I-beams. The roof of the entire building is built of concrete laid on Hy-Rib reinforcement plastered underneath. The roof framing of the annex section consists of 9-in. 21-lb. I-beam rafters; that of the main section consists of steel trusses placed 20 ft. center to center, supporting 9-in. 21-lb. I-beam purlins. The sides of the building are, in large proportion, of glass. The main building is designed with crane girders, on which a traveling crane having a lifting capacity of 40 tons has been installed. These girders are of reinforced concrete, with the runway rails embedded therein. All of the concrete in the exterior of the building was made of waterproof composition obtained by the use of hydrated lime in the mixture in the proportion of 10 per cent. of the cement used, and the roofs are covered with roofing felt. The roof drainage is run through the interior of the building to a central drain to guard against frost in the conductors.

Scheme of Regulation

The static head is 350 ft.; the length of the penstock system being 13,700 ft., the ratio of the pipe is about 1:40. The part played by a high ratio of head to length of penstock, as an unfavorable factor in the solution of the problem of power regulation under variant-power-load conditions, was fully realized and much study was given to the general scheme with a view to obtaining the most favorable combination, but the ratio obtained was the best available owing to the naturally unfavorable topographical conditions and to the fact that the forebay is located at the nearest suitable point in relation to the power house, the general slope increasing from this point gradually to the power-house site. The problem presented in laying out the penstock system from the site selected for the forebay to the power house was therefore confined to locating the best available grade line, considering the details of construction and existing property lines. In a penstock system of such a high ratio of length to head it is difficult to obtain power regulation by means designed to conserve the water supply, but inasmuch as there was no scantiness of supply and economy of water was not a factor in the design of this plant the problem of regulation as presented was comparatively simple.

The arrangement adopted insures against sudden or high rises in pressure in the penstock system as an effect of throttling of the turbine gates by the governor gear of each turbine operating a relief valve on its penstock, which opens and closes synchronously with the corresponding action of the turbine gates, thus permitting water to waste in approximate proportion to the load taken off, and maintaining so nearly a uniform rate of flow in the penstock as to prevent the pressure rises due to governor throttling to exceed a nominal percentage of the pressure due to the active head. This valve is geared so as to be adjustable to close in any desired length of time, so that waste of water need be no more than sufficient to diminish the penstock flow at a safe rate.

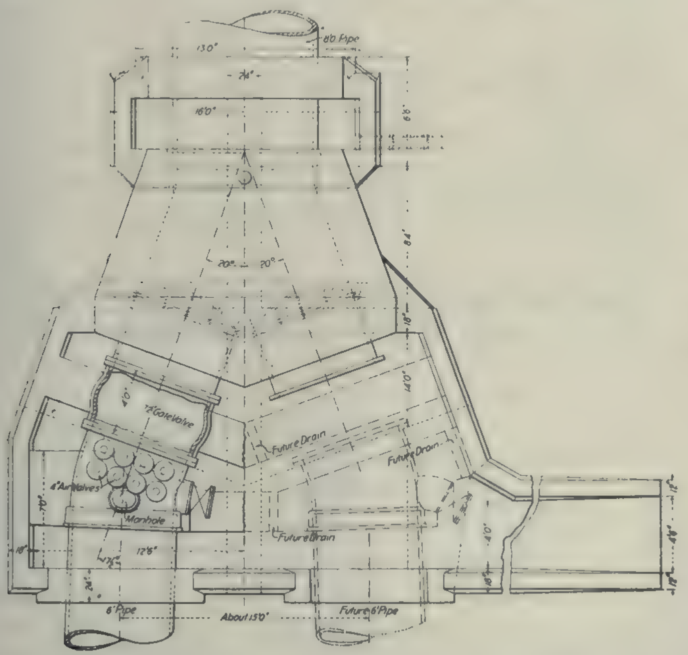
The general arrangement as designed includes, in addition to the governor actuated relief valve, a direct-pressure independent relief valve which would open in the event of extraordinary rise in pressure caused, for instance, by an impediment or accident occurring to the governor gear. In addition to the governor actuated relief valve, a direct-pressure independent relief valve which would open in the event of extraordinary rise in pressure caused, for instance, by an impediment or accident occurring to the governor gear. In addition to the valves described there is a safety relief consisting of a bursting plate closing the end of a nozzle, which terminates each penstock in the power house, so that in the event of accident to the governor gear and relief valves any abnormal or dangerous rise in pressure would be prevented by the blowing out of such bursting plate.

Turbines

Reaction type turbines with governor control effected by multiple balanced gates at the inlet, actuated by the governor gear, have been installed. A hydraulic shutoff valve is placed in each penstock in conjunction with the turbine. These machines are direct-connected to their respective generators. Specified rating of each turbine is 4700 h.p. under the conditions to be obtained when the penstock system is completed, and supplies four units at full power, for present purposes only two of these units are installed, and inasmuch as the upper portion of the penstock system is already constructed of the requisite capacity for four units the available power of the two turbines now installed exceeds their rating to the extent of 28 per cent. in the case of one turbine operating alone and 7½ per cent. when both are running at full gate. In general arrangement within the power house the machines are placed with the shaft axis parallel with the longitudinal axis of the building. The floor space required for the installation of each unit is 32 x 50 ft. and the floor space dimensions of the ultimate power house, as designed, are 34 x 214 ft. The floor-space dimensions of the main building as far as constructed for the accommodation of the present units is 34 x 117 ft.

The alternating-current generators are of the waterwheel type, with the lower portion suspended from the foundation piers within the foundation pit. These machines are designed for a normal constant output of 3,500 kw. at 500 r.p.m. and 13,200 volts, and they are capable of carrying a 25 per cent. overload continuously. Each machine has its exciter direct-connected, the capacity of one exciter being sufficient for two machines when operating at 80 per cent. power factor.

In the concrete floor and foundations are laid the electrical conductors from the generator pits, and the leads are accessible at numerous points in manholes and tunnels. The grouping of the leads from the switchboard and switching apparatus is effected in a central tunnel. The switchboard and control station are placed on an extension of the second floor of the annex, projecting as a gallery within the main portion of the building, from which the full interior of the power house proper is visible to the operator. The switching apparatus is located on the second floor and is contained in a series of reinforced-concrete cells. Six lightning arresters are located on the upper floor, and from these the transmission lines pass out through the side of the building, with the usual insulated wall entrances and attachments, which are protected by a 6-ft. awning extension of the roof.



Detail plan, showing general arrangement of upper Y branch.

The plant is now in operation and its performance is meeting all expectations. It will be noted that the storage and diversion works, water conduit, forebay, wasteway and the upper third of the penstock system are completed for the full capacity of four units, while the lower two-thirds of the penstocks are completed only for supply to the two of these units now in operation.

The cost of the plant as now constructed figured on the basis of the normal output capacity of the two units installed is less than $70 per horsepower at the power-house switchboard, and the corresponding cost will be reduced to less than $60 when the plant is completed and the output of four units is used. The proportional costs of this plant per unit of capacity as stated are considerably lower than the average cost of such plants, and in fact they will compare favorably with the lowest costs for similar plants. Considering the permanent character of the work throughout, the isolated location of the plant in relation to the material and labor markets and the fact that a great deal of material and appliances required for its construction had to be imported and were subject to heavy customs duties these low costs reflect efficient design and construction.

Equipment

Generators and electrical apparatus were manufactured and installed by the Canadian General Electric Company.

Turbines with governor gear, the relief valves and hydraulic penstock-stop valves were furnished and installed by Escher-Wyss & Company, of Zurich, Switzerland.

Gate valves, 50 and 72 in. in diameter, installed in the penstocks were furnished by the Crane Company, of Chicago, through its branch house in Vancouver, B. C.

Air valves are of the Crispin type; those for outlets up to 4 in. are single units; those for outlets exceeding 4 in. are made in clusters of 4-in. units. These valves were also furnished by the Crane company.

The lock-bar steel pipe 50 in. in diameter, was made by the East Jersey Pipe Company, of Paterson, N.J.

The power house and hydraulic development constituted a general contract, which has been performed by Grant Smith & Company, contractors, of Seattle, Wash. Briefly, this contract embraced all of the work from the clearing of the land to and including the power house, with the exception only of the machinery and power-house apparatus. The work was begun in the late fall of 1911, and while no unusual difficulties were encountered much delay was caused by extraordinarily high water and inclement weather.

The construction of the plant and installation of the machinery were supervised by the Canadian Collieries (Dunsmuir), Ltd., of which Mr. W. L. Coulson is manager and Mr. Joseph Hunter is chief engineer. They were represented on the work by Mr. L. Netland, resident engineer.

The materials, fittings and structural parts purchased for the power house and hydraulic development were inspected and tested at the various places of manufacture by Robert W. Hunt & Company, under the general instructions of Canadian Collieries (Dunsmuir), Limited, and the consulting engineers.

Plans and specifications for the work, including the detail drawings, were furnished by H. K. Owens-A. V. Bouillon, consulting, civil and mechanical engineers, of Seattle.

Timber in Exhibition Building

The machinery hall being constructed for the Panama-Pacific Exhibition at San Francisco, which, according to the Engineering Record, is to have a floor area of eight acres, a length of 967 ft., a width of 367 ft., and an extreme height of 135 ft., is being built entirely of timber, and will form one of the largest buildings erected in that material. In ordinary circumstances steel would have been adopted for the work, but the proximity of the Pacific Coast forests renders wood more economical. In order that the building may be completed in time for the celebrations in 1915 the contract requires that the operations shall be finished in 240 days. In consequence of this stipulation, it is necessary to hasten the work as much as possible, and during one week timber amounting to 600,000 ft. b.m. has been placed in position, while in four hours 55,000 ft. b.m. were erected. The total amount of wood required amounted to 7,500,000 ft. b.m., and the average number of men being employed is 475 a day.

Highway Bridge Construction—Part III[*]

By F. Tissington[†]

Laterals or Wind Bracing

THESE are generally composed of single angles and in the majority of cases for trusses under one hundred feet span, the minimum size angle 2½ x 2½ x 5-16 will be found sufficient. For trusses with longer spans a slight increase in the sectional area of the laterals at the ends will be necessary. Naturally the angle of inclination these make with the chords will affect the stress.

These members are attached to the lower chord (and upper chord of through trusses by means of gusset plates rivetted to the panel points. (See Fig. 7).

Brace or Sway Frames

In through trusses it is usual to provide a series of these frames (see Fig. 4), i.e., one at each pair of posts and there are generally regulated in depth to just clear the headroom allowance specified. This clearance is generally not less than fourteen feet above the roadway level. The top and bottom members of these frames should be designed to act as a strut between the two trusses with a maximum ratio of l/r of 150. This allowance, it will be noted, is twenty-five per cent. in excess of that required for the posts and struts in the truss members. The other members are purely nominal in size for the usual run of highway bridge work.

The addition of these frames serves to break up the length of the posts as well as to impart a good deal of stability to the top of the structure.

Portals

Quite a number of different styles of portals have been designed from time to time, but for simplicity and low cost of manufacture, the writer prefers the same style as adopted for the sway frames. Practically the same remarks quoted for the sway frames will apply in this case, but it should be borne in mind that at least half the accumulated stress due to the wind pressure on the top chord has to be transmitted through this frame to the leeward end post.

Handrailing

Usually both trusses are filled in with a latticed handrail about three feet deep arranged with the bottom chord about six inches above the wheelguard.

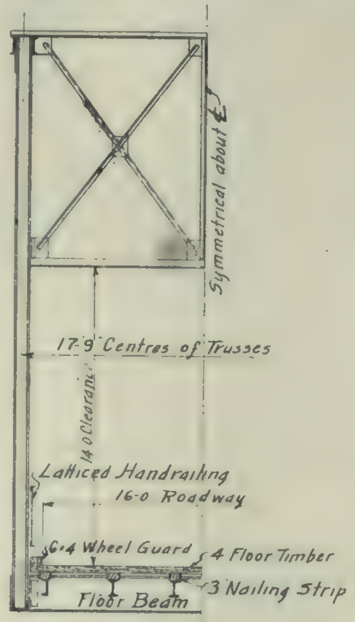


Fig. 3

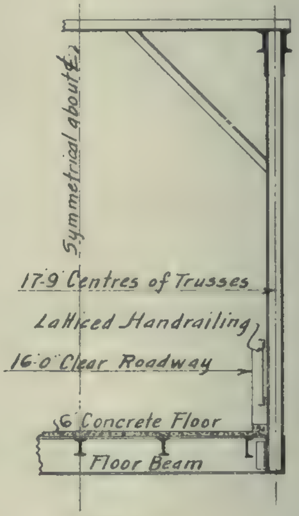


Fig. 4

These are indicated in Figs.1, 2, 3 and 4 in section, and also on the general drawing Fig. 8 accompanying this article. It is permissible to use smaller and thinner sections than the minimum sizes fixed for the trusses, as the junction of this railway is only to close up the openings between the truss members. The lacing bars are alternately of angle and flat section, the angle being 1⅛ x 1⅛ x ⅛ and the flat bar 1⅛ x ⅛. The top chord has to withstand a horizontal pressure of 45 lbs. per foot run and must be designed accordingly. The railings as a rule terminate with an orna-

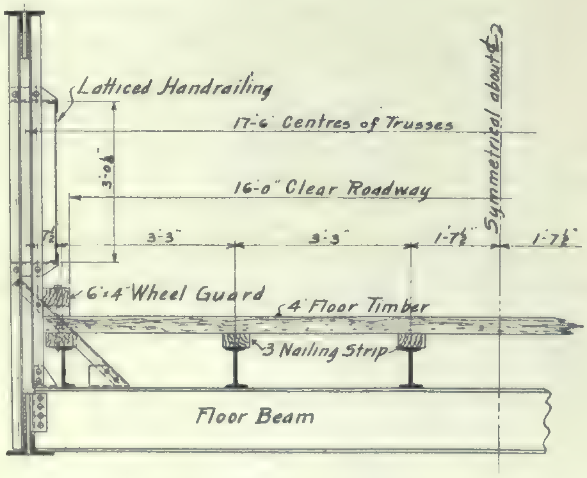


Fig. 1

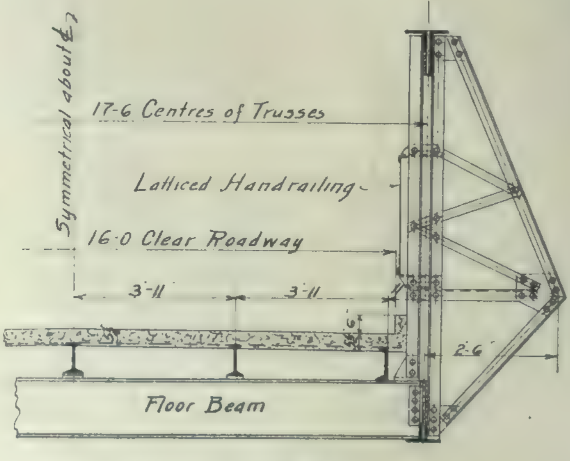


Fig. 2

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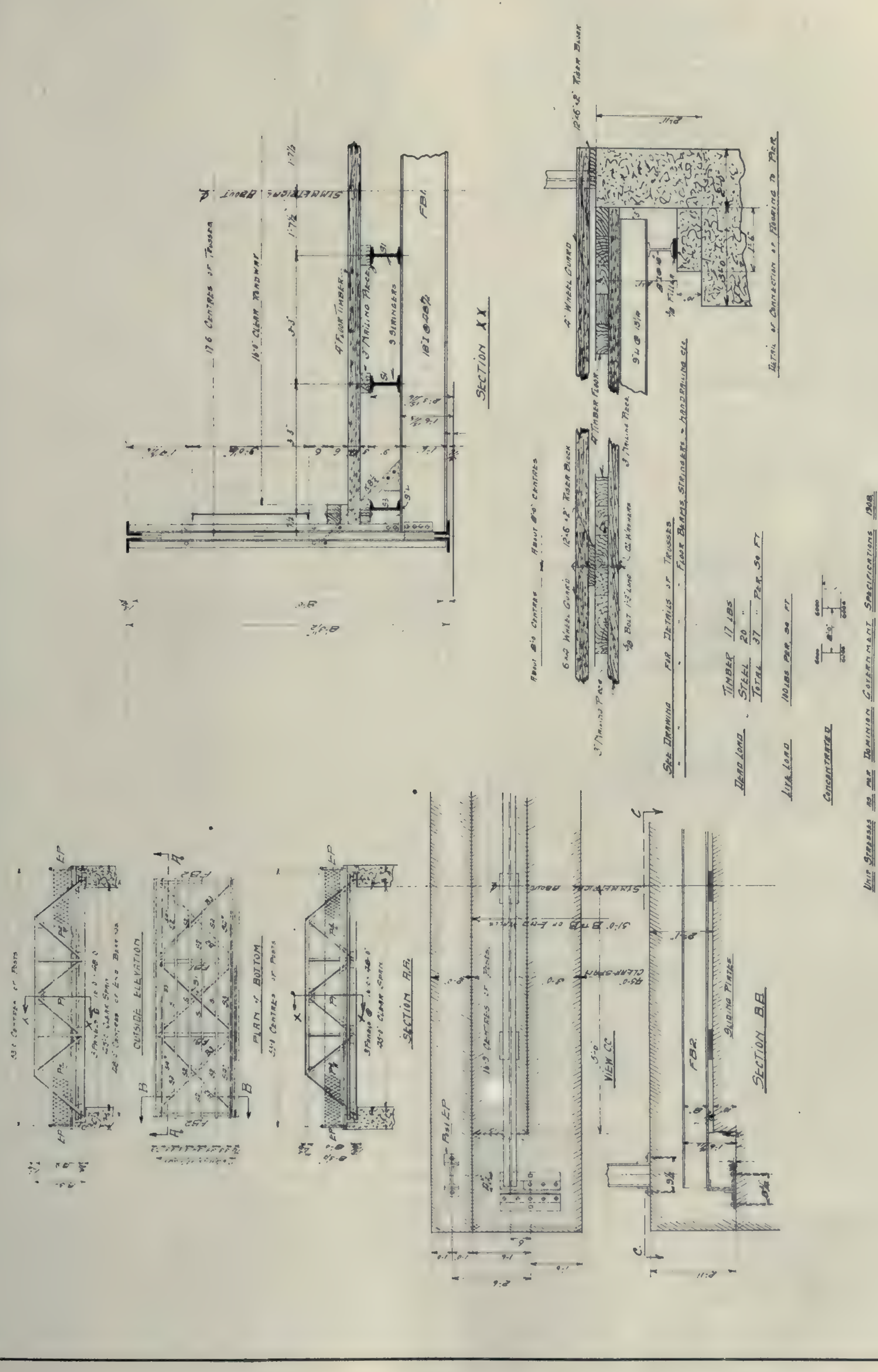
[*] Parts 1 and 2 were published in our issues of Sept. 3 and Sept. 24 respectively.

[†] Chief Draughtsman, Mackinnon Holmes & Co., Sherbrooke, Que.



General arrangement and erection diagram for 48 ft. span c. to c. highway bridge.

mental post placed at the centre of the back wall on the abutments. The position of this is also indicated in Fig. 8.

Roller Nests, Sliding Plates, Etc.

All trusses of 80 ft. span and over should have roller nests arranged at one end of the span. These are of a simple type consisting of a series of rollers held in position by a cage and running between two machined plates, one rivetted to the end of the bottom chord and the other fastened to the abutments. Under 80 ft. span these roller nests may be replaced by a sliding plate. The bed plate rivetted to the underside of the bottom chord of truss being provided with slot holes to allow for expansion and contraction.

General Drawings

Fig. 8 gives a comprehensive idea of the usual type of erection diagram and general drawing necessary to provide for the contractor of the substructure, the erector for the steelwork and for the laying of the floor timbers.

Weights of Highway Bridges

Table 8 gives the weights for a few examples designed to meet the requirements of the Quebec Government. The whole of these were laid with timber floors. Most of the weights given represent actual material used in manufacture.

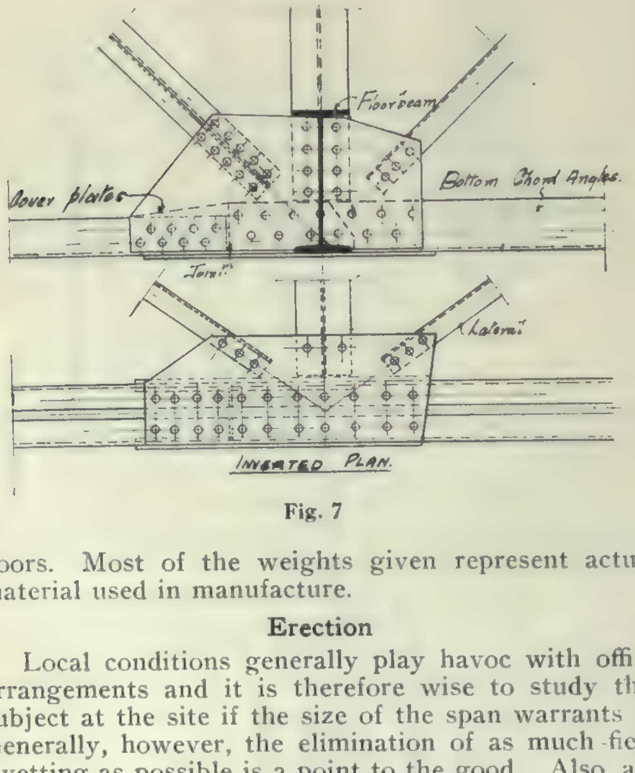


Fig. 7

Erection

Local conditions generally play havoc with office arrangements and it is therefore wise to study this subject at the site if the size of the span warrants it. Generally, however, the elimination of as much field rivetting as possible is a point to the good. Also, another line of policy that has been found economical is to build each truss up complete in the works and seam all field connections before despatch.

If a proper system of marking is used there should be no difficulty in repeating the performance with ease in the field.

A reinforced-concrete pontoon crane, 100 feet long by 43 feet wide, fitted with a motor and screw and capable of being navigated by its own power, has been constructed at Marseilles. It is to carry a crane 33 feet high, with an overhanging or unsupported length of 33 feet, able to support a load of 30 tons. The pontoon has double sides, protecting it against the influx of water should the outer skin be damaged.

Waterproof Concrete Paints

THE committee on treatment of concrete surfaces of the National Association of Cement Users has investigated a number of the so-called waterproof concrete paints and finds that they are much more efficient than colorless solutions.

These paints may be divided into two classes: First, those which give white, or light tints, or other colors pleasing to the eye and of a decorative nature; and, second, those which employ compounds of tar and asphalt which are necessarily black, or nearly so, and are, therefore, seldom used on exposed surfaces.

The presence of a finely-divided pigment serves to seal up the small pores in the surface of the concrete, leaving less work to be done by the vehicle.

In most cases the proportion of pigment used is small, and by using a cement color but little change in the surface appearance of the concrete need be made, unless desired, while on the other hand, almost any shade of color may be obtained. In this way the waterproof-coating is made more serviceable and at the same time ornamental.

All these treatments are applied with a brush in the same manner as paint and are probably as durable on concrete as paint is on wood.

Linseed oil paints should not be applied directly to new concrete, or to any concrete which has not been long exposed to the weather. The free lime in concrete not thoroughly weathered out on the surface by exposure to the elements will saponify the oil, destroying its adhesive power and its life, and the paint will soon peel off. After concrete has been exposed for a long time to the elements, linseed oil paint may be used with greater safety. It is difficult, however, to determine when the concrete is sufficiently free from lime to render it safe for the application of linseed oil paints, and it is therefore safer to avoid their use directly on concrete.

There are preliminary applications which may be given to concrete which renders it harmless to linseed oil paints. The best known, and perhaps the most thoroughly proved treatment of this kind, is that devised by Charles Macnichol, of Washington, D.C., and published in the transactions of the American Society for Testing Material for 1910. It consists in giving the concrete, after it has been thoroughly set, a priming coat of a solution of zinc sulphate, eight pounds to a gallon of water. This is applied with a brush, and after it is dry ordinary linseed oil paints may safely be applied over it.

The solid substantial business buildings that have been constructed in Winnipeg during the past few years are worthy of note. In 1910 there were nineteen buildings erected at a cost of over $100,000 each. In 1911 twenty-two buildings were put up each costing over $100,000. In 1912 the big buildings costing over $100,000 each numbered twenty-five, and for the eight months of this year Winnipeg has completed sixteen buildings at a cost of over $100,000 each. This year Winnipeg has had three buildings that have cost over $500,000 each, while last year the Government Law Courts was the only permit that exceeded the half million mark. In 1911 the Grand Trunk Pacific Hotel "Fort Garry," was the most costly building erected, calling for an expenditure of $1,000,000, and in 1910 the two largest buildings in the permits were the Bank of Montreal, $950,000, and the Canadian Bank of Commerce permit, $800,000.

Essentials in City Pavements of Concrete

By J. S. McCullough, City Engineer, Fond-du-lac, Wis.[*]

SOME of the things I have found to be essential in concrete pavement construction are:

The sub-grade must be adequately drained and rolled until all depressions are taken out. A uniform compression should be the aim, and on placing a pavement over a wider area than has formerly been travelled care should be taken to get that portion outside of travelled track, as solid as the center of roadway.

When gutters are put in, we require same amount of rolling and compression under curb and gutter as under pavement proper.

The material to be used for aggregate in concrete must not only be clean when delivered on the work, but must be kept clean until it gets into the work. Work has been ruined by allowing clay, loam or other ruinous materials to get mixed into stone, gravel and sand, after it was dumped on the road or street.

Cement should be carefully watched, and frequently tested on the job to guard against insufficient grinding, and also to detect cement damaged in transit, or in warehouse by getting damp or wet. We test our cement for pavement work as it is received, and inspector on street looks out for any particular defective sacks that may have got wet, and partly set.

Where expansion joints are left to be filled later with asphalt extreme care must be exercised in removing templates used to make space. There is danger of pulling up part of concrete in removing the templates and such damaged spots will soon ravel and develop bad holes and ruts. We use a patented wedge for this purpose which enables us to make the space for expansion without any damage to concrete, and the removal of the wedge is no trouble at all.

Our work is all two-course work, and in order to get the top course or wearing surface of the desired uniform thickness we use an adjustable gauge, cut to desired crown of street, which travels on the gutter or curb, as desired and gives us a uniform crown and thickness. This gauge is also used to test sub-grade, and there is no excuse with its use for not getting thickness of concrete called for by specifications.

For wearing surface our idea is that ½ in. thickness in a special rich mix for wearing surface with granite for aggregate, and sand and cement mortar, making a mix of equal parts cement, sand and granite, laid on a base of 1:2½:5 concrete will produce a better pavement, than the same amount of cement put into a one-course job.

We have no washed gravel available, and our limestone is rather soft, so have continued to build two-course work, with granite, sand and cement wearing surface. In our clay soil the changes in sub-base on account of moisture and frost and the temperature changes, have convinced us that a 6½-in. thickness of slab is not strong enough, and we have been reinforcing with a No. 7 triangle mesh wire.[1]

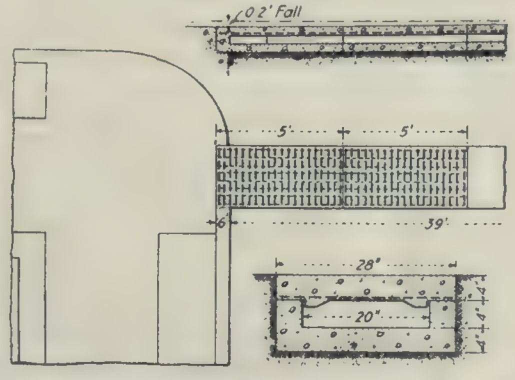
For next season's work we have in mind increasing both thickness of slab, and the weight of reinforcement, and put all the crown of the pavement in the concrete, by making sub-grade flat.

Our pavements are standing well, and the only defect we are trying to overcome is the tendency to crack longitudinally. The cracking does not appear to be a serious defect in the opinion of taxpayers, however, as we have been building concrete pavements in this city since 1908, and with the exception of our first year's work, the pavements have all been laid on petition, from abutting property owners.

We have approximately 10 miles of concrete pavement in the city now, and have petitions granted and on file for more than 3 miles for next year.

Combined Street-Crossing and Culvert

On several of the residence streets in San Antonio, Texas, concrete street-crossings of a unique type have been built under the direction of Mr. A. C. Pancoast, City Engineer. These are designed to serve not only as crossings for pedestrian traffic, but also as culverts to carry storm water from the gutters across the streets to outlets in the creeks and the San Antonio river, which flow through the center of the city. Some such device to take care of surface water on occasion, is necessary from the fact that the city has few large underground sewers owing to the infrequency of heavy rainfall in that section.



Combined concrete street-crossing and culvert

These culverts, as shown in the diagram, are 4 in. high and 20 in. wide, and are poured on the ground, half the width of the street at a time so that the work will not interfere with traffic. The cover slabs are cast as separate units 5 ft. long; and are 4 in. thick, reinforced with 3-in. steel rib metal. They are strong enough to support the heaviest steam rollers. To prevent chipping of their edges, a strip of rock asphalt 2 to 3 ft. wide is laid alongside.

A horse hitched to a heavy truck at Rochester, N.Y., recently caught his shoe on a manhole lid, pulling the cover up as he lifted his forefoot. His hind legs sank through the opening, only 30 in. in diameter, and after many kicks and struggles the animal freed himself from his harness and gradually slipped into the opening until head and forefeet had completely disappeared below the surface of the street. A derrick was summoned, and after much difficulty the horse was hauled out by ropes looped around his neck and front feet. With the exception of a few scratches the horse apparently suffered little from his close contact with 2,500-volt cables in the manhole.

Hardly as lucid as it might be, perhaps; but it shall never be said any novel method of construction was refused notice in our own pages:—"Frank McGuire is building a new house for himself on his lot on the Greenlead Road. He is building the new house outside of the old one, and after the new house is inclosed he will tear the old one down."—From the Ontonagan Herald, Ontonagan, Mich.

Classification of Materials in Constructional Operations*

SYSTEMATIZATION of construction work has in the past few years been carried forward to a point hardly dreamed of by the old "rule of thumb" contractors. The great variations occurring in construction work deterred contractors from attempting standardization and systematization to any extent, for they looked at their problem as a whole and became discouraged. The variations, however, can be eliminated or foreseen if taken up one by one, each being solved by itself. It is not the writer's intention in this article to explain how construction work can be systematized, but only to show how by scientific studies made in connection with systematizing work new ideas are developed—for instance, like the one of classifying excavation work by expressing the manner in which the materials are removed and not by the name of the materials.

There is probably no feature of construction work which is more common than excavation. The large work, of course, is handled by machinery to a great extent, but nevertheless some hand pick and shovel work must always be done also. There are a great many contractors doing this line of work for the reason that the work is generally very simple and it takes only a small equipment. What does this mean? It means that competition is keen and the prices for doing this class of work are well established. This makes the amount of work a contractor gets largely dependent upon how well he can determine what the real cost of excavating different kinds of materials should be, and to see that he gets it done for that price. In order to simplify the facts the writer will explain the point in question by taking for an illustration the excavating of a sewer line which was excavated entirely by hand. Let us consider how the materials to be excavated are generally classified. They are generally classified as loam, sand, gravel, clay, hard pan, rock, etc. No distinction is made as to the proportions in which the materials are mixed, or whether a material is hard to remove, like cemented gravel, or easy to remove like gravel containing a large percentage of fine sand. All these conditions, however, affect the cost to such a great extent that it seems strange that stress has not been directed along these lines before.

This problem of classifying materials on excavation work came up in connection with the adoption of scientific management for a large land development company in the South, of which the writer had charge. In order to properly "route" the work of installing the sewer lines, it was necessary to determine accurately the amount of time required to excavate the trench to lay the pipe, and to backfill the trench. "Routing" the work means the planning out ahead of time, on paper, of every detail, and developing instructions, stating exactly how this work is to be carried on and the time it should take to do the job. In other words, a job is minutely analyzed and every detail is pre-determined. To do this, exact data had to be obtained through "time study." These time studies give a true basis for comparing the work of one gang with the work of another gang, they give a comparison between the work of individual men in the same gang, and they also give a more accurate method for estimating purposes than can be obtained in any other way. Setting rates by time studies, if properly done, is a scientific and correct method of determining the proper time for doing the work, differing from the ordinary way of setting piece work rates which are based on the personal judgment of the foreman or superintendent as to the time it should take. The subject of time study work will not be taken up in detail in the present article.

Let us digress a little from the topic in hand in order to bring out a few points which have important bearing on this proposition of studying the work in detail and determining the amount of time required to perform each operation. The first point is, can the present records which are kept of the finished work be used accurately to determine what future work should cost? The second point is, of what value would it be to the executive engineer of a construction company to know what the work was costing day by day and get this report on the following day?

Records Generally Crude

Taking up the first point, we find that the records of most construction companies who do excavation work are very crude in that they omit to have recorded, or even sent in from the job, daily records of every condition which affects the cost of doing the work. The records on the books will show the work done under one foreman varying by as much as 500 per cent. or more, without giving any adequate reasons for same. Sometimes a brief description may be recorded stating that 25 per cent. of the material was rock and that water was encountered, but it fails to state whether the rock was blasted out, whether the water was sufficiently great to require pumps or what not. When this foreman is called into the office, he generally can satisfy every one as to the reasons for a high or low cost, for he remembers the conditions on the various jobs which were troublesome and probably costly and enlarges or diminishes the extent of the trouble according to whether he is accounting for a high or low cost. The storing of the information of the jobs in the heads of the various foremen is a very bad practice, for it not only is not available to the proper party, but it becomes distorted and even dangerous to use unless the party using it takes into consideration the foreman who is giving the information.

A discussion of the second point, namely, of what value would it be to the executive engineer to know what the work was costing day by day and to get a cost report on the following day, involves a consideration of the following question: Can any engineer after a job is finished give good, accurate reasons why the cost of one day's work sometimes costs double that of some other day's work? Was the foreman inefficient, was it due to exceptionally bad material, was it due to ground water or rain washing in the banks, or was it due to a combination of several or all of these causes? It is impossible for any one to state definitely the real cause, for after a job is finished it is impossible to remember all details. The construction engineer needs to know whether or not the men are producing a good day's output, and that the foreman is competent or not, from day to day. If this is possible, then an inefficient workman or foreman will not be kept on indefinitely, but will be held accountable for each day's work and he cannot get along many days before being found out. If a company had a means of determining this, could they afford to pay the man and foreman a bonus? Actual figures show that the work in one case which was conducted on a task and bonus system was performed 50 per cent. cheaper than previous work of the same character, and this figure takes into consideration the extra money paid to the men in the form of a bonus. Many other cases of a similar character could be cited. What does this mean? It means more money to the men; it means cheaper work for the company, and places the company in a position to know actually what the work is worth.

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* By W. O. Lichtner, in Engineering and Contracting.

Returning again to the topic in hand, we found at first some of the officers of the company were very much opposed to the taking of the time studies, for they could not see, in the first place, how it was possible to take the studies, and in the second place, they didn't believe that the time values could be used after they were all developed on account of the great variation in the character of the materials encountered. There are probably only a few places in this country where so many different kinds of materials will be encountered as was found in this one locality. The materials differed in composition, varying from a fine quicksand, which virtually boiled up from the bottom of the trench and ran through joints in the sheeting, although it was closely sheeted, to a very tenacious stiff clay, and also to boulders and solid rock which had to be blasted. These varying materials were not in different localities, but were encountered in a trench 600 ft. long.

In taking time studies the time study man made his observations in the usual manner and classified the materials according to the materials encountered, calling them by their names—sand, clay, gravel, etc. This seemed satisfactory until we started to work up the notes, when it was found that with all the conditions being identical as far as could be determined, that is, having the same man, the same tools, the same weather conditions, and what was thought to be the same materials, the times per cubic yard for excavating would vary termendously. This variation then must be due to a slight difference in the materials. To determine this, samples were taken of every kind of material, and as it was removed from a trench, each sample was placed immediately in a glass quart jar, sealed up, and taken to the office for further study. This study resulted in getting up a symbol list for designating the materials, so that the men in making out their reports could indicate the materials by a letter or symbol instead of using a long description, using, for instance, MC for medium clay, DS for dry sand, etc. More time studies were taken and worked up and compared with the previous ones taken to see if we could determine the time it should take for each of these items. This was tried out for a short time and the classification found unsatisfactory also, for there was some element which was defying us in some way. We found that a medium clay, for instance, could be excavated in one case with comparative ease, while in another case it was hard to get out. Upon closer inspection of the first sample, we noted that it contained mica, while the other hard sample did not seem to contain as much as the first one, so it seemed possible that the kind of material of which it was composed was the determining factor in the case.

The various samples of materials which had been gathered in the mason jars were submitted to a number of geologists for analysis as to the geological composition of each of the samples. After an exhaustive study by these men we found that no geological separation was possible. This problem, like a number of other problems we have had to deal with in taking time studies, was one which at the start looked extremely simple, but which in reality had an element in it which never had been brought out by any one and probably never could have been brought out excepting by a detailed study of the whole problem with a view to determining the exact time of doing each part. This proposition was therefore studied further with the result that we noted that different materials of entirely different composition sometimes broke up under the pick in the same way, while similar materials did not, if they contained different percentages of water or if mixed with carrying percentages of other materials. This same fact was noted to hold with the shovelling operations. For instance, a rotten rock was picked with difficulty, but it broke up into fine particles, so that it piled up high on a shovel and shoveled as easily as a fine moist sand or cinders. New studies were then taken, using this as a basis, and it was evident from the first studies now taken that the correct solution of the problem had been found.

Satisfactory Classification

From the new time studies a new classification was made, basing the times on two variables, first, on the time it takes to pick the material, and secondly on the time it takes to shovel the material after it is picked. The material to be excavated then would be designated by two capital letters like BA. The first letter always designated the picking element and the second letter the shovelling element. By time studies the amount of time it would take a man to pick one cubic foot of material was determined and classified as B picking; also a time per cubic foot was determined for C picking, etc. In a similar manner, time per cubic foot was determined for all kinds of shovelling. The picking classification, which was always the first letter and always made with a capital, was as follows:

A—No picking required.

B—Loosens uniformly into fine material, with no appreciable lumps, and picks easily.

C—Loosens easily into its component parts like a non-homogeneous material, as gravel mixed with sand, clay, or loam. Gravel less than 50 per cent. and not large.

D—Same as B except pick does not enter readily.

E—Loosens into lumps like a homogeneous material, not as hard as J.

F—Loosens hard into component parts like a non-homogeneous material as a cemented gravel.

G—Loosens into lumps and picks hard like a homo geneous material which is brittle.

H—Loosens into lumps. Material very tenacious.

I—Loosens into large lumps with very little fine.

J—Loosens hard on account of pick striking stones.

K—Loosening small boulders in trench (1 man size).

L—Loosening large boulders in trench.

M—Sledging rock.

The shovelling classification, which was always the second letter and always made with a capital, was as follows:

*A—Finely divided material which heaps up on shovel.

B—Finely divided material which does not heap up on shovel.

C—Lumpy and fine material mixed.

D—Loose material like sand, clay, or loam, mixed with small gravel.

E—Same as D except large gravel.

F—Finely divided material. Can be spaded easily and requires no picking.

G—Supersaturated clay which can be shovelled.

H—Supersaturated clay which must be baled out in buckets.

I—Supersaturated material with small boulders which is baled out in buckets.

J—Sticky material which adheres to shovel.

K—Large lumpy material which averages 1 to 2 lumps per shovel.

L—Lifting small boulders from trench (1 man size).

M—Lifting large boulders from trench.

This classification has been used with great success for some time now and is a most satisfactory classification for practical purposes. The determination of the time for each one of these items is a matter of time study which can be readily accomplished. Studies will have to be made, of course, to take care of the great number of variables, and tables compiled accordingly. We were able to utilize the information which came into the office daily, due to the "routing" of the work, and this saved one taking a great many time studies, which also meant quite a large saving in expense.

The major part of the time studies were made by Mr. Frank A. Baker, one of our engineers, who deserves great credit for the manner in which he co-operated with the writer in this work.

Treatment of Worn Out and Ravelled Macadam Surfaces*

By Col. Edmund A. Stevens†

BEFORE discussing the cure it is well to define the trouble, and to analyze its causes. The word ravelling is used rather loosely. For my purpose I shall consider it as the loosening of the bond of a road surface until the macadam stone lies loose and free on the road. By macadam stone, I mean, not the small stone used to fill voids and give a smooth finish to the surface, but the stone that constitutes the body of the road's surface. In macadam work this stone when compressed to its final form occupies about sixty per cent. of the volume of the road surface. The forty per cent. of voids is filled in varying proportions with surface stone, screenings, stone dust, sand, earthy materials and any chemical binder used to "hold the road." The mixture of fine stone, sand and earth filling the voids has no appreciable tensile strength. Its duty is to wedge the macadam stone in place and prevent internal movement. Such a structure is called on to carry loads, to receive and absorb propelling thrusts. The road should be of sufficient depth to transfer the stresses thus imposed to the sub-base without serious internal movement and at unit pressures less than the resisting power of the soil. It is thus subjected to vertical and horizontal forces that contribute largely to ravelling.

Let us briefly consider these.

A draft horse weighing 1,200 lbs. will have all his weight at one time on two feet. He will exert say one horse power at a speed of four miles. The vertical force at the foot is 600 lbs., the horizontal $\frac{23,000}{2 \times 4 \times 88} =$ 47 lbs. These forces are or may well be concentrated on a toe calk two inches in width; the resultant force slightly exceeding 300 lbs. per linear inch.

A motor truck weighing, loaded, 16,000 lbs. and exerting at the wheel runs say 30 h.p. at 10 miles an hour, will with 60 per cent. of load on rear axle, exert a vertical force of 4,800 lbs. and a horizontal of 562.5 lbs. at each rear rim, the resultant being about 800 lbs. per lineal inch for six inch tire.

For a pleasure car weighing 4,000 lbs. with 60 per cent. of weight on rear axle and exerting 40 h.p. at the wheel rims with a speed of 35 miles, the vertical force at each wheel is 1,200 and the horizontal 214. The resultant is about 400 per linear inch for a bearing width of 3 inches.

At curves with high speed cars, the horizontal force is considerably increased, for it is impossible to so "bank" a curve as to suit the speed of all classes of traffic.

In the case of wheels transmitting vertical loads only, observation indicates but little dust raising from a road not overlaid with loose dust. Such a wheel will at the point of mathematical tangency have no velocity relative to the road; a vertical velocity is imparted to it and as any section leaves the surface it will raise with it any of the lighter particles that are loose and may come into contact with it. At the driving wheel there is a slight slip which in addition to lifting will throw particles backwards.

These are the forces tearing at the road surface. In some cases they are more than the road can stand. The horse's calk acts somewhat like a chisel. It will pry out the binding material between the stones as well as the latter themselves when the bond is weakened. The driving wheels of motor vehicles push or suck any material thus loosened out of place. The binder loses weight as it parts with moisture; besides this, without moisture it also loses, not only its property of recementing itself under pressure but to a great extent, its binding power as well. The real work of transmitting the stresses due to traffic must be borne by the stone. These are merely held in place by the binder. The latter is gouged out by the horse, drawn or pushed out by the automobile tire, blown away by the wind, or washed off by the rain and a loosening of the upper stone results.

Even on a well consolidated road climate stresses impose a heavy duty. If, however, there be voids the risk of failure increases. Voids may be due to deficient rolling or to the rise of too much clay in the earthy binder. Lumps of this material will bridge the space between stones even under hard rolling. The bridge will break down eventually either from pressure or moisture or a combination of them. A void forms where the bridge was and continues rising until near the surface when ravelling results. The same may be true in the cases of too light rolling.

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* Read at American Road Congress, Detroit, Mich., Sept. 29—Oct. 4, 1913.

† State Highway Commissioner of New Jersey.

When bituminous material is used as binder it is liable to disintegration from weathering, from overheating or from admixture of earthy materials.

An ordinary water bound macadam may lose material by wear up to a thickness of about half an inch a year without being overloaded. The thickness that can thus be lost will vary with conditions, one of which probably is the ratio of the maximum wheel load to the total tonnage borne by the road.

Whatever the rate of waste it must be replaced if the road is to be maintained.

To summarize the foregoing:—

Road ravel from;

1. Improper construction.
2. Overload.
3. Neglect.

In all cases these affect the binder.

Poor workmanship in construction can only be cured by remedying the original defects. These generally show themselves by small local depressions in the surface from which ravelling spreads, in certain cases at an almost incredible speed. In bituminous surface faulty material and thin spots generally show up clearly. In both cases the only remedy is to rebuild the work properly, if necessary, from the subbase up. This is not strictly repair work.

Effect of Overloading and Neglect

In considering the effect of overloading and neglect it must be borne in mind that any given type of construction may be so maintained as to vastly increase its carrying capacity. The problem is largely one of economics and administration. As an illustration, assume in two cases the same foundation—let one road have a water bound macadam surface dressed with a heavy bitumen forming a sheet about one-half inch in thickness and the other a bituminous concrete (mixed method) surface of say two inches. The former will cost about 40 cents for stone and 15 cents for dressing, or 55 cents per square yard, and the latter about $1 (both exclusive of the foundation). With proper care the lighter surface will last about three years under fairly heavy traffic, the heavier one an unknown period, but let us assume twelve years. The total yearly charges against the two may then be stated about as

The fixed charges are 7.2c against 12.3c.

The operating charges 6.8c against 1.7c.

I do not claim that these figures are more than illustrations of the principle involved. They show a great saving in operating charges, those that show up in the yearly tax bill. The fixed charges, however, are just as real and must be met at some date.

For a road with 9,500 sq. yds. per mile the costs as shown in yearly tax charges where depreciation and interest are not visible, would in this case be,

For the dressed macadam, per mile ...	$636.50
For the Bituminous Concrete	161.50

yet as shown above the real cost of the two roads is the same. This case affects our subject because the treatment of a ravelled road surface must depend on the system of maintenance.

In most communities the great consideration is the next yearly tax bill. If that can be kept down for a period the ultimate economy of such a policy receives but slight attention. It is generally easier to get money for a new road than for repairs. A road requiring a large yearly repair charge is condemned without a hearing. The road calling for heavy interest and depreciation charges may be an equally or even more expensive solution; but the interest charge is not so apparent and the depreciation charge is not made. This is simply putting off the day of reckoning which is sure to come. However, the troubles of those in charge ten years hence are usually lightly borne by the officials of today.

If we consider the structure of the road surface we can easily see that the 40 per cent. of voids in the macadam stone will be filled somewhat as follows:—

Surface stone, passing 1-in. ring and caught on ½-in. ring	15% to 20%
Screenings, passing ½-in. ring	15% to 10%

The other 10 per cent. should be composed of sand and clay.

When dry the clay is driven off to a greater or less extent as dust washed away or splashed off as mud. Its place is supplied to some extent by detritus the result of the wear of the larger and heavier materials. These also blow or wash away and the road loses its bond. If our road is not overloaded we can retain its usefulness by making good its losses, with proper materials in their needed proportion. It is here that the trained road man is most needed. Nothing can replace his experienced judgment.

In the case of a ravelled road having first determined that the road was well built we must decide whether the traffic is too great for the type of surface, or whether the failure was due to neglect. If the former we must resurface with some better type. If the latter we can repair the old surface.

Resurfacing should always be preceded by scarifying and by bringing the road up to the necessary depth of stone. For water bound macadam needing greater surface strength several classes of chemical binder may be used of which I shall discuss two, bitumen and lignin.

Application of Bitumen

The bitumen may be applied either by penetration or mixing methods. The former is the cheaper, the latter the more trustworthy. Which method is to be used will after consideration of the care the road will receive depend on the estimate of the overload, as will also the depth of the bituminous sheet. My own observation leads me to question the wisdom of attempting to get any thickness exceeding one-half inch by penetration methods. It also leads me for this class of work to prefer tar to asphalt. The former material appears less sensitive to injury by dirt and to yield better results in repair work.

The lignin binders are derived from the waste products of wood pulp or tannin manufacture. There are cements being also used to bind core sand in foundry work and impart a tensile strength to the binding materials. They will not act on materials soaked in the so-called road oils. The action of some of these materials on slag and red shale is quite remarkable. They are slightly soluble in water and will therefore need renewal. Their application, however, is easy and inexpensive and the effect of successive applications seems cumulative, increasing not only the depth of penetration but the strength of the bond. The waterproofing of lignin bound roads with bituminous tops has been carried out in Connecticut but I am unable to give any facts as to the results.

For water bound macadam roads that have failed through neglect a thin coat of gravel carrying some earthy matter or of screenings or coarse sand mixed with earth will usually cure cases that have not gone too far. In some of the counties of New Jersey it is usual to fill all ruts, depressions, etc., with fine stone and to give the middle of the road a coat of the same mixed with a little clay. Much of this material is wasted by being thrown off the road by the traffic, and the old ruts almost invariably reappear. This method, however, is very successful in preventing ravelling. It seems a false economy to omit rolling and wet rolling, at that. The same is true of patching holes with anything but macadam size stone. The roads treated with small stone are yearly losing depth. The moisture for wet rolling is usually bountifully supplied by nature, in the early spring. It can also be had by the use of hygroscopic salts where water is hard to get. Traffic will usually throw off from the road surface enough stone to pay for rolling.

A treatment of clay, without rolling, will often give astonishing results. Such treatment, however, seems only a palliative not a cure. Roads thus treated become dusty or muddy according to the weather, show a tendency to ravel again and are hard to properly treat with bitumens. They will, however, take the lignin binders with good results, if the dose of clay has not been excessive, or if the excess is swept off before treatment.

In closing a word of warning as to the use of the so-called cold oils may not be out of place. Those of the so-called non-asphaltic class, to a greater extent than the so-called light asphaltic oils, seem to act as lubricant on road materials and to foster pot holes, ravelling, and other failures. It may be possible to properly apply these materials but if so it is rarely done. It is certain that even slight depressions will cause a deep penetration of the road. The dust laying qualities of the material thus absorbed are lost and its lubricating effect given the best possible conditions to get in its pernicious work. Local authorities and even private individuals seem to select roads with uneven surfaces as those on which to use these oils.

The Investigation of Existing Engineering Structures

By Horace R. Thayer

PROBABLY no more difficult, unpleasant or thankless task confronts an engineer than the examination and report on a structure of doubtful safety. The first step in such an undertaking is to obtain the complete dimensions, cross-sections and details of the entire structure. Sometimes these data may be found on the contract plans. There must be used with very great care, however, as it is rare that some changes are not made either at time of erection or in subsequent use.

The character of the material may appear on plans or in the records. Several pieces may be cut out to be tested, or perhaps a visual examination will determine a good deal. The former is the approved method of ascertaining if steel has been injured by fire or accident, while the latter might be of assistance in the case of wood or cast iron. It is extremely important to note the deterioration caused by rot, rust and wear due to traffic. One trouble with steel is that its overload is hard to detect by an examination unless stresses exceed the elastic limit. Workmanship must be determined by eye.

Finally, we must estimate live loads, compute maximum unit stresses in weakest part of each member, and compare results with those allowable by some standard specifications. Before rendering a definite decision, we should consider:

(1) What possibility is there of an increase of loads during future life of the structure? It is quite possible that it might be all right for present conditions but without reserve capacity. In this case the structure should be passed conditionally.

(2) Would some special weakness exist under extraordinary loads? It may be wise to strengthen that part for the sake of the additional security.

(3) Secondary stresses need not be included for designs in accordance with modern practice. But for long members and eccentric loads secondary stresses should be computed, especially for columns. If found to be excessive, say above 15 per cent. of the principal stress, a corresponding reduction in allowable principal stress must be made. We believe that the present tendency is toward the much more logical method of computing secondary stresses and increasing in a like ratio allowable value.

(4) Assistance of parts other than those usually taken as carrying the load, is to be assumed with a great deal of caution. For example,, rails, guard rails, and guard timbers will do much to assist a short, weak I-beam span; but if they are to be figured on, splices must be watched and the trackmen prevented from pulling them up for repairs at a time when the full load is coming on.

(5) Standard specifications have been evolved as a result of the failures and successes of the past and may generally be taken as a safe and dependable guide. For example, the usual clause prohibiting welded joints for members other than counters and wind laterals is to prevent accidents like that of Bussey Bridge.

(6) Particularly to be emphasized are the following points:

(a) Precautions to avoid possible loss of life by fire in a building. Not only should the steelwork be protected as specified, but guard as well against inter-room communication and the exposure to fire.

(b) Provision for wind pressures all the way through the structure.

(c) Fastenings of each part so that its separation from the remainder can be accomplished only by the rupture of the fastening.

(d) Support of long compression members at frequent intervals.

(e) Thorough bracing, especially in localities where high winds or earthquakes may be expected.

(7) It might seem that the margin between an ultimate strength of 60,000 lb. per sq. in. and an allowable

value of 16,000 lb. per sq. in. such as is employed in buildings, is excessive. First, however, let us consider that the structure would be ruined by 35,000 lb. per sq. in., or more probably 25,000, for practical conditions with full-sized pieces. When we come to consider eccentric stresses, overloads, etc., we find our margin nearly exhausted.

As a general rule we suggest:

For good designs allow 10 per cent. excess of stress above specifications; 10 to 20 per cent. overload should receive constant watching; 20 to 40 per cent. is dangerous; above 40 per cent. the structure must be replaced at once.

For poor designs, compute secondary stresses and permit totals to exceed above percentage values by 15. For worn, corroded or injured material, estimate or determine by testing, its strength as a percentage of its original strength, care being taken not to overestimate. Original allowable values multiplied by the percentage give our standards for the particular case.

The Government Dry Dock at Levis

The new dry dock which is to be built by the Dominion government on the St. Lawrence River, near Levis, across the river from the city of Quebec, will have the following dimensions: length from caisson stop to head wall, 1,150 ft.; width of entrance, 120 ft.; depth on sill at ordinary high water, 40 ft. It will be divided in two parts, 650 and 500 ft. respectively, the outer entrance will be closed by a steel rolling caisson, and a floating caisson will close the inner entrance. The dock will be emptied by three electrically driven centrifugal pumps, each having a capacity of 60,000 gal. per min., the current being furnished by three turbo-generators.

The design and construction are under the direction of the Department of Public Works, Eugene D. Lafleur, Chief Engineer, and E. A. Hoare, of Quebec, has been appointed to supervise the execution of the work.

The Levis dock will be when completed the largest dry dock in the world, slightly larger than the present design of the new dry dock under consideration for the port of Boston. This latter dock will be of the size noted in the following table showing the three largest dry docks, one completed, one under construction and one under design:

Contraction and Expansion of Cement and Concrete

Dr. P. Rohland, in a recent issue of Mitteilungen der Centralstelle, has summarized the phenomena of expansion and contraction of cement and concrete as follows: If concrete and reinforced concrete set in the air, contraction takes place; if they set under water, expansion takes place. The latter is true if concrete sets in very damp air. Mixing more sand, or else adding hydroscopic salts decreases contraction. Another method to avoid excessive contraction is to cover the concrete with wet cloths.

If cement is mixed with water, elements in the colloidal state separate, which absorb water and lead to an increase in volume, accompanied by a slight lowering in temperature. As the cement begins to set, the volume gradually decreases, while the temperature increases. The cause of this decrease in volume and increase of temperature is the sudden coagulation of the colloidal elements in the cement which occurs with separation of water.

We have, then, two distinct steps: 1. Absorption of water with increase of volume and decrease of temperature; 2. Separation of water with decrease of volume and increase of temperature. It must be mentioned that the increase of volume in the first period is greater than the decrease in the second period. At the end of the setting process in cement and concrete a considerable decrease of volume takes place, for which allowances must be made, especially if the concrete sets in dry air.

Boring for the Simplon Tunnel

According to our London contemporary, The Engineer, the boring of the second gallery of the Simplon Tunnel is advancing steadily, 1,367 workmen being employed in the tunnel itself and 816 outside it—in all on an average 2,183 per day. The work is in the hands of the Swiss Federal Railways, and is being supervised by Chief Engineer Rothpletz, who was also the chief engineer of the Lotschberg Tunnel. Originally there was talk of handing over the contract for the work to a German firm, whose tender was lower than that of any Swiss firm, but owing to the outcry raised by the Swiss engineers, and more or less by the Swiss in general, the Federal Railways decided to be its own contractor. The total length of the second Simplon Tunnel is 12 miles 555 yards. The length of the completed shaft at the end of last July amounted to 995 yards on the north or Brigue side, and 1,777 yards on the south side. The work advanced during July at the rate of 286 m. on the south and 273 m. on the north side. Of the whole tunnel 11.2 per cent. was completely blasted out at the end of July. So far, no special difficulties have been encountered, and the temperature is as yet not at all unbearable. Great precautions are being taken to ensure the safety of the original tunnel, which it is now recognized ought to have been at a somewhat greater distance from the second gallery.

Rather a striking piece of reconstruction work has been accomplished in Tuscarawas County, Ohio. During the recent floods many bridges were destroyed in this county. One stone pier, however, was found to be intact, but badly settled on one side. The foundations had been laid in the river bed, in 16 feet of water. A diver was employed, who, upon examination, discovered that the pier was resting uniformly upon a bed of gravel. Instead of removing the entire pier, as is usual, the upper part only was removed to a plane 24 inches below the surface. Piles were then driven in around the remaining part; and on these piles a new foundation, over and around the old one, was constructed, and upon this the material of the old pier was reset. Neither cofferdam nor excavation was necessary, as a tight foundation form properly braced contained the concrete which was deposited under the water. The method proved both effective and cheap.

Three hundred men are at work on the new 18,000,000 gallon reservoir being constructed by the city of Winnipeg on Logan avenue, west of McPhillips street, which is being rushed to completion. It is a great hollow structure, and has taken 13,000 cubic yards of concrete and 600 tons of steel rods to complete. Over 600,000 feet of lumber have been used to make the concrete forms. The reservoir will hold three days' supply of water and will be completed by November 1st. The structure is 570 feet long, 460 feet wide and 15 feet high, and will cost $100,000.

Engineering Topics in the Old Land

London Correspondent of the Contract Record Commends Canadian System of Registration and Discusses "Professional Unions"

WITH a view to bringing the constructional interests of Canada more closely in touch with the Old Land and also with a view to setting forth such examples on either side as may be profitable the one to the other, we have completed arrangements with a well-known engineering authority in London, England, to contribute articles dealing with matters of current interest, and particularly with such subjects as may have an international bearing. It is hoped that readers of the Contract Record will show their interest in these articles, which will appear once a month, by contributing letters dealing with the topics under discussion.

The letter published this week deals with two very interesting subjects, the conditions surrounding which find a ready parallel in this country, although from the instances mentioned we are reminded of what the surveyors have accomplished in the way of closing their profession in Canada.

Under the heading, "Professional Unions," our correspondent makes a few observations which are particularly timely in view of the fact that a Canadian Society of Municipal Engineers is now in sight. It comes as a bit of a shock to us who have espoused the cause of such a distinctive society to learn that in England, where there are two such institutions, things are no better than they are in Canada. As to whether it is fair to draw conclusions from this and apply them to Canada is a matter that might well engage our readers in the task of a letter for publication.

London, Eng., September 27, 1913.

The registration of engineers, architects and surveyors is a matter which has been exercising the minds of professional men in this country for several years now. As things stand, anyone may practise in any or all of the professions. No qualification whatever is needed, and it is quite understood that a swagger office and a motor car are more profitable assets than education and technical knowledge.

The ignorance of some, even of the biggest, men in the profession is simply appalling, and many of them depend entirely upon their assistants to carry out the huge jobs that are entrusted to them. Ghosts and jackals, living on the shillings thrown to them by their guinea-earning brethren, abound, and it is among these that the real talent exists. An architect who is now top of the tree in his profession "devilled" for years for firms of auctioneers and estate agents, who, owing to the lack of registration, called themselves also "architects and surveyors." A ghost who is a personal friend of the writer prepared a rough scheme, with estimate and sketch plan, of a large system of tube railways, receiving as his fee a sum of less than twenty guineas! What the engineer who sweated the job out to him obtained for his report, based largely upon the rough scheme, it is not possible to say, but the twenty guineas could well have been squared and then trebled in his case.

Instances such as these, incredible as they may seem, could be multiplied indefinitely. Registration would at least mean qualification of a sort (when the present generation had been weeded out) and the brainy individual would then be given some slight opportunity of coming into his own.

As things are now, numbers of able men are leaving the country to seek for those better opportunities which the Colonies afford, and if they don't find exactly a bed of roses they can (given grit and persistency) at least earn a decent living.

It is quite as well, however, to know the conditions of a country before deciding to emigrate. One of these "able men" who has just returned from Alberta writes: "I then decided to go into real estate and surveying. Unfortunately I found that I could not obtain a surveyor's license to enable me to practise as a surveyor, until I had served twelve months' articles with an Albertan land surveyor."

Another found that there were similar restrictions in British Columbia. He writes: "One cannot subdivide property or make a survey of any description to be put on record unless one is a British Columbia land surveyor, and to get this diploma one has to be articled to a British Columbia land surveyor for a period of three years and take two examinations." Something of the kind here in England is sorely needed, if the nails of the incompetents are to be cut and the men of ability enabled to scratch around for a decent living of their own.

Professional "Unions"

In municipal engineering things are no better, in spite of the existence of two institutions representative of the profession, and the fact that both of them hold periodical examinations and confer degrees. Local authorities are utterly supine, and neither membership nor qualifications count for anything in their eyes. Many appointments are political or avuncular, while the local favorite is always very strong in the running. There are scores of men holding really responsible positions who can neither write nor speak their own language correctly, while the less said about their technical qualifications the better. The natural result of this is that the municipal engineer cannot call his soul his own. His office is entirely unprotected. He is at the absolute mercy of his council. Except in the very largest cities no scheme of superannuation exists, and his tenure of office is often only from mouth to mouth. The wonder is that there are as many good men as there are.

It will be asked, what are the institutions doing? And there can be but one reply: Nothing. The municipal engineer has a horror of the word "combination," savouring as it does of "union," and any reference to trade unionism is taboo in his society. He has not the acumen to recognize that the State-protected professions of law and medicine are the strongest of unions. It is strange to think of some thousands of men, holding responsible posts, spending annually millions of public money, and yet, simply owing to an unreasoning pride, bowing their necks in slavery, suffering untold indignities and receiving (as regards the large majority) a wage that would be scorned by the union bricklayer.

It is to be hoped that any Canadian institution of municipal engineers that may be formed will work upon "union" lines, with the sole proviso that the word union be taken in its best sense and not merely as an aggregation of units bonded together for the purpose of taking all they can get and conceding as little as possible in return—**B.W.**

The West Vancouver Ferry Company has asked the council at that place to bring in a by-law for the construction of a wharf at Dunderave at a cost of $40,000.

Tests of Road Materials

Third International Road Congress

FIVE reports were submitted to the congress on the subject of communication No. 2, "Tests of Materials Used in the Construction of Macadamised Roads." In the British and the American Reports the apparatus used for physical tests of road stones is described and illustrated, the British report including a two-page table showing the results of tests. There is a similar table, giving maximum and minimum values for twenty-seven kinds of stone, in the American report, which runs to twenty-six pages of text and illustrations together, the apparatus being very carefully described and discussed. The French report is a useful summary of tests usually employed, including tests for aggregate materials and mixtures. The Austrian report is mainly a comparison between the wear of stones on the grindstone and that with the sand blast. The German report includes a description of the methods employed in testing samples of road crust taken from the roads, special attention being given to absorption and freezing tests. A few of the most important of the facts reported and opinions expressed are briefly noted below.

GERMANY

Dr. J. Hirschwald, Professor, Technical High School, Berlin-Charlottenburg

The report describes the methods employed at the Mineralogical and Geological Institute of the Royal Technical High School, Berlin, and reference is made to the reporter's work, "Handbuch der Bautechnischen Gesteinsprufung." The investigations into the condition of crusts after they have been in service include studies of chemical combinations. "Experience shows that the good quality of road-surfacing material, above all, depends on the strength and toughness of the stone." Since water expands about one-tenth of its volume on freezing, absorption up to 90 per cent. of saturation is harmless even with very weak stones, but the strongest stones burst on freezing if nearly saturated. This has been proved, experimentally, with many samples.

AUSTRIA

Prof. A. Hanisch, K.K. Oberbaurat, Vienna

In the grindstone test the load is 30 kilogrammes on 50 square centimetres for 440 turns, radius of stone 25 centimetres, 20 grains of Naxos emery No. 3 for every twenty-two turns, the sample twisted through 90 deg. during each revolution of the stone. The sand-blast test is on a cube or plate of 7 cm. edge, the blast pressure being four atmospheres, and the exposed surface a circle of 6 cm. diameter.

A number of samples of basalt showed considerably greater wear in the grindstone test—3.8 to 4.5, 5.7 to 9.5, 7.3 to 8.5, and one sample showed equal wear, 9.8. Granites usually showed less wear on the grindstone—8.1 to 6.0, 8.3 to 7.1, 9.8 to 8.7, 10.2 to 6.7, and so on—but sometimes greater wear on the grindstone—6.0 to 6.9, 6.6 to 7.8—the wear under the sand-blast being much the more variable. Close-grained limestone showed much more wear on the grindstone—8.1 to 23.1, 9.8 to 41.9, 14.5 to 25.1, 15.1 to 21.6 (sand-blast to grindstone). A silicious limestone gave 4.8 to 3.4, and a quartzite 9.9 to 5.8. One sandstone gave less on the grindstone—20.9 to 17.9—but two others 26.2 to 33.7 and 28.3 to 47.9 A hornblende gneiss gave 19.6 to 9.2.

UNITED STATES

L. W. Page, Director United States Office of Public Roads

The reporter's discussions of the values of different tests, and of the relations between one test and another, cannot properly be summarised in a brief and yet intelligible manner, but attention may be directed to the following passages:—

"Investigations . . . seem to indicate that the cementing value depends on certain hydrated colloidal conditions of the particles. All rocks that cement well are hydrated—i.e., contain water of combination—although it does not follow that all hydrated rock powders will cement. It seems that only a certain kind of water of combination is concerned with and measures the cementing value." [There follows a description of a ball mill devised for the testing of the cementing value of rock powders.]

" . . . there is no very definite relation between the Dorry test and the Deval test. . . . There seems to be a more definite relation between the toughness and the percentage of wear for high values of toughness, so that the results of the Deval abrasion test are probably more dependent on the toughness than on the hardness."

"Certainly the hardness test alone is of no value, since the rock might be hard but be entirely lacking in toughness, as evinced by some of the quartzites and sandstones. . . . The toughness test, on the other hand, if satisfactorily passed, would likewise assure a compliance with the hardness requirements. Some form of toughness test, then, seems to be the logical one for testing rocks for road building, whether it be of the Deval abrasion type or some convenient form of the pure impact type. There is much to be said both for and against the Deval abrasion and the impact test."

"The Dorry hardness test, in its present form, is one which requires a good deal of care in order to obtain reliable results."

FRANCE

P. Le Gavrian, Ingenieur des Ponts et Chaussees, Secretary of the Research Commission of the Ministry of Public Works

As regards the Deval apparatus the reporter writes: "It would, perhaps, be of interest to modify the apparatus, for example, by constructing the cylinder with a double tube, the interior envelope being pierced with holes to act as separator sieve for the dust."

"The Dorry mill has some disadvantages [attention is drawn to these as noted by Mr. Page] . . . For this reason at the Laboratory of the City of Paris the substitution of the Dorry machine by a machine giving a cylindrical wear of uniform character has been quite recently thought out. The following is a brief description of this apparatus: A cast-iron drum of 0.60 metres (about 2 ft.) in diameter turns about a horizontal axis; the test pieces are placed in shutter boxes sliding in sockets and supported on the upper surface of the drum on the cylinder; these are two calibrated funnels which allow from the one powdered sandstone and from the other water to flow on to the contact surfaces. A few preliminary revolutions of the apparatus are sufficient to give to the lower face of the sample an initial curve, fitting the surface of the drum exactly; then the height of the sample is measured. This measurement is again taken at the end of the experiment."

Tests of the Point of Fusion of Bituminous Materials.—"The simple result of these methods [a number of which are described] shows how greatly the determination of the point of fusion of materials of pasty nature is subject to variations according to the method adopted, and, with a certain [? a given] method, according to the person who uses it."

THE UNITED KINGDOM

T. E. Stanton and R. G. Batson, of the National Physical Laboratory, Teddington

The machines described are the following: The four-cylinder Deval machine, as used in the United States Office of Public Roads; the Page impact machine, with a 4.4-lb. hammer, acting through a plunger with a spherical surface 0.4 in. in diameter; the Dorry machine, speed twenty-eight revolutions per minute, repeated impact machine for the cementing test, after grinding of the materials in a ball mill and making the briquettes in a moulding machine.

A table of a full series of tests on fifty-one occasions is included in the report.

Test on Three Sweeper Tuec Cleaner

The Engineering Department of Brown University, Providence, R.I., recently conducted an exhaustive test on a Tuec Air Cleaner, results of which are given below.

It is interesting to note the large volume of air given at the end of the hose. This volume would be amply sufficient to pick up any material able to enter the large tool openings or the large hose openings.

A Tuec Vacuum Cleaner (No. 600) was installed in the basement of a building in Providence and connected to suitable openings on the various floors by 3-inch risers to the fourth floor and by 2½-inch risers from there to the eighth. This machine was driven by a 5 h.p. d.c. motor designed to run at 3,500 r.p.m. All tools were attached to the wall openings by 25 feet of 1¾-inch hose.

With all openings closed and a voltage of 498, the motor ran at a speed of 3,416 r.p.m. and used 2.64 kw. Under this condition a vacuum of 2.7-in. was obtained at the machine.

With one floor tool open on the end of a 25 ft. length of hose, the motor used 3.28 kw.

With two floor tools on 25 ft. lengths of hose and one wall socket open, the motor used 5.02 kw.

The vacuum measured at the eighth floor, when all openings were closed was 2.65 inches.

With one 25 ft. length of hose and unequipped with tool, open, the vacuum was 2.5 inches.

With two 25 ft. lengths of hose, and unequipped with tools, open, the vacuum was 2.05 inches.

With three 25 ft. lengths of hose, unequipped with tools, open, the vacuum was 1.8 inches.

230 cu. ft. of air per minute was drawn through one length of open hose when all other openings were closed; 418 cu. ft. of air per minute was drawn through two lengths of open hose when all other openings were closed, and 567 cu. ft. of air per minute was drawn through three lengths of open hose when all other openings were closed.

Enquiries should be addressed to Mr. Jas. J. Martindale at the Canadian factory, 159-61 Richmond street west, Toronto.

Progress on Hydro-Electric Plant of Cedars Rapids Company

The Cedars Rapids Manufacturing & Power Company, which is constructing a very large hydro-electric power plant near Montreal, has issued a progress report showing the amount of work done up to August 23. Part of the work was done by the company but recently a contract for the other portion of the scheme was let to Fraser, Brace and Company. The Cedars Rapids Company is controlled by the Shawinigan Water and Power Company and the Montreal Light, Heat and Power Company. The report states that the following work has been completed: Rock excavation, other than stripping and trench work, 19.85 per cent.; rock excavation in trenches and ditches and stripping seats of bank, 59 per cent.; earth excavation other than stripping and trench work, 43.25 per cent.; earth excavation in trenches and ditches and stripping seats of banks, 36.20 per cent.; transporting and placing excavated rock in entrance works dam, .98 per cent.; transporting and placing excavated rock as stone protection, 1.54 per cent.; transporting and dumping excavated rock other than as per two preceding items, 54.40 per cent.; transporting and placing excavated rock in entrance works dam, .540 per cent.; transporting and placing other earth, 71.40 per cent.; for plain concrete in power house sub-structure, 15.70 per cent.

The report points out that when the canal is finished it will have its outer or south bank practically a straight line two miles long, and parallel thereto a similar bank located on the natural flow of the river, and at a distance from the south bank of about 1,200 feet. The width of the canal on the water line will be about 1,000 feet, and the total length of the canal from the ice fender above the Isle-aux-Vaches to the power house will be about 12,000 feet. Extending across the lower end of the canal and forming a dam, is the power house structure itself. This structure is of concrete, and in the power house is concentrated the total fall of 32 feet given by the difference of level between the top and bottom of the Cedars Rapids.

Several plants have been constructed during the past two or three years, using this single runner type of wheel with success. The units will be very different in appearance from the familiar Shawinigan units, or the smaller machines of the various power plants of the Montreal Light, Heat & Power Company.

The new Shawinigan wheels have a capacity of about twice the Cedars' wheels, but it must be borne in mind that the wheels at Shawinigan Falls are operating under a head of 150 feet, and the amount of water required to develop 20,000 horse-power under these conditions is about two-fifths of that required for the operation of the 10,000 horse-power units at Cedars.

On account of the low head and the available space it was impracticable to use a horizontal type of development. The wheels at Cedars will have a diameter of about 18 feet, and the generators will be about 35 feet in diameter.

The ice fender at the upper end of the canal will not take care of what is known at frazil ice, and special precautions are being taken to prevent interruption from this cause.

Very large units are not susceptible to the same trouble from this kind of ice as smaller units, and a very large amount of this ice will pass through the wheels as the openings through these wheels will be about 7 feet high and 3 feet wide.

As a preliminary to the enlargement of the Canadian canal at Sault Ste. Marie to a depth of 31 feet, the Government is arranging for the expropriation of Whitefish Island and an additional strip of land along the south side of the present canal. The actual work of enlarging the canal must wait until sanctioned by Parliament, but it is understood that a vote will be asked at the next session of Parliament for a preliminary survey and for the preparation of plans. The enlargement of the Soo Canal is a logical sequence to the enlargement of the Welland Canal. The next step will be the enlargement of the whole St. Lawrence canal system so as to give a continuous 30-foot channel right through from the head of the lakes to the Atlantic. This is the big scheme which Hon. Frank Cochrane is reported to have in view, and which the Government, it is said, will adopt. The formal announcement of the whole scheme will probably not be made for some considerable time yet, but meanwhile the enlargement of the Welland and the Soo Canals will be proceeded with.

Mr. W. H. Wheeler, formerly assistant city architect, has been commissioned by the city council of Edmonton to prepare the specifications for the public market building to be erected in First street at a cost of $80,000. It is announced that tenders will be called for at once, so that the work may begin without delay.

Methods of Bituminous Construction[*]

The Penetration Method as Specified by the Pennsylvania State Highway Department—Selection of Materials Governing Factor

By S. D. Foster[†]

THE subject of bituminous construction is such a broad one, and one upon which so much has been said and written, that I will not attempt to discuss its merits, compare it with other types of pavements, or take up the correct method of maintenance after construction, but will deal entirely with the two types of construction most commonly used by engineers today, viz: The bituminous road constructed by penetration method, and the bituminous road constructed by mixing method.

Speaking generally of the two methods of construction, and taking into account the hundreds of miles of bituminous roads already constructed, I feel safe in saying that there is probably no other type of construction about which there is less absolute information concerning the physical and chemical characteristics of the bituminous materials and the road metals which will bring about the best results. There is no type of road construction which requires more care or more consistent expert supervision and inspection than that involved in the use of bituminous material, and, until such time as we are able to thoroughly educate and instruct efficient and capable engineers and inspectors in this type of construction, the same will remain in an experimental stage. In general, also, I would state that the preparation of the sub-grade, the drainage, and the foundation are extremely important factors in the success of bituminous pavements, and, unless properly constructed, will bring about their destruction. I might state at this time that, to my mind, the experimental stage in foundation work has been passed, and, that for the ordinary country traffic to which the average highways must be subjected, an eight-inch Telford foundation, or a five-inch cement concrete foundation, when properly constructed, is sufficient for the carrying of any class of pavement which we may desire to place thereon.

Penetration Method

Presuming that the foundation has been properly completed, I do not believe that I can better describe the method of building thereon a bituminous penetration pavement than by quoting from the Pennsylvania State Highway Department's specifications, to wit:

> "Upon a suitable foundation there shall be spread a layer of broken stone of such quality as may be suitable. The stone shall be broken in fairly uniform and regular cubes, free from dirt or dust, and comparatively free from flakes or splinters. The stone shall be of such size that they will pass a one and one-half inch circular opening and over a three-quarter inch circular opening. This layer of stone shall be of such thickness that, when it has been rolled with at least a ten-ton power macadam roller, it shall have a thickness of three inches.
>
> The surface must be firm and, when completed, correspond to the grade in proper crown of cross-section. Upon each square yard of this surface shall be evenly spread, by means of an approved pressure distributor or fan-spout sprinkling-pot, from one and one-half to one and three-quarter gallons of bituminous material, of a penetration from 90 to 120 lbs.
>
> The bituminous material shall be heated to a temperature of approximately 350 degrees F. Immediately thereafter, sufficient dry, dustless screenings, passing a one-half inch screen, shall be spread in sufficient quantities to evenly cover the surface of the road and take up excess bituminous material. The road shall then be rolled until firm and a smooth surface results and conforms to the longitudinal and transverse section.
>
> While the surface is clean and warm, a seal coat of bituminous material of proper consistency to be flexible when cold, shall be spread one-half gallon to the square yard. It shall be applied while at a temperature of 350 degrees F., and, while the bituminous material is in a liquid state, there must be spread a top dressing of clean, dry, Torpedo sand, or dustless stone chips, in sufficient quantities to cover the entire surface of the road and take up any excess bituminous material.
>
> Immediately thereafter, the road shall again be thoroughly rolled; if so directed, the stone, chips, and sand must be heated. In rolling, the roller should start from the side line and work toward the center, and, in all cases, continued until thorough compression is secured."

By following these instructions, a first-class penetration pavement can be constructed, but, in the experience of the Department, the Engineer has continually occurring the several conditions which I am about to enumerate, any one of which, escaping his attention, will be bound to produce a weak spot in the pavement, to wit: The presence of water in the foundation, due either to wet weather springs, or to rainfall after the foundation has been placed. This condition results in water working up through the telford stone; thence through the stone comprising the aggregate of the pavement; and attacks the bituminous material which, losing its bonding powers, readily disintegrates the pavement. Another condition, ofttimes occurring, is due to the contractor not napping his telford properly and attempting to bring the same to the proper crown and cross-section by the use of stone spalls. These cannot be thoroughly rolled into the foundation, and, when the stone which is to be treated with bituminous material is hauled on the road, the spalls continually work up through the smaller stone and produce a weak place in the finished pavement.

Soft Stone a Problem

The use of soft stone, especially in districts where local stone is used for road purposes, furnishes another problem for the engineer. Soft stone, when placed in the pavement and rolled, may seemingly be treated with bituminous material and thus cover up all cracks or fractures which may have been made by the initial rolling, but the rolling of the pavement, both after the first application of the bituminous material and by the final compacting of the same, will again fracture more or less of the stone aggregate. These fractures, occurring as they do after the application of the bituminous material, will be void of binding qualities and the stone will immediately start to break down through continued rubbing, one piece against the other. This, in itself, produces dust and allows the moisture to penetrate into the pavement, again causing destruction to the bonding powers of the bituminous material. In addition, this soft stone is readily worn away by passing vehicles and serves to shorten the life of a bituminous pavement.

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[*] Presented at the Third American Road Congress, Detroit, Sept. 29-Oct. 4.

[†] Chief Engineer, State Highway Department of Pennsylvania, Harrisburg, Pa.

Stone crushed in quarries, where there is an abundance of stripping, or where there is a strata of soft stone, or stone hauled upon the highway and allowed to stand for several days subject to clouds of dust from passing vehicles, become covered with a fine film of dust particles. Stone of this character, when placed in the road and subjected to the application of bituminous material, cannot be properly bonded, inasmuch as the bituminous material, while covering each stone, is unable to directly bond itself to the stone proper, for the dust layer covering the stone will act as a barrier and, while the bituminous material will or may hold the stone in place in the pavement, it will not have the proper bonding of one particle of stone with another. Stone with a smooth non-porous surface will prove a failure on account of the inability of the bituminous material to adhere thereto. Wet or damp stones result, likewise, in the bituminous material not obtaining any adhesion. It is well also to avoid those classes of stone which do not crush in a cube or near-cubical shape. Stone that break or crush in splinters will not take the compression and will not interlock themselves one with the other in the manner most desired in accomplishing first-class results.

Selection of Binder

The selection of a suitable binder is a most important matter, requiring skill and judgment. There is no one "best" product, and the selection must be governed by a number of conditions. The principal feature to be considered in this connection are: The characteristics of the stone to be used; the manner of applying the bituminous cement—whether the material is to be applied hot or cold, by means of distributors with or without pressure, or by pouring-pots—the quantity and character of traffic to which the road will be subjected; climatic conditions; the cost of bituminous material; and the probable cost of application.

Inasmuch as the results to be obtained are the securing of a compact, uniformly solid paving surface, impervious to water, it is obvious that continued and experienced supervision and exceptional care be taken. Equally important with the selection of the bituminous material is the care with which it must be heated, as the slightest over-heating will burn the product and render it unfit as a binder. It has been my experience that no successful results can be accomplished unless the inspector keeps continually with him on the work a thermometer, with which to test the temperature to which the bituminous cement is being subjected. Another frequent failure occurs through lack of uniformity in the quantity of bituminous material applied to the stone and is caused by crude or careless applications, and cannot bring about proper results. The hand-pouring should be supplanted by suitable mechanical distributors which will apply the bituminous cements under pressure and insure thorough penetration and a more even application.

In enumerating the various mistakes which so often occur in penetration work, I would say that the cause of failures can be readily traced in many instances to faulty plans and specifications, lack of care and judgment in the selection of materials, poor and inadequate equipment with which to carry on the work, inexperienced labor for both skilled and unskilled service, continuation of work during unseasonable or inclement weather, and insufficient funds to expedite the work under way. I might say in passing that probably the most noticeable cause of failure is that a class of incompetent contractors, having absolutely no experience in bituminous construction, bid on highway work and look to the engineering department as a school of instruction for their guidance.

As to what the life of a bituminous penetration pavement will be, time alone can tell, as the body of these roads contains a mass of material that is not evenly, properly, or finely graded. There exist sections that are both coarse and fine, permitting an application of the bituminous binder either in excess or deficiency; and, possibly, in some instances, only a light seal application is secured. While this condition does not exist generally, I must acknowledge that it is there and feel that wherever this method of construction has been, or is being, followed, it is only a question of time until the weak places show signs of disintegration; these, of course, can be repaired by an efficient maintenance force, and upon this maintenance force the probable length of life of this type of pavement depends. Where this class of pavement is supervised under the most expert management, the results at best are only those of a surface character and produce a road that for the time being seems to give satisfactory results.

Bituminous concrete pavements, constructed by the mixing together of stone, sand, and bituminous cement, in mechanical mixers, reduce the chance of failure to the minimum and eliminate many of the causes of failure found in penetration construction.

It is not necessary for me to discuss here the material, its size, quality, or character, or to explain in detail how this mixture is secured, as the average engineer is well acquainted with this type of pavement, inasmuch as it is very similar to the mixtures used in all the large cities for street purposes. While the best results from this type of pavement are obtained by using a cement concrete foundation, it is not absolutely necessary that such a foundation be used, as experience has demonstrated that water-bound macadam roads, where they have been properly drained, can be resurfaced with a mechanical mixture, and the results therefrom compare favorably with those of sheet asphalt streets. This type of construction has been a success and I feel safe in saying that most of the old water-bound macadam roads that have been torn by the heavy traffic can readily be brought to grade, properly crowned, made firm, and covered with a bituminous concrete that will be economical and serviceable for many years.

I do not very much believe in the use of telford foundation for a mechanically-mixed surface, as it is almost impossible to obtain, upon a telford foundation, a surface that will not be more or less wavy, and we all know that bituminously-constructed pavements, which have a wavy surface, are soon doomed to destruction. In the construction of this type of pavement, there are a few points which must be closely watched: The first—and to my mind the greatest—is the resultant mixture produced by the majority of mixers at present in use. There is a tendency in all revolving mixers to bring the large stone together, and, unless in the dumping of the mixer this is closely watched, the purpose of mixing will be defeated, which is that of having the aggregate of different sizes so mixed as to give the lowest percentage of voids. This condition will again arise if the material has to be transported a very great distance from the mixer to the road, as there will be a tendency for the larger stone to work toward the top of the load and the smaller material toward the bottom. So, it is important, in placing the material in the pavement, that it should first be dumped upon a platform, and from there shoveled into place in as uniform a mixture as possible.

I have used two distinct types of mixed bituminous construction. One, a cut-back bituminous material which remained in a plastic state for several days after being placed on the road, thereby bringing about a continuous bonding process, by means of local traffic passing over the road. The result of this was to bring about a perfectly smooth and uniform surface, in which there was probably from 70 to 80 per cent. of mineral aggregate exposed, which furnished traction for horses' shoes and automobile tires, thus eliminating one of the great criticisms of this type of pavement. The other, a straight bituminous material of approximately 60 to 70 penetration, upon which a seal coat was used to bring about a smooth and compact surface.

Care should be exercised in determining the sizes of stone for the type of pavement which is to be constructed. From experience, I do not believe it wise to use any stone larger than will pass through a one-inch ring, in the construction of a pavement upon cement concrete foundation, inasmuch as, in this type of pavement, while the load is seemingly carried upon the surface, it is in reality carried directly upon the foundation, and, if stone larger than one inch in size is used, there will be a likelihood of the larger stone occurring directly upon one another, thus throwing open the chance of fracture to either or both stones by impact from horses' shoes, or weight from the tires of heavily-loaded wagons.

Another point that does not favor the larger stone lies in the fact that sooner or later the stone is exposed in the surface in its largest diameter, again placing it in a position to be fractured by traffic. When such fracture occurs, unless the pavement is treated from time to time with light applications of bituminous cement, it opens the way for moisture to enter the pavement and thus destroys the binding quality of the bituminous material.

Where ordinary care has been taken in the construction of mixed bituminous pavements which have come under my observation, the results obtained fully warrant a continuation of this kind of construction, and I believe that the time is not far distant when the experimental stages of these pavements will be a feature of the past, providing explicit specifications are drawn to plainly designate the quality of all bituminous and other material desired in each individual job, and the old practice of copying specifications and methods in use elsewhere, regardless of local conditions such as drainage, sub-base, and traffic, is discontinued; and providing we are successful in properly educating highway engineers, inspectors, contractors, and the forces, both skilled and otherwise, in connection with the use of all materials that enter into the construction of this class of paving; and I consider that in the very near future there will be little distinction between the general specifications that designate the construction of highway pavements and those that designate the construction of city streets, inasmuch as the automobile and automobile truck—which are the most dangerous factors in the destruction of the average pavement—will traverse the city street and the country road in equal numbers.|

The Third American Road Congress

Detroit the Mecca of Good Road Enthusiasts—Representative Gathering in which Canadians Played Prominent Part

THE Third American Road Congress, which was held at Detroit, Mich., September 29-October 4th, was attended by some five thousand delegates from all parts of the continent. Canada was well represented and Mr. A. W. Campbell, Deputy Minister of Railways and Canals, was among the speakers at the opening session.

Mr. Campbell outlined the Canadian prospective federal legislation to aid in the construction of principal roads, as submitted at the last session of parliament, and vouchsafed the view that interest in the highways movement had not terminated with the differences of political opinion which occurred over the terms of the measure of last spring.

Mr. Campbell impressed upon the congress the importance of planning in a comprehensive way for the requirements of the state, the class of roads necessary, the materials to use and how to use them. He emphasized the maintenance problem and urged that construction should not be undertaken without providing adequate and systematized methods of maintenance.

Mr. W. A. McLean, Provincial Engineer of Highways, who was accompanied by the Hon. Dr. Reaume, Minister of Public Works for Ontario, was particularly active, gathering material upon which to base recommendations for the Ontario Legislature.

The Hon. Dr. Reaume had the honor, on the opening day, of proposing the toast to the President of the United States. "Canada stands for unrestricted reciprocity in road-building," declared Hon. Dr. Reaume, amid applause. He declared that the Government of Ontario purposed to inaugurate a new era of highway construction along modern and approved lines, and to this purpose the Commission, headed by Mr. Magrath, was at work. "We have tried various systems in various localities," proceeded the Minister. "We have sought to open up New Ontario under a system of colonization roads, but we have realized that we cannot thus cope with the situation. In old Ontario we have had the highways improvement act, which worked well for years, but with the advent of heavy modern automobile traffic it has not proved satisfactory. We have a large province, not so densely populated as most of your States. We have a larger problem in that regard than you, and we do not propose to spend money haphazard. At the latest sitting of the Legislature we appropriated $5,000,000 to the work, and there are more millions behind.

Dr. Reaume stated that Ontario would act following the report of the Commission. It desired to be guided by the wisdom of experience, and thus had come to "this school of international philanthropy."

That Quebec proposed to vie with Ontario in the business like enterprise of good road making, was the message of Hon. Mr. Caron, who followed. Quebec desired the Congress to meet in that province because she was deeply interested in what the Congress was doing. "We are ready to take lessons from Ontario, from the United States, or from any country which can teach us," Mr. Caron declared.

Quebec had been working diligently on the road problem for the past three years. The Provincial Government had appropriated $10,000,000 to the enterprise, and already $8,000,000 of this had been applied for by the counties to which it was advanced. In three years hence he expected the big modern trunk highways from Quebec city to Montreal and from Montreal to the border to be completed.

Colonel Sohier, Highways Commissioner for Massachusetts, speaking for the various State Commissions, paid high tribute to Canadian enterprise and endeavor. He gave assurance that the members of the Ontario Commission would find a warm welcome awaiting them wherever they went, and eulogized Mr. W. A. McLean for the work he had already done as Highways Engineer.

An outline of the programme was given in an earlier issue of the Contract Record. Many valuable papers were presented. In our issue of October 1 we published two of these—"Requirements of Waterway Structures," by Mr. A. R. Hirst, State Engineer of Wisconsin, and "The Selection of Macadam Road Material," by Mr. L. W. Page, Director of the U. S. Office of Public Roads, Washington, D.C. Elsewhere in this issue will be found interesting papers entitled, "Treatment of Worn Out and Ravelled Macadam Surfaces," by Col. E. A. Stevens, State Highway Commissioner of New Jersey, and "Bituminous Construction," by Mr. S. D. Foster, Chief Engineer, State Highway Department, Harrisburg, Pa.

An exhibition of road machinery and appliances was held concurrently with the convention. The Office of Public Roads of the United States Department of Agriculture exhibited two series of miniature models, one showing the development of road building from the early Roman roads to the types of road now in use, the other showing all modern types of road, such as sand-clay gravel, water-bound macadam, bituminous macadam, brick concrete, etc. The exhibit also included models of bridges, culverts and drainage structures, electrically-operated models of rollers, etc.

Growing Optimism in the Coast Province

Vancouver Reports Improved Financial Conditions with Several Costly Undertakings Maturing—Fireproof Structures Gaining in Favor Rapidly

Office of the Contract Record,
Vancouver, October 2, 1913.

An examination of the building and contracting situation in the southwestern portion of Canada's Pacific Coast province reveals the presence of a strong undercurrent of confidence in the stability of our principal cities which augers well for future development along the lines of construction in British Columbia. In the city of Vancouver alone, there exists at the present time a more optimistic feeling with regard to future conditions in the local constructional field than has been observed for some months past. There can be no question but that the chief element influencing an improvement in the general outlook is the gradual relaxing in the financial situation in Western Canada. A number of large undertakings which have been tied up for the greater part of this year on account of the difficulty in securing adequate loans are now in a fair way to be successfully launched, and although no definite announcements have as yet been made, it is understood that active operations will in all probability be inaugurated in the case of several extensive projects before the end of the present year.

These include office buildings and hotels in various parts of the city, a theatre with seating accommodation for 1,400 people on the corner of Granville and Nelson streets, a large vaudeville and moving picture theatre near the corner of Carral and Hastings street, another moving picture theatre on Granville street, the new east wing of the Provincial court house costing about $350,000, and quite an imposing list of other buildings ranging in cost between $20,000 and $100,000, on which work is scheduled to commence just as soon as financial arrangements will permit. Credence is being given a persistent report in Vancouver to the effect that the Bank of Commerce has purchased a site at the corner of Pender and Main streets measuring 57 x 120 feet for approximately $3,000 a front foot, and is considering the erection of an extensive branch office building on this location.

One of the most noticeable features in connection with local buildings of recent months is the tendency to erect fireproof structures of a permanent description entailing the use of reinforced concrete, in place of mill construction. Quite a large proportion of the permits taken out this year have been for reinforced concrete buildings and it is estimated that permits for this class of building will show an even greater increase during the ensuing twelvemonths.

On September 25 the number of permits of all classes which had been issued at Vancouver since the first of the month totalled 136, valued at $1,244,888.

In the opinion of the Vancouver building inspector, the value of permits for the whole of this year will fall short of the figures for 1912 by $3,000,000 approximately. This is a comparatively small decrease in view of the discouraging financial conditions which have been in evidence since the beginning of the present twelvemonth period.

Important Additions to Big Hotel

The most important permit issued at Vancouver during September was one for $1,100,000 to provide for the erection of the east wing of the New Hotel Vancouver, and an addition of four storeys to the central portion of the building now under construction. Messrs. Skene & Christie, a well-known local contracting firm, having charge of the entire contract. The first permit taken out for the central portion allowed for only eleven storeys. This will now be increased to fifteen storeys. The section of the new east wing adjoining the central part of the hotel will be eleven storeys high, and the portion fronting on Granville street will be seven storeys. Along with the permit previously taken out, the total cost authorized to date is approximately $2,000,000. The alterations and additions to the west wing will be contained in a later permit. The centre part is to be surmounted by a roof garden forming the sixteenth floor. The present west wing will be left practically as it stands, but several storeys will be added to it in order to conform with the general architectural scheme of the whole.

Splendid New Shaughnessy Heights Residence

Among the list of other buildings for which permits were issued during September was an artistically planned residence for Mr. A. E. Tulk, of Vancouver, costing about $75,000, upon which construction is already well under way at Shaughnessy Heights. This building is designed after the Elizabethan style of architecture. The exterior will be finished in tapestry brick and dressed Haddington Island stone. The roof will be covered with plain English tile, and all chimneys are to be built of brick and stone. The windows will be fitted in steel casements, and glazed with leaded glass. All the principal rooms on the ground floor of the interior, as well as the entrance hall and corridor, will be finished in hardwoods. Enriched plaster ceilings will be a feature in the principal reception rooms, and also in the boudoir, situated on the first floor. The bedrooms and other apartments on the upper floors are to be finished principally in white enamel. Hardwood will be extensively used for the floors throughout the building.

The remainder of the equipment includes among other items, complete plumbing and hot water heating systems. The excavation and concrete pier foundation of this residence were completed some weeks ago, and good progress is being made on the later stages of construction. Messrs. McLure & Fox, of Vancouver and Victoria, are the architects, and the general contract is in charge of Messrs. McPherson & Sinclair, Vancouver.

New Sub-Post Office Described

It is expected that tenders will be invited very shortly for the erection of the proposed sub-post office building in Mount Pleasant, Vancouver, plans for which are now in course of preparation by Mr. A. Campbell Hope. The building is to be fireproof throughout and constructed entirely of British Columbia materials. Below the ground floor the material used will be Denman Island stone; from the ground floor up to the eaves Haddington Island stone and pressed brick will be employed. The cornices and pilasters will consist of stone suitably carved. The interior of the building will be finished in marble slabs. The dados will be of marble and the columns, capitals and moulded cornices will be of carved stone. The floors are to be of concrete with hardwood finish, and terrazzo in places. The building will be heated with hot water and the usual radiator system with ventilation through the outer wall. The windows will be of plate glass made to slide behind the stone tracery. The stairs will be of steel frame with marble treads; the landings and enclosing walls are to be of concrete with marble finish. The cost of the construction will be in the neighborhood of $100,000.

Y. M. C. A. building under construction, Georgia Street, Vancouver.

Progress of the Y. M. C. A. Building

The photograph produced herewith shows the reinforced concrete frame work completed on the new Y. M. C. A. building at Vancouver. This structure has a frontage of 131 feet on two streets—Georgia and Alberni—and measures 132 feet in depth. It is of reinforced concrete and steel construction, the first two storeys being of steel. Terra cotta will be used in the first storey, while the succeeding five storeys will be faced with red paving brick, and the top storey will be of terra cotta with galvanized iron cornice. On the Alberni street frontage the exterior facing will be red paving brick with terra cotta trimmings. All interior woodwork will be of British Columbia fir. The entrance on Georgia street and the vestibule of both entrances will be decorated with terra cotta. The basement floor will contain a cafeteria, kitchen, barber shops, lockers, swimming pool, general lavatory, shower baths, boiler rooms and attendants' rooms. The swimming pool will be a feature of the building. It will measure 75 feet by 24 feet, with a depth of 7 feet 9 inches at the deepest end, grading to 4 feet 3 inches at the other end. The walls of the room in which the swimming pool is located will be lined with white enamel tile. The swimming pool and the floor of the room will be of white hexagonal tile, and there will be a white terra cotta life-rail. There are two spectators' galleries in this room. The floor of the locker rooms will be of cement, while the floor of the cafeteria will be of terrazzo. A filtration plant will be installed to purify the water before it enters the swimming pool. On the first floor will be located the reception lobby, social room, club room, reading room, writing room, the general offices, committee rooms, auditorium and banquet hall, boys' game room, together with coat rooms and dressing rooms. The reception hall is to be panelled in British Columbia fir, and the boys' lobby panelled in burlap. On the second floor there will be a main gymnasium and an auxiliary gymnasium, together with boxing and wrestling rooms, fencing room, physical director's room, club rooms, employment department and class rooms. The floors of the gymnasium will be of maple, and walls of main gymnasium lined with buff brick and walls of auxiliary gymnasium with cement plaster. All the other rooms on this floor will have a covering of battleship linoleum, with the walls plastered with ordinary plaster.

The third storey will comprise the running track, which will have a fir floor covered with felt. The gymnasium will extend in height for two storeys. Besides the spectators' gallery there will be located on this floor a private dining room, ministers' parlor, ladies' parlor, library, museum, educational secretary's room, five class rooms and rooms for headquarters and supervisory and extension agencies.

The fourth, fifth, sixth and seventh storeys will be set aside for bedrooms. On each floor there will be about forty-three bedrooms and one large dormitory. Accommodation will be provided for about seventy-seven persons on each floor, making in all living accommodation for nearly 320. One big lavatory will be provided for on each floor, and each room will be equipped with a telephone. The floors of the dormitories are to be of cement.

Located on the roof will be the laundry. It is placed on the roof in order to save space in the basement. One passenger elevator will be in use. Steam heat will be used throughout, and the building will be equipped with an oil-burning apparatus. The building will be ventilated by a system of fan ventilators, which will change the air about four times every hour.

The total cost of construction has been estimated at approximately $350,000, while an appropriation of $50,000 will be made to cover the interior equipment and furnishings, Mr. H. S. Griffith, of Vancouver and Victoria, is the architect, and Messrs. Booker, Campbell & Whipple, of Vancouver, have charge of the construction .

VICTORIA CONTRACTS PLANNED

Features of the Hudson's Bay Company's New Store

During the third week in September the excavation work on the site of the Hudson's Bay Company's new departmental store in Victoria was inaugurated, and it is expected that the contract for erecting the superstructure will be awarded in a few weeks' time. The building has been closely modelled after the style of the Calgary store, but according to the plans it will be more attractive as regards its exterior appearance than the latter establishment. It will have a frontage of 240 feet on Douglas street and 120 feet on both Fishguard and Herald streets. There will be two fine entrances on the former thoroughfare, and one each on the two other streets. The exterior facings are to be entirely of terra cotta. The base of the pillars on the three street elevations will be square and of exceptionally large dimensions. From the first storey up these will be converted into fluted Corinthian columns, and will provide one of the most attractive features of the architecture. Only four storeys will be proceeded with at present, but it is the intention to add four or six additional floors at a comparatively early date, the plans providing for extra strength in the construction of the basement and lower storeys in order to support the extra floors when these will be required.

The first section of the project alone calls for an expenditure of approximately $450,000, and the cost of the completed building has been estimated at $600,000. Forty departments are being arranged for in the present establishment, and upwards of 400 employees will be required. The equipment throughout will be thoroughly in keeping with the requirements of a modern departmental store, and only high grade materials will be used in the construction. Messrs. Burke, Harwood & White, of Toronto, are the architects.

Personal Mention

Mr. Chas. Curtis, manager of Western Pavers, Limited, Winnipeg, is well known in many parts of Canada. Like many another good man he obtained his early experience in Toronto, receiving his training from such men as Sir William Meredith, Hon. W. T. White, the present Minister of Finance, and others. Mr. Curtis has filled many positions in paving companies. Within recent history he was appointed first commissioner of the city of Saskatoon, Sask., at a salary of $6,000 a year, but resigned the appointment shortly afterwards when he found that his hands were tied, after the manner common to city officials. Mr. Curtis went back to his former business and is doing excellent work as Manager and Secretary of Western Pavers, Limited. Since 1910 his firm has completed contracts for sidewalks and curbs representing almost a million dollars in value. These contracts were in Saskatoon, Regina and Edmonton and have no regard to large quantities of work in the smaller towns and cities of the West.

Mr. Chas. Curtis, Winnipeg.

Mr. E. L. Cousins, Chief Engineer, and Mr. A. C. Lewis, Secretary, of the Toronto Harbour Commission, were in Ottawa last week for the purpose of discussing with the Minister of Public Works the transfer of certain property required by the Commission in the fulfilment of its development schemes.

Mr. J. N. Finlayson has been appointed Professor of Civil Engineering at Dalhousie University, Canada, vice Professor C. D. Howe. Mr. Finlayson was educated at McGill University, and later served for two years as instructor in the department of civil engineering at McGill. He has been with Waddell & Harrington, consulting engineers, during the past two years.

Mr. J. C. V. Horwood, of Messrs. Burke, Horwood & White, has been at Victoria, B.C., in connection with the Hudson Bay Company's new store, for which his firm are the architects.

Sir Maurice Fitzmaurice, the eminent London engineer, who has supervised several big Canadian undertakings and who is a former contributor to this journal, has been invited to proceed to Australia to advise the Commonwealth government on the establishment of a chain of naval bases.

Mr. E. E. Sands, Supervising Engineer, department of Natural Resources, Canadian Pacific Railway, with headquarters at Calgary, Alta., was recently appointed City Engineer of Houston, Tex., succeeding Mr. Frank L. Dormant. Mr. Sands is a graduate of the University of Wisconsin, class of 1900, where he served for the two succeeding years as instructor in civil engineering, when he entered the United States Reclamation Service.

Mr. F. J. Herlihy, of Great Falls, Montana, has been appointed chief engineer of the enlargement of the Montreal aqueduct, the contract for which was recently awarded to the Cook Construction Company, of Sudbury, Ont. Mr. Herlihy has been connected with some of the largest engineering enterprises in the United States, and was until recently engineer in charge of bridge and building construction on the Milwaukee Railway's Great Falls-Lewistown line. He designed and built the west Milwaukee terminals for the Milwaukee road, and also had charge of the bridge and building work for the Milwaukee's Puget Sound division west of Butte. The object of the enlarged aqueduct is to generate 100,000 horse-power, which will be used to pump water into the reservoirs and also to enable a scheme of municipal lighting to be carried out.

Mainly Constructional

The News in Brief—From Coast to Coast

E. J. Ryan, Limited, is the name of a new concern which has incorporated at Vancouver as builders and contractors with a capital of $100,000.

The Dominion Bridge Company have purchased a block of vacant land adjoining their property in Longue Pointe, P.Q., for an extension of their plant.

The North Vancouver district council recently decided to have a building and plumbing by-law prepared so that uniform regulations in that regard would be ready for next year.

Excavation has commenced at the site of the Hudson Bay Company's departmental store at Victoria, B.C. When completed the building will represent an expenditure of $600,000.

The Industrial Foundation & Waterproofing Company, 25 Toronto Street, Toronto, are supervising the installation of the foundation and waterproofing of the new Dominion Bank, Yonge and King streets, Toronto.

It is stated that the largest programme of surface local improvements ever undertaken by the city of Edmonton is now nearing completion. The 1913 programme has involved sixty miles of paving at an expenditure of $1,700,000.

Hamilton By-Product Coke Ovens, Limited, are contemplating the erection of a large plant in Hamilton, Ont. The initial expenditure is placed at $1,500,000. The first unit will be built on a 33-acre site on the bay shore, in the east end, and will consist of 50 ovens, each of 16 tons capacity, operating on 18 hours coking time. A 5,000,000 cubic feet gas holder will also be erected there. The plant will carbonize 1,000 tons of coal per day, producing 700 tons of coke per day. Over 100 men will be given employment at the start. United States capital holds a controlling interest.

The B. C. Granitoid & Construction Company, Vancouver, has been awarded a general contract covering the construction of a four-storey reinforced concrete hotel building in Victoria, for Mr. C. M. Cookson. Mr. L. W. Hargreaves was the architect.

A contract for the crushed rock supply required in the concrete work for the Hudsons Bay Company's new store at Vancouver has been awarded to the Whinstone Macadam Quarries Company, 310 Richards street. The order will embrace about 10,000 cubic yards of material.

Messrs. Perry & Fowler, architects, Vancouver, who have been commissioned by the Dominion Government to prepare plans for the proposed drill hall in the Grandview district, announce that it will be at least the middle of November before the plans are ready for contractors to figure on.

For the month of September Montreal's building permits totalled $1,199,304, a decrease of $146,495, as compared with the same month last year. From 1st January to 30th September the value was $15,816,018, a gain of $2,488,952 over the corresponding period in 1912.

The Department of Public Works of the Dominion Government has awarded a contract to John S. Metcalf Company, Limited, Constructing Engineers, Montreal, for about half a mile of grain shipping conveyor galleries at berths No. 5 and No. 6, Sand Point, West St. John, N.B. The approxi-

Work is due to commence on a modern three-story apartment building with full basement to be erected in Victoria by the Equitable Bond Corporation, Limited. The plans show a building measuring 50 x 120 feet, with brick veneer exterior. The apartments will consist of two and three rooms each.

Mr. Newton J. Ker, the former city engineer of Ottawa, who now occupies a position with the C. P. R. in British Columbia, has submitted an application to the city of Ottawa requesting that he be given a $2,000 retiring allowance—following the precedent of the council in voting this amount to the former city solicitor.

Constructional operations have been started on the new grand stand at the Woodbine race track, Toronto. The total frontage of the stand will be 400 feet and there will be a depth of 52 feet. The seating capacity will be 8,050. There will be three exits. Mr. Geo. W. Gouinlock, of Toronto, is the architect.

In the recent competition for plans for the proposed Hollywood School in Victoria, the designs submitted by Messrs. Spurgin & Wilkins, a local architectural firm, were awarded first place. Second place in the competition was given to Mr. Arthur Fleet, also a local architect. It is intended to undertake construction of this new school without delay.

E. F. Giberson and Company, Limited, Montreal and New York, have obtained the contract for supplying "Real Bedford" Indiana limestone for the Express Terminals of the C. P. R., Toronto, for which Messrs. Hutchison, Wood & Miller, Montreal, are the architects, and the Peter Lyall & Sons Construction Company, Limited, the general contractors.

Messrs. Cauchon & Van Tyne, architects, have completed plans for a seven-storey steel building, 25 x 150 feet, on Rice street, Edmonton, for Mr. Edwin Auld. The cost is placed at $110,000. The lower floor will be a store, with 70 offices on the six upper storeys. Tenders have been called for the construction work. The building is to be completed early in 1914.

It is understood that tenders for a large apartment block to be built on the Fairfield Estate in Victoria will be called for at the beginning of October. Mr. Bryant Newbold is the architect for this structure, which is estimated to cost approximately $70,000. No details of the construction other than that the building will be modern and fully equipped, are available at the present time.

Messrs. Sloane & Harrison, of New Westminster, were recently awarded the contract for building an addition to the Dominion Government building in that city, which will provide increased accommodation for the postal and other departments. The tender was for $48,000, but the structure will cost altogether about $60,000. The building will be three storeys high, with a basement—on a ground space of 32 by 54 feet.

Plans for the Prince Rupert drill hall, for which tenders closed at Ottawa on September 23, call for a building of cement, stone and brick construction. It will have a length of 201 feet and a width of 84 feet. The drill hall proper will measure 125 x 77 feet. A nine foot basement is provided for and will be used as a shooting gallery. The outside measurement of the height of the building is 104 feet. No estimate of the cost of construction is available at present.

At the annual general meeting of the British Columbia Society of Architects, Vancouver chapter, held on September 4, the following were elected as the new executive and council for the chapter, year 1913-14: Mr. C. J. Thompson, president; Mr. W. M. Dodd, vice-president; Mr. J. Drummond Beatson, honorary secretary; Mr. Robert Lyon, honorary treasurer. Council: Messrs. G. A. Birkenhead, Franklin Cross, C. B. Fowler, W. F. Gardiner, G. A. Horel, W. T. S. Hoyt, T. E. Julian, J. G. Liebert, J. L. Putnam and F. G. Gardiner.

The Toronto Board of Control has awarded the first contracts in connection with the Humber boulevard. The Asphaltic Concrete Company will construct a rocmac macadam pavement on the east bank of the Humber from the G. T. R. north to connect with Dolorway Point. The cost will be $1.62 per square yard. The same company will construct a rocmac macadam pavement on the east side from Bloor street, Weatherel street north and west to Gamble avenue for $1.67 a yard or 3,755 square yards for $6,262.50.

"Consol" Canadian-made transits and levellers, manufactured by the Consolidated Optical Company, Limited, 400 Richmond street west, Toronto, are the subject of an illustrated pamphlet which contains testimonials from a number of city engineers, railroad engineers and others. The company has every facility at its extensive plant and they claim that in buying a Canadian-made instrument not only is the duty saved but an instrument obtained that is adapted to local use and which can be repaired readily by the men who originally built it. Catalogue and quotations will be sent on request.

An Edmonton despatch says that the Government's long looked for solution to the Alberta and Great Waterways difficulty has been found in an offer from J. D. McArthur, Winnipeg, who has now under construction the Edmonton, Dunvegan and B. C. Railway. Mr. McArthur proposes to take over the A. and G. W. Railway and construct the line between Edmonton and Fort McMurray on a route approved by the Government, the specifications, however, to be similar to those of the E. D. and B. C. Railway. If the mileage between terminals does not exhaust the guarantee the remainder will be used for branch lines on similar terms, to be later specified by the legislature.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Harrow, Ont.
The Village Council plan new waterworks system for fire protection purposes. Further information from Clerk.

Montreal, Que.
Sewer, cost $4,000, Wiseman Ave., for Town of Outremont. Sec.-Treas., Mr. Sampson, Town Hall. Engineer, Mr. Duchastel, Town Hall, Outremont. Tenders received by Sec.-Treas. till Oct. 8.

Concrete sidewalks planned by Board of Commissioners. Sec., L. N. Senecal. City has decided to do this work themselves and has contract with cement people to purchase all material.

Ottawa, Ont.
Pavement, cost $5,000, Lakeside Ave., planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Macadam pavement with tarvia finish. Tenders will be called this week.

Stamford Twp., Ont.
Waterworks, cost $10,000, planned by Twp. Council. Clerk, C. F. Monroe, Southend. Engineer in charge, J. C. Gardner, Niagara Falls. Specifications at office of Engineer. Artesian wells, electric pumping plant, pipe line.

Toronto, Ont.
Tenders received until October 9th for construction of Midway sewer system, outlet via Hiawatha Ave., Gerrard St. and Morley ave. Plans at office of Works Dept. Board of Control. Mayor, H. C. Hocken.

CONTRACTS AWARDED

Barton Twp., Ont.
Macadamizing roads, Kilbogie Survey, planned by Twp. Council. Clerk, A. G. F. Bryant, Hamilton. Reeve, Mr. Gallagher, 16 James St. S., Hamilton. Engineer-in-charge, E. G. Barrow, John St. S., Hamilton. General contractor, R. J. Crossmore, Chedoke, Ont.

Beamsville, Ont.
Cement walks planned. Clerk, S. B. Bisbee. General contractors, Jeffries & Boughner. 12c. per ft.

Estevan, Sask.
Waterworks and sewers planned by Town Council. Sec.-Treas., P. J. Stephens. General contractor, Town Engineer. Engineers, Chipman & Power. Work being done by day labor.

Moncton, N.B.
Watermain, cost $767.70, John and Birch streets, planned by City Council. Engineer, J. Edington. Chairman, S. O. Humphrey. General contractors, Dan & Pat Gotro. Work to start at once.

Twp. Sandwich East, Ont.
Concrete pavement planned. Engineer, Owen McKay, Walkerville. General contractors, Guoin & Desjardins, Tecumseh, Ont.

Toronto, Ont.
Sewer, East Toronto Section A outlet, $86,000. General contractors, Jennings & Ross, 79 Spadina Ave. Transferred from Commissioner of Works.

Pavements planned by Board of Control. Bitulithic on Rosemount Rd. and Biggar ave., to the Warren Bituminous Paving Co., 103 Bay St., $12,674; brick block on St. Clair, to Grant Constructing Co., 50 Front St. E., $11,839; concrete on lane north of Queen E., from Parliament, to Riverdale Concrete Paving Co., 256 Jones; concrete on lane west of Yonge south from Elm, to A. J. Penberthy, 292 Booth ave.; General contractors, The Asphaltic Concrete Company, 74 King St. E.: brick block on Sorauren, $2,695; brick block on Sterling Rd., $16,990; concrete curbs, Sorauren ave. to Ramsay Contracting Co., 39 Indian Rd. Cres. Sterling Rd. to A. R. Buckles.

Sidewalks planned by Board of Control. General contractors, Grant Contracting Co., 50 Front St. E. Chalmers, Rockwell & Howick ave., $1.08 per lin. foot. Concrete curbs, Erindale Ave., to the Constructing & Paving Co., Confederation Life Bldg., 41c per foot. Concrete curb on Smith St., to Routly & Summers, 47 Benlamond at 45c per ft.

Sewage pumps, cost $4,227, required by Board of Control. General contractors, Drysdale & Co. Three motor-driven centrifugal sewage pumps for main drainage works.

Foot bridge, cost $12,000 over Don River, planned by Board of Control. Mayor, H. C. Hocken. Commissioner Harris has forwarded plans to Works Committee.

Sewer, cost $29,340, planned by Board of Control. General contractors, Gawne Contracting Co. Sec. No. 3 Wilton Ave., storm overflow sewer.

Valleyfield, Que.
Concrete wall, Beauharnois Canal, planned by Dom. Govt. Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, Cossette & Co., Valleyfield.

Walkerville, Ont.
Pavements, cost $8,000, planned by Town Council. Clerk, Cecil H. Robinson. Engineer, Owen McKay. General contractors, Cadwell Sand & Gravel Co., 84 Sandwich St., West Windsor. 5,000 sq. yds. concrete pavements on several streets.

Pavements and sewers planned by Town Council. Clerk, Cecil H. Robin- Public Works, until Oct. 29th. Plans, specifications, etc., at offices of J. G. son. Engineer, Owen McKay, C.E. General contractors, T. Chick & Co., Bruce and Elliott Sts., Windsor.

Welland, Ont.
Sewers, cost $10,000, Ross St. Chairman Sewerage Com., James Hughes. Clerk, C. M. Webber. Engineer-in-charge, D. T. Black. General contractor, I. Y. Harper, St. Thomas.

Winnipeg, Man.
Water main and granolithic walks, planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Ashley, engineer of construction.

Railroads, Bridges and Wharves

Province of Alberta
C. P. Rly. have approved locations of stations situated at Strathmead, N. E. ¼ Sec. 14-22-27, W.4.M. and at Strangmuir, S. W. ¼ Sec. 23 to 25, W.4.M.

Balgonie, Sask.
C. P. Rly. will construct 2 tracks of a Wye adjoining S. boundary of company's main line in Sec. 3-18-17, W.2.M.

Berlin, Ont.
G. T. Rly. has been authorized to construct siding across Wellington street.

Chocolate Cove, N.B.
Dredging and wharf extension. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 29th. Plans, etc., at office of F. G. Goodspeed, Dist. Engineer, St. John, N.B., Postmaster, Chocolate Cove, and at Dept., Ottawa.

Findlater, Sask.
C. N. Rly. has been authorized to construct branch line to gravel deposit near Findlater.

Hamilton, Ont.
G. T. Rly. has been authorized to construct sidings for Otis-Fensom Elevator Company.

Railway construction. Mayor, John Allan. City Solicitor, F. R. Waddell. Engineer, A. F. Macallum. On Oct. 10 at a meeting of the Dominion Railway Commission the city will present plans to have all lines enter via a north end route and the T. H. & B. tracks on Hunter St. from Aberdeen Ave. to Baillie St. abandoned. It is planned to have a common entrance for all railways and a Union Station at James and Stuart Sts. The G. T. Rly., C. P. Rly. and T. H. & B. are interested.

Havelock Sub-Div., Ont.
C. P. Rly. Co. has been authorized to construct bridge No. 75.6.

Kincardine, Ont.
Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of

Sing, Dist. Engineer, Confed. Life Bldg., Toronto, H. J. Lamb, Dist. Engineer, Windsor, Postmaster, Kincardine, and at Dept., Ottawa.

London, Ont.
London & Lake Erie Transportation Co. will build new line into London Brick Company's plant. Manager, S. Warburton.

Montreal, Que.
12 street cars and equipment required for Montreal & Southern Co. Rly., Canadian Express Bldg. Tenders received by Mr. Powell, c/o. Company.

C. P. Rly. Co. have approved clearances for new train shed at Windsor St.

Ottawa, Ont.
Bridge, cost $50,000, Bank St., planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Recommended to be built of steel instead of reinforced concrete, bridge will be 60 ft. wide.

Province of N.B.
Moncton & Northumberland St. Rly. will construct railway from Richibucto to Buctouche, a distance of 19 miles.

Province of Ontario
Michigan Central R. R. will construct bridge over Alexander Drain between Comber and Ruscomb.

Regent, Man.
C. P. Rly. will construct station on its Boissevain-Lauder Branch.

Regina, Sask.
C. P. Rly. authorized to construct spurs into premises of J. B. Tudhope & R. A. Carman, lots 31 to 40, block 200.

St. Jean Port Joli, Que.
Wharf improvements. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 28th. Plans, specifications, at office of J. A. Tremblay, Dist. Engineer, Montmagny, Chas. Chapais, Dist. Engineer, Post Office Bldg., Quebec, Que., Postmasters, St. Jean Port Joli, and at Dept., Ottawa.

Schepler, Ont.
C. P. Rly. Co. have approved location of station at mileage 51.4 on Fort Nicholl sub-division.

Stratford, Ont.
Water storage tanks. G. T. Ry. Co. contemplate the purchase of water storage tanks. Master mechanic, Mr. R. Patterson, Stratford.

Thornbury, Ont.
Harbor improvements. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 29th. Plans, specifications, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life. Building, Toronto, J. H. Armstrong, Dist. Engineer, Midland, Postmaster, Thornbury, and at Dept., Ottawa.

Toronto, Ont.
Board of Control has been authorized to construct viaduct carrying Bloor St. across property of C. P. Rly., C. N. O. and G. T. Rly. to connect with Danforth Ave.

Station and viaduct, cost $5,000,000, for C. P. Rly. and G. T. Rly., Montreal. Architects, Ross & MacDonald, 1 Belmont St., Montreal, and Traders Bank Bldg., Toronto. Plans will be ready to call tenders about January 1st, 1914. Steel, reinforced concrete and brick construction, concrete foundation.

Welland, Ont.
G. T. Rly. Co. has been authorized to construct siding into premises of S. L. Lambert.

Wellington, Ont.
Harbour improvements planned by Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Oct. 29th. Plans, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto Postmaster, Wellington, and at Dept., Ottawa.

Winnipeg, Man.
C. P. Rly. Co. authorized to construct spurs for Dominion Bridge Co., Ltd., on Saskatchewan ave. and extension to spur into premises of Western Coal Co., Ltd., Parish, St. John.

Yorkton, Sask.
G. T. P. Branch Line Co., has been authorized to construct spur for the International Harvester Co. of Canada, Ltd., turning out from its Yorkton branch in a northerly direction across Broadway in Sec. 35-23-4 and Sec. 2-26, W.2.M.

CONTRACTS AWARDED

Canso, N.S.
Wharf, cost $6,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Andrew McConnell.

Dorchester, N.B.
Reconstruction of wharf, cost $16,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Island Dredging & Construction Co.

Granby, Que.
Railway construction for Montreal & Southern Rly. Co., Can. Express Bldg., Montreal. General contractors, Ross & McCombe. Mr. Ross, c/o Queens Hotel, Montreal.

Levis, Que.
Double-tracking railway to Chadiere Junction, for Intercolonial Rly. Co. Manager, F. P. Gutelius, Moncton, N.B. General contractors, Messrs. Soper & McDougal, c/o Gen. Manager. Eight miles double track.

London, Ont.
Bridge, cost $28,000, Wharncliffe Rd., planned by City Council. Chairman No. 2 Com., B. W. Bennett. Engineer, W. N. Ashplant. Steel work, Hamilton Bridge Works Co., Barton and Bay Sts., Hamilton.

Twp. Sandwich East, Ont.
Concrete culvert planned by Twp. Council. Engineer, Owen McKay, Walkerville. General contractors, Guoin & Desjardins, Tecumseh, Ont.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
Operating room, cost $3,000, contemplated by Hospital Board. Chairman Bldg. Com., Dr. Bell. Architects, Wicks & Green, Buffalo, N.Y. Tenders to be called shortly.

School contemplated. Finance Com. of City Council recommend by-law to raise $45,000 for new building in Eastwood.

Calgary, Alta.
Industry housing building, cost $250,000, 9th and 5th, planned by City Council. Clerk, J. M. Miller. Architect, Alex. Piria, Board of Trade Bldg. Six stys. and basement, 100 x 130. By-law carried Sept. 27th.

Stock yard, etc., cost $350,000, planned by City Council. Clerk, J. M. Miller. Interested, President Negilus, of The United Farmers of Alberta. By-law carried Sept. 27th.

Hospital, cost $30,000, planned by City Council. Clerk, J. M. Miller. Ratepayers passed by-law to raise above amount for Tuberculosis Hospital.

Dunnville, Ont.
Alterations and extension to lodge, Canal St. W., planned for L. O. L. No. 161. Sec. Bldg. Com., Chas. R. Bilger. Chairman, J. W. Holmes. Bulk or separate tenders received by Sec. until Oct. 16th. Plans and specifications from either Chairman or Secretary.

Fredericton, N.B.
School contemplated. Sec.-Treas., Chas. Simpson. Architect, F. Neil Brodie, 42 Princess St., St. John. Site on Smythe St. has been selected, 230 x 126. Plans will be prepared.

Guelph, Ont.
Prov. Govt., Dept. of Public Works, contemplate new Dormitory building to be erected for Ontario Agricultural College. Plans will be prepared.

Gaspe Basin, Que.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 27th. Plans, etc., at office of Chas. Chapais, Dist. Engineer, Post Office Bldg., Quebec, Que., Post Office, Gaspe, and Dept., Ottawa.

Graham Hill, Sask.
School contemplated for Shakespeare School Dist. No. 3057. Treas., S. C. Smith, Graham Hill. Plans will be prepared.

Kingsville, Ont.
Public building. Tenders received by Secretary, Dom. Govt., Dept. of Public Works, R. C. Desrochers, Ottawa, until Oct. 27th. Plans, specifications, etc., at office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at Department, Ottawa.

Marengo, Sask.
School, cost $2,100, planned for Pizarro School Dist. No. 2984. Treas., Hugh H. McNaughton, Marengo.

Medicine Hat, Alta.
School, cost $150,255, for School Dist. No. 7. Treas., R. M. Napier. Eight rooms, brick and stone construction. Plans in progress.

Montreal, Que.
Public bath, Ontario St., planned by Board of Commissioners. Sec., L. N. Senecal. Architect, Dalbe Viau, 76 St. Gabriel St. Tenders close with Architect, Oct. 10, for General Contractor.

Fire and police station, cost $85,000, Bois de Boulogne. Architect, C. A. Reeves, 58 St. James St. Former tenders were too high, new tenders will be received by Commissioners from Oct.

13th to 23rd. Two storeys, 80 x 120. Board of Commissioners. Sec., L. N. Senecal.

Fire station, cost $85,000, Ottawa and Young, contemplated by Board of Commissioners. Sec., L. N. Senecal. Architect, D. I. Spence, 46 Beaver Hall Hill. Tenders called shortly.

Club and library contemplated for Mechanics Institute, Mr. Hamilton, St. James and St. Peter Sts. Architect not chosen. Site not yet decided on.

Neville, Sask.
School, cost $8,000, contemplated by Neville School Dist. No. 2846. Treas., A. J. Grenache. Brick veneer construction. Plans will be prepared.

Ottawa, Ont.
H. Brouse, 168 Sparks St., is seeking permission from Council to erect theatre on Bank St.

Owen Sound, Ont.
Normal school contemplated by Prov. Govt. Dept. of Education. Minister, Hon. R. A. Pyne, Toronto. Plans will be prepared.

Peace River Crossing, Alta.
School contemplated for School Dist. No. 2526. Treas., H. A. George. Building material and school equipment required.

Quebec, Que.
Heating and ventilating of post office. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 16th. Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Post Office Bldg., Que., Postmaster, Que., and at Dept., Ottawa.

Sapperton, B.C.
Church contemplated for St. Mary's Congregation. Plans will be prepared.

Sorel, Que.
Post office fittings. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, will receive tenders until Oct. 14th. Plans and specifications at office of R. L. Deschamps, Overseer Public Bldgs., Post Office, Montreal, Postmaster, Sorel, Que., and at Dept., Ottawa.

Toronto, Ont.
Three schools, cost $34,000, contemplated by Scarboro Twp. Council. Clerk, Thos. Crawford, Agincourt, Ont. By-laws have passed Council and plans will be prepared.

Public lavatory, Birch Ave., N. Toronto, planned by Board of Control. Mayor, H. C. Hocken. Property Commissioner Chisholm has secured site.

Church for St. Francis Congregation (R. C.), Arthur and Grace Sts. Rev., W. A. McCann, 15 Grace St. Site secured for new building, N. E. corner Grace and Mansfield. Plans will be prepared.

Vancouver, B.C.
Addition to hospital contemplated by Vancouver General Hospital Board. Plans will be prepared.

CONTRACTS AWARDED

Bury, Que.
Drill hall, cost $11,750, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, A. Cromwell, Cookshire, Que.

Dresden, Ont.
Public library, cost $10,000, planned by Town Council (Library Board). Sec. of Board, Thos. Conway. Architect, W. A. Mahoney, Guelph. General contractor, Geo. Clark, Dresden. Mason, F. Jennings, Dresden.

Edmonton, Alta.
Fire hall and police station, cost $35,000. Mayor, Mr. Short, Civic Office. Clerk, C. Cox, Civic Offices. Architect, A. Jeffers, Civic Offices. General contractor, Owner, Construction Dept. Two storeys, 68 ft. 3 in. x 103 ft., brick construction, concrete foundation. Excavating started.

Galt, Ont.
Repairs to Town Hall. Clerk, Jos. McCartney. Roofing, Brown-Jarvis Roofing Co., 205 Colborne St., Brantford. Metallic roofing.

Little River, N.B.
Hatchery, cost $11,000, for Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. General contractor, E. W. Green, Tisdale House, St. John, N.B. Concrete work, Jas. Sproul, 281 Princess St.

Montreal, Que.
Church, cost $80,000, for Fabrique of St. Francois Xavier, Longue Pte. Architects, Gauthier & Daoust, 180 St. James St., Montreal. General contractor, Jos. Fateux, Laurier and De L'Epee, will call tenders for roofing about December 1st.

Hall, cost $3,200, for C. C. Holland, 519 St. Catherine St. W. General contractor, Mr. Hill, Ritz Carleton Hotel, doing work by day labor. Alterations to interior woodwork, painting, etc.

Post office, cost $70,000, Westmount (Greene Ave.). Dom. Govt. Dept. of Public Works. Sec. R. C. Desrochers, Ottawa. General contractors, excavating and brick, Jno. Quinlan & Co., 4412 St. Catherine St. W. General contractor called for tenders for all other trades on Oct. 6th. Two storeys, 102 x 85.

Newmarket, Ont.
Isolation hospital planned by Industrial Home Commrs. of York County, J. G. Cornell, Scarboro, Ont. General contractor, W. B. Graham, 543 Jarvis St., Toronto. Will sub-let all trades except carpentry.

Ottawa, Ont.
Church for St. Peters Evangelical Lutheran Congregation. Pastor, 250 Lyon St. Architect, Hubert Shleacow, 45 Sparks Chmbrs. Mason, McDiarmid & Tyndall, 243 Flora. Carpenter, Alexander & Campbell, 587 Lisgar. Sheet metal, Wood & Co. Plastering, H. McNulty, 641 King Edward. Painting, D. Rankin & Son, 291 Sunnyside. Heating and electrical not let. Plumbing, McKinley & Northwood, Rideau Sta. Cement block construction.

Petrolia, Ont.
Citadel, cost $7,000, for Salvation Army. Major McGillivray, London. Architect, Major Miller, S. A. Headquarters, Toronto. General contractor, H. Clark, Petrolia.

St. John, N.B.
Observatory, cost $25,000, Douglas Ave., for Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Prince William St. Foundations in.

South Edmonton Alta.
Business college, cost $10,000, Whyte. Architect, general contractor and carpenter, N. Cuthbertson, 113 8th St. S. W. Mason, Mr. Provincial, Main St. Painting, Cameron Paint Co., Namayo Ave. Heating, Reliable Plumbing & Heating Co., 544 9th St. Electrical, Burnham Frith Elec. Co., Rice St. Interior fittings, roofing and plastering not let yet. Two storeys, 33 x 68, brick construction, felt and gravel roofing.

Toronto, Ont.
Church, cost $50,000, Sunnyside, for Howard Park Methodist Church. Architect, W. G. Burns, 74 Indian Grove. Mason, H. H. Hall, 6 Park Place. Carpenter, W. A. Rumney, 886 Dufferin St. Basement only to be finished now, main building to be started in spring. 50 x 108.

Theatre, cost $8,500, 373 Yonge St., for E. Jackson, 661 Spadina ave. Architect, J. W. Sidall, Confederation Life Bldg. General contractors, Hall & Sons, 516 Manning ave. Steel, Dom. Bridge Co., Victoria St. General contractors will not sublet. Two storeys, 33 x 130. Walls started.

Welland, Ont.
Rebuilding court house, cost $1,000, East Main. Co. Clerk, R. Cooper, Welland. Inspector, J. C. Laughlin, Thorold, Ont. General contractors, Clark & Son (of Toronto), Welland. Electrical, McMurray Bros., Welland, $856.24.

Business Buildings and Industrial Plants

Calgary, Alta.
Flour mill, cost $1,400,000, contemplated for Calgary Flour Mills Co., Ltd. President, O. G. Devenish, c/o O G. Devenish & Co., 813a 1st St. E. Vice.-Pres., T. M. Fyste, 605 14th Ave. W. Sec., A. W. Pryce Jones, c/o Pryce Jones (Canada), Ltd., 12th Ave. and 1st. St. W.

Flour mill contemplated for Lake of The Woods Milling Co., 212 McDermot Ave., Winnipeg. Company are looking for a favorable site and plans will be prepared.

Dundas, Ont.
Addition and alterations to drug store, King St., for Thos. H. Ralph. Architect, M. H. Hewitt. Roughcast construction. Plans in progress.

Forest, Ont.
Addition to factory planned for Forest Basket Factory. Pres., Thos. Maylor. Company will double capacity. By-law passed Sept. 29th granting exemption from taxes for 10 years.

Ingersoll, Ont.
Addition to piano factory, cost $25,000, contemplated for Evans Bros. Architect to be selected. White brick construction.

London, Ont.
Addition to garage, cost $10,000, contemplated for R. Hueston & Sons, Wellington St. Architect to be selected. One storey, white brick construction.

Mansonville, Que.
Pasteurizing plant for Lyndonville

Creamery Assn., will be installed, similar to the one in operation at Glen Sutton, Que. Manager, A. Rice, Glen Sutton.

Montreal, Que.

Store and residence, cost $12,000, St. Hubert, for Philippe Picard. Three storeys, 50 x 95, concrete foundation, felt and gravel roofing. Plans in progress.

Office building, cost $350,000, St. James near McGill, for Marcil Trust Co., 180 St. James St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Square. Contractors bidding, Geo. A. Fuller Co., 210 Reid Bldg., Norcross Bros., New Birks Bldg. 10 storeys, 78 x 104.

Bank building contemplated, Maisonneuve, for Bank of Montreal, 109 St. James St. Architect not chosen. Further developments later.

Alterations to stores, Bleury St., for J. E. Wilder, 41 Major St. Plans in progress.

One store and 2 flats, cost $4,500, for Roch Lussier, 2853 St. Lawrence. Three storeys, 25 x 50, brick foundation, felt and gravel roofing. Plans ready.

North Sydney, N.S.

Stores and offices, cost $15,000, Commercial street, planned for N. A. McMillan and W. M. McCallum. Tenders received by N. A. McMillan. Two stys., brick and concrete foundation, brick construction, concrete and red facings.

Niagara Falls, Ont.

Brick manufacturing plant, cost $50,000, Victoria Ave., contemplated for John Dawson, Trustee, Huron and Welland Ave. Plant for manufacture of plain, wire cut and pressed brick. Electric power to be used. Plans will be prepared.

Ottawa, Ont.

Alterations to stores, cost $4,000, Slater, for C. B. McTaggart, 341 McLeod. Architect, W. Herbert George, Castle Bldg., Queen St. Plans drawn.

Addition to warehouse, cost $10,000, for S. J. Major, Ltd., York St. Architect, C. P. Meredith, 126 Sparks St. One storey addition, brick and reinforced concrete construction, electric lighting. Plans in progress.

Regina, Sask.

Foundations for warehouse, for Campbell Bros. & Wilson, Princess and Bannatyne Sts., Winnipeg. Architect, J. H. G. Russell, 1110 McArthur Bldg., Winnipeg. Six storeys, 103 x 108, brick and mill construction, stone trimmings, concrete foundation, electric lighting, steam heating, 3 freight elevators. Foundation will go in this year. Plans not completed for remainder yet.

St. Catharines, Ont.

Garage, cost $5,000, Queenston St., for W. C. Warren, Nelson St. Tenders received by Architect, Joseph Daw, 165 St. Paul St., until Oct. 4th. Two stys., 35 x 46, brick construction, concrete foundation.

South Dorchester Twp., Ont.

Farm buildings, cost $4,000, for Angus Taylor, Belmont P. O. Fireproof construction and roofing, concrete foundation. Plans in progress.

Toronto, Ont.

Coal shed, Dufferin and Belt Line, for Conger Leigh Coal Co., 95 Bay Street. Site purchased, 265 x 115 and plans will be prepared.

Factory, cost $40,000, planned for R. Crean & Co., 12 Balmuto St. Architects, G. M. Miller & Co., 93 Yonge St. Contracts not yet awarded. Four storeys, 50 x 132, steel and brick construction, brick foundation, felt and gravel rfg.

Gull Lake Lumber Co., Ltd., has been incorporated, H. O. Gravenhurst, Ont. Capital $100,000. Interested, F. L. Tate, 240 Dupont St.; W. R. Bird, 157 Bay St. To construct, build and operate mills for for the manufacture of the by-products of wood and timber.

Alterations to restaurant, 9-11 Richmond St., for Childs Co., Yonge & Richmond Sts., Toronto, and 200 5th Ave., New York, N.Y. Plans will be prepared.

Victoria, B.C.

Pottery plant, cost $100,000, contemplated, for British Columbia Pottery Co., 626 Pandora. General manager, A. T. Monteith. Plant was destroyed by fire, start rebuilding shortly.

CONTRACTS AWARDED

Amherst, N.S.

Store, cost $20,000, Church, for H. Hagen & Co., plumbers. General contractor, carpenter, steel and roofing, J. A. McLellan. Mason, J. N. Fage, Heating and plumbing, Owner. Two storeys, 69 x 67, brick construction.

Berlin, Ont.

Shoe factory, Kaiser St., for Gourlay & Fogelberg, Kaiser St. General contractors, Secord & Sons, Brantford. Foundations in.

Ford City, Ont.

Bank building for Merchants Bank of Canada, H. O. Montreal. Architects, Hogle & Davis, 80 St. Francois Xavier St., Montreal. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich.

Hamilton, Ont.

Office, cost $3,000, Wentworth St. N. Owners and general contractors, Hamilton & Toronto Sewer Pipe Co., Terra Cotta Ave. 1½-storeys, brick and hollow tile construction, concrete foundation.

Foundry, cost $125,000, Aberdeen Ave., for Canadian Westinghouse Co., Ltd. Manager, Paul J. Myler. Architects, Prack & Perrine, 3 James St. S. General contractors, H. G. Christman Co., 32 Main St. E. Two storeys, main building, 304 x 70, reinforced concrete construction.

Alterations and addition to stores, cost $15,000, James N., for M. & S. Epstein, c/o Dom. House Furnishing Co., 120 James N. Architect, W. A. Edwards, 7 Hughson St. S. General contractor, Geo. E. Mills, King St. E.

Addition to store, cost $5,000, King E., for Walter Howell, King and Emerald. Architects, Mills & Hutton, Bank of Hamilton Bldg. General contractors, Hogan & Farr, 15 Fairholt Ave.

Laundry and heating plant, cost $18,000, planned by City Council Hospital Board. Architects, Stewart & Witton, 7 Hughson St. S. Mason, W. H. Yeates, 24 Leeming St.

Alterations and addition to store, James St. N., for J. H. Aussem, James St. N. Architect, L. A. Wardell, 110 Hunter St. W. General contractors, Mitchell & Riddle, 111 Pearl St. N. Three storeys, steel and brick construction, stone foundation.

Lacombe, Alta.

Store and residence, cost $6,000, Barnett Ave., for A. M. Campbell. General contractor, Sam Watt. Plumbing, electrical and interior fittings not yet let.

Montreal, Que.

Carriage factory, cost $8,000, Albert, for J. P. Montpetit, 73a Argyle Ave. Architect, O. Dufort, 192 St. Catherines St. W. General contractor, J. Boucher, 60 St. Clodile, St. Henry. Brick, A. Leger, 41 Agnes St., St. Henry. Four storeys, 46 x 80.

Store and apartments, cost $50,000, Westmount (Greene and Sherbrooke), for Brillon & Jarry, 1185 St. Denis (Mr. Brillon). Architect, G. A. Monette, 260 St. James St., Montreal. Mason, brick and carpenter, Peel & Peel, 710 Fullum. Work has been held up but is going ahead now. Four storeys, 60 x 40.

Bank, cost $5,000, 101 St. James St., for Banque Nationale, 101 St. James St. General contractor, L. Beaudry, 2420 Hutchison.

Garage, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, Beaver Hall Square. General contractors, Reid, McGregor & Reid, Guy Block. 30 x 30, concrete foundation, reinforced concrete, sandstone and enamelled brick construction, fireproof roofing.

Two stores and 4 flats, cost $15,000, Cote St. Paul (cor. Church and York), for Levi Jacob, 1421 Demontigny. General contractor, mason, Nap. Lavoie, 218 Bond Ave., Verdun, will receive tenders for all other trades. Three storeys, 55 x 50, concrete and stone foundation, glazed brick construction, brick cornices, felt and gravel roofing.

Factory for Prowse Range Co., 22 McGill College Ave. Architects, Wright & Son, 204 St. James St. General contractor, Robt. Neville, 11 Busby Lane. Excavating, mason and brick work, A. E. Wand, Victoria Ave., St. Lambert, Que. Four storeys, concrete foundation, steel and brick construction.

Greenhouse and conservatory, cost $25,000, for L. H. Timmins, Dom. Express Bldg., St. James St.. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason and brick, Reid, McGregor & Reid, Guy Block. Steel, Structural Steel Co., New Birks Bldg. Roofing, painting, heating and electricity, Pierson U-Bar Co., 10 Phillips Place. Stone foundation and construction.

Warehouse, shops and office, cost $40,000, Beaumont, for Gen. Fire Extinguisher Co., 175 McCord St. Architect, Robt. Findlay, 10 Phillips Place. General contractors, Reid, McGregor & Reid, Guy Block. Roofing, Richardson & Simard, 745 Clarke. Painting, Alex. Craig, 41 Jurors. One and two storeys, 200 x 120, concrete foundation, brick construction, felt and gravel roofing. Foundations in.

Store and 4 flats, cost $5,000, Rosemount (10th Ave.). Owner and general contractor, A. Marcotte, 545 Garnier St., Montreal. Three storeys, 25 x 40, concrete foundation, brick construction, felt and gravel roofing. Day labor.

Ottawa, Ont.

Factory, cost $27,000, Nelson St., for Crown Lithographing Co., Wellington St. General contractors, masonry and carpentry, Toms & Copeland, Arlington St. Plastering, painting and electrical not let. Foundations started.

Addition and alterations to store, cost $7,000, Rideau. General contractors, Alexander & Campbell, 587 Lisgar St. Owner, R. B. Whyte, 370 Rideau St. Architect, W. E. Noffke, Central Chambers. Solid brick construction, stone foundation.

Regina, Sask.

Stable, cost $23,900, Albert St., planned by City Council (Dr. M. R. Bow, M. H. O.). Architect, R. W. Allen, City Engineer's office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Two storeys, frame, stone and brick construction, galvanized iron roofing, electric lighting.

Addition to hotel, cost $12,000, S. Railway, planned for Palmer House, Ltd., S. Railway and Broad Sts. General contractors, McKay Construction Co., 1818 Scarth St. Will add 20 bedrooms. Two storeys, brick construction and foundation.

St. Catharines, Ont.

Factory, cost $10,000, Pamilla street, for Rice Hulbert Shoe Co., Courtland, N.Y. (L. R. Hulbert). Architect, Jos. Daw, 165 St. Paul St. Masonry, Rymer Bros., Maple St. Brick work started.

Sherbrooke, Que.

Extension to offices, cost $8,000, Wellington, for J. W. Gregoire. General contractors, Sherbrooke Construction Co. Three additional storeys, 70 x 40, steel and brick construction, asbestos roofing and plaster.

Stratford, Ont.

Addition to factory, Erie, for Canadian Gen. Elec. Co., King and Simcoe Sts., Toronto. Architect, J. S. Russell, 21 Downie St., Stratford. General contractor, J. L. Youngs, Stratford.

Toronto, Ont.

Factory, Leaside, for Canada Wire & Cable Co., 1170 Dundas St., Toronto. General contractor, Owner. Main building, 3 storeys, 100 x 200, mill and brick construction, steel sash, felt and gravel roofing. Extension to main building, 1 storey, 200 x 500, steel frame construction.

Store and residence, cost $6,000, 1069 Bathurst. General contractor and mason, J. Burford, 14 Vermont. Will sub-let some trades. Three storeys, 24 x 60, brick construction, stone foundation.

Walkerville, Ont.

Store and flat, cost $6,000, Lincoln Rd., for Fred Laforet. Architects, Smith & Walker, Excise Bldg. Mason, H. Howe, Walkerville. Carpenter, J. J. Miller. Iron and steel, Canadian Bridge Co. Heating and plumbing, Jas. Purse, 30 Glengarry Ave., Windsor. Store fronts. Foundations in.

Winnipeg, Man.

Store, cost $5,000, Burnett & Ellice, for E. A. Whatley, Spence & Ellice. Architect, D. W. Bellhouse, 7th Floor Canada Block. General Contractors, Fred Lewis & Co., 901 Somerset Bldg. One storey and basement, pressed brick construction, stone and concrete foundation. Excavating started.

Store, cost $4,000. Owner and general contractor, E. A. Whatley, Spence and Ellice. Architect, D. W. Bellhouse, 703 Canada Block. One storey, brick construction, concrete foundation.

Office building, cost $860,000, Garry and Ellice. Prudential Trust, Limited. Architects, Ross & MacDonald, 928 Union Bank Bldg. General contractors, Geo. A. Fuller Co., Ltd., 1001 Union Bank Bldg. Foundations will go in this year.

Addition to hotel, cost $15,750, for J. J. O'Connell, 322 Nairn Ave. Architect, C. S. Bridgeman, 20 Canada Life Bldg. General contractor, W. J. Wilson, c/o Architect. Three storeys, 40 x 40, frame construction, concrete foundation. Excavating done.

Office, Main St., for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust & Loan Bldg. General contractors, Geo. A. Fuller Co., Union Bank Bldg. Walls started.

Residences

Brampton, Ont.

Rectory, John St., contemplated for St. Mary's Congregation. Site purchased, 60 ft. frontage and plans will be prepared.

Fort William, Ont.

The Colonial Realty & Securities Corporation Ltd., Lumsden Bldg., Toronto, Ont., contemplate purchase of land in North End of City, and will commence operations shortly on the erection of 100 residences.

500 workmen's homes, Western Limits, contemplated by a Syndicate. Interested, Mr. D. Walker, Leeds, England. Houses to cost about $1,500 each, work to start shortly.

London, Ont.

Residence, cost $7,000, contemplated for Hubert Ashplant, 462 King St. Architect to be selected. Two storeys, hollow tile and red pressed brick construction, stone and concrete foundation.

Residence, cost $5,000, contemplated for Geo. C. Raymond, 195 Wharncliffe Rd., South London. Architect to be selected. Two storeys, red pressed brick construction, stone and concrete foundation, shingle and slate roofing.

Residence, cost $4,000, for N. S. Roberts, 83 Dundas St. Two storeys, red pressed brick construction, concrete foundation. Plans in progress.

Montreal, Que.

Residences, cost $15,000, Outremont (Bloomfield), for A. Racine & A. Gravel, 1549 Blvd. Gouin. Architect, Z. Trudel, 1075 Cartier St. Three storeys, 60 x 76, cement foundation, brick construction. Plans ready.

Toronto, Ont.

Residence, cost $3,500, for D. Baker, 34 Jackman Ave. 2½-storeys, 20 x 42, brick construction and foundation. Plans drawn.

One detached residence, cost $3,000, Edgewood Grove, for A. T. Fox, 111 Edgewood Ave. Tenders received by owner. 2½-storeys, 22 x 40, brick construction and foundation.

Winnipeg, Man.

Residence, cost $45,000, Fort Garry Drive, for Col. R. M. Thomson, c/o Architect. Architect, C. W. U. Chivers, Keewayden Bldg., Portage Ave. E. 2½-storeys. Plans in progress.

CONTRACTS AWARDED

Brandon, Man.

Five cottages, cost $20,000, Lunatic Asylum, planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Colin H. Campbell, Winnipeg. Architect, V. W. Horwood (Prov. Architect), Winnipeg. General contractor, J. Clark, Brandon. Sub-Contractors, Beaver Bldg. Co., 44 Clement Block, Brandon. One storey, 27 x 40, frame construction, concrete foundation, electric lighting.

Residence, cost $4,650 Lunatic Asylum, for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin H. Campbell, Winnipeg. Architect, V. W. Horwood (Prov. Architect), Winnipeg. General contractor, J. Clarke, Brandon. Sub-Contractors, Beaver Bldg. Co., 44 Clement Block, Brandon. 1½-storeys, 28 x 40, frame construction, concrete foundation.

Calgary, Alta.

Apartment block, cost $20,000, for O. G. Anderson, 1215 12th Ave. W. Architects, Burroughs & Richards, 11 Crown Block General contractor, Supt. A. P. Hindleman. Two storeys, 100 x 40, brick veneer construction. Excavating done.

Edmonton, Alta.

Residence, cost $7,000, 26th. Architect and general contractor, C. R. Horne, 1700 24th St. Two storeys, 26 x 44, brick construction, concrete foundation. Excavating started.

Hamilton, Ont.

Five residences, cost $10,000, Cumberland Ave., for T. Carleton, Main and Spadina Ave. General contractor, W. H. Bryant, 18 Clyde Ave. Brick construction, stone foundation.

Montreal, Que.

Residence, cost $11,200, Caston, for J. R. Colby. Architects, Peden & McLaren, 20 St. Alexis, Montreal. General contractor, masonry, carpentry, steel and painting, J. J. Kirkpatrick, Montreal W. Plastering, A. Leger, 96 4th ave. Elec., Mr. Gregory. Heating and plumbing, Mr. Bain. Tenders for roofing close with general contractor Nov. 1st. 2½ storeys.

Two cottages and 3 flats, cost $20,000, Outremont (Querbes). Owner and general contractor, P. Guidazio, 327 Querbes St. Two storeys, 25 x 38, solid brick construction, felt and gravel. Foundations started.

Three flats, cost $4,000, Chestnut, for C. A. DeRepentigny, 63 Geo. Etienne Cartier. General contractor, Owner. Day labor. Three storeys, 25 x 53, felt and gravel roofing. Foundations in.

Residence, cost $7,000, Outremont (Durocher St.). Owner and general contractor, P. Guidazio, 327 Querbes St., Outremont. Architect, Z. Trudel, 238 St. Andre St. Painting, G. Taillefer, 412 Delisle. Three storeys, 25 x 85, stone foundation, pressed brick construction, felt and gravel roofing.

13 flats, cost $8,000. Owner and gen-

(Continued on page 74)

eral contractor, A. Piche, 524 Casgrain. Three storeys, 67 x 40, concrete foundation, felt and gravel roofing.

Montreal West, Que.

Residence, Ainslie Rd., for L. A. Mosher, c/o Imperial Wire & Cable Co., Guy St. Architect, W. J. Carmichael, Bell Telephone Bldg. General contractor, E. W. Barnes, 188 Wolsley Ave., Montreal W. Brick and concrete foundation, brick construction. Excavating started.

Niagara Falls, Ont.

Residence and office, cost $9,000, for Dr. S. McCallum, Huron St. Architect, Wm. Geo. Burns, 74 Indian Grove Ave., Toronto. General contractor, John Blair, Niagara Falls. 2½-storeys, 40 x 50, brick construction. Foundations in.

Ottawa, Ont.

Residence, cost $7,500, Echo Drive, for S. T. Bastedo, Trafalgar Bldg., Bank St. General contractors, Geo. Eaman & Son, Isabella St. Brick veneer and stucco construction, stone foundation.

Quebec, Que.

Residence, cost $6,000, St. Patrick St., for Eugene Dube. General contractor, Jos. Breton, 175 St. Olivier St. Four storeys, 43 x 30, concrete, wood and brick construction, iron and asbestos roofing.

Residence, cost $8,000, 35 St. Cyrille, for Simeon Poulin, 101 Richelieu. Architect, O. Legare, 234 Massue. General contractors, Ideal Constr. Co., Ltd., 224 Massue, does all work. Three storeys, 33 x 33, concrete foundation, frame and Scotch brick construction, galvanized iron roofing. Excavating done.

Three residences, cost $9,000, Limoilou (7th St.), for Cote & Frere, 7th St. and 2nd Ave., Limoilou. Architect, general contractor and carpenter, O. Cote, 79 7th St., Limoilou. Other trades not yet awarded. Three storeys, 75 x 30, stone foundation, frame and red and Scotch brick construction, galvanized iron and asbestos paper roofing.

Residence, cost $10,000, Limoilou (cor. 3rd Ave. and Beauport Rd), for Nap. Bergeron, 792 St. Valier St., Que. General contractor, Edm. Bouchard, 234 Prince Edward. Three storeys and basements, 75 x 32, wood and brick construction, iron and asbestos roofing.

Flats, cost $14,000, St. Cyrille St. Owner and general contractor, E. G. Brochu. Day labor. Three storeys, 69 x 36, stone or brick construction, iron and asbestos roofing.

South Edmonton, Alta.

Residence, cost $9,000, 3rd Ave. N., for Mrs. B. C. Fraser, 450 1st Ave. N.E. General contractor, J. S. Fraser, 450 1st Ave. Two storeys, 38 x 47, frame construction, concrete foundation.

Toronto, Ont.

Two pair and 1 detached residences, cost $13,000, Browning Ave. Owner and general contractor, C. Coldwell, 583 Carlaw Ave. Owner superintending construction. Two storeys, 33 x 42, brick construction and foundation.

One detached residence, cost $5,000, 35 Spadina. Owner and general contractor, A. E. Armstrong, 61 Farnham, will sublet. 2½-storeys, 28 x 36, brick construction, stone foundation.

Residence, cost $8,000, St. Clair Ave. W., for Dr. T. G. Phillips, 61 Yorkville Ave. General contractor, Jas. Crang, 906 St. Clair W. Will sub-let. Brick construction and foundation.

Walkerville, Ont.

Six 2-family flats, cost $30,000, Devonshire Rd., for Walkerville Land & Bldg. Co. Architects, Smith & Walker, Excise Bldg. General contractors, carpenter and roofing, Schmied-Sisman, 387 Beaufort Ave., Detroit, Mich. Plumbing, Otto Schmied, 344 Hendricks, Detroit, Mich. Electrical, W. A. Richards, Walkerville. Plastering, Jack Reid, Goyeau St., Windsor. Two storeys, 45 x 24, hot air heating.

Residence, cost $14,000, Kildare Road, for Wm. Grant, c/o Parke, Davis & Co. Architects, McFarlane, Maul & Lantz, Wayne Bank Bldg., Detroit, Mich. Mason, H. Howe, Walkerville. Iron and steel, Canadian Bridge Co. Carpenter, roofing, painting, heating, plumbing, electric and interior fittings not let. Two storeys, 58 x 54.

Winnipeg, Man.

Two residences, cost $3,000 each. Architects and general contractors, Hadley & Fidoe, 376 Atlantic Ave. One-storey, frame construction, concrete foundation, shingle roofing. Excavating started.

Residence, cost $4,000. Architects and general contractors, J. McDearmid & Co., 704 Canada Bldg. 2½-storeys, frame construction, stone foundation, shingle roofing. Excavating done.

Two residences, cost $5,500 each. Architect and general contractor, M. Sightburn, 307 Union Trust Bldg. Two storeys, frame construction, stone foundation. Excavating done.

Terrace of residences, cost $8,000. Owners and general contractors, Cohen & Rosenblat, 498 Alfred St. Architect, Mr. Blankstein, 450 Dufferin Ave. Two storeys, brick veneer construction, stone foundation.

Residence, cost $5,000. Architect and general contractor, W. Burnhard, 677 Main St. Two storeys, frame and brick veneer construction, stone foundation. Excavating done.

Residence, cost $5,000, Ethelbert. Owner and general contractor, E. Russell, 890 Ida Ave. Two storeys, 29 x 28, frame construction, stone foundation. Excavating done.

Residence, cost $10,000. Architect and general contractor, N. T. Wallace, Suite , Lincoln Apts. 2½-storeys, brick veneer construction, concrete foundation. Excavating started.

Power Plants, Electricity and Telephones

Charlottetown, P. E. I.

Street railway system contemplated for Maritime Telegraph & Telephone Co., Ltd., 88-92 Hollis St., Halifax, N.S. General manager, J. H. Winfield, c/o Company.

Elmira, Ont.

Hydro-electric plant planned by Town Council. Clerk, J. H. Ruppel. Engineer, Mr. Surtee. Machinery being installed by Geo. Klink.

Estevan, Sask.

Standard street lighting system, cost $46,000, planned by Town Council. Sec.-Treas., P. J. Stephens. By-law passed Sept. 23rd.

Hamilton, Ont.

Gas mains planned by National Natural Gas Co. Representative, R. F. Miller, Bank of Hamilton Bldg. Ratepayers will vote on by-law Oct. 10th re giving franchise to above company to supply city with gas at 37½c. per 1,000 ft. If by-law carries Company is to lay 7½ miles of mains in the city before January, 1915. All work to be done to the satisfaction of City Engineer, A. F. Macallum. Mains, valves, regulators, pipe, etc., will be required.

London, Ont.

Addition to sub-station planned for Hydro-electric Power Commission. Chairman, Philip Pocock. Architect, H. J. Glaubitz. Additional lighting and power transformers, etc., to be installed. Reinforced brick construction, concrete foundation.

Montreal, Que.

Dam and water power development planned by Southern Canada Power Co., Ltd., c/o C. J. McCuaig, 17 St. Sacrament St. Water power purchased and company is expected to supply electricity for Drummondville, Que.

Addition to telephone exchange, cost $52,500, Hospital St., for The Bell Telephone Co. of Canada. Architect, W. J. Carmichael, c/o Owner. Work will not be started until spring. Tenders called later. Two storeys, 145 x 148.

Smithers, B.C.

Work will be started soon on an electric lighting plant and water plant for J. L. Hamilton and J. Fraser. Site has been selected.

Toronto, Ont.

Sub. station planned for Toronto Hydro-electric Commsn., 226 Yonge St. Site secured at Coxwell and Rhodes for sub-station to supply power for Danforth and Gerrard Civic street car lines.

West Hamilton, Ont.

Street lighting planned for Dundas Hydro-electric Commission. Chairman, R. W. Karch, Dundas. 30 or 40 100 watt tungsten street lights to be installed.

Winnipeg, Man.

Gas testing euipment planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Equipment for 1 central and 2 branch gas testing stations. Specifications at office of Engineer. Tenders received by Board till October 8th.

Transformers required by Transcona Board of Control. Sec. M. Peterson. Engineer, J. G. Glassco, 50 King St. Three 600 kv.a. single-phase, step down transformers. Specifications at office of Engineer. Tenders received by Board of Control till Oct. 16th.

Business Notes

Gananoque, Ont.

Factory of The Spring & Axle Co., King and Pine St. burned. Damage $50,000, covered by insurance.

Montreal, Que.

School "St. Clements," Maisonneuve

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Kingsville, Ont.," will be received at this office until 4 p.m., on **Monday, October 27, 1913**, for the construction of a Public Building at Kingsville, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Kingsville, Ont.; at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles Streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48549. 41-42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater at Kincardine, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of a Breakwater at Kincardine, Bruce County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of H. J. Lamb, Esq., District Engineer, Windsor, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Kincardine, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46683. 41-42

Debentures for Sale

$17,955.98. Town of Pembroke 4½ per cent. Bonds. Viz.:—

$8,500 for extension of waterworks system, maturing 20 years from September 6th, 1912, interest payable annually at Bank of Ottawa, here.

$5,000 for bonus to manufacturing industry, payable in 20 annual instalments from February, 1913.

$4,455.98 for local improvements, due in ten years from July, 1913, interest payable annually.

Offers for the purchase of above debentures, including accrued interest, addressed to W. H. Bromley, Esq., will be received up to October 15th. Delivery of Bonds at Bank of Ottawa here.

A. J. FORTIER,
Town Clerk.

40-41

TO ARCHITECTS

Masonic Temple, Toronto

Competitive designs for the above will be received up to noon on the **20th day of January, 1914**. The conditions of competition have been prepared by a competent professional adviser who will also report upon the merits of the various designs. For copy of Conditions apply to Mr. W. H. Best, No. 181 Avenue Road, Toronto. 40-41

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Thornbury, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the Harbour Improvements at Thornbury, Grey County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Thornbury, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47674. 41-42

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 2 p.m. on **Monday, October 27th, 1913**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Clerk's office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
Township Clerk.

41-42

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46393. 41-42

TENDERS

Separate or bulk tenders addressed to the undersigned will be received up to and including **Friday noon, October 24th, 1913,** for the construction of the new Young Men's Christian Association building, St. Thomas, Ontario.

Plans and specifications can be arranged for and seen at the office of architect.

The lowest or any tender not necessarily accepted.

JOHN T. FINDLAY, Architect,
41 St. Thomas, Ont.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **October 9th, 1913,** for the construction of the following work:—

Midway Sewer System, Outlet Via Hiawatha Ave., Gerrard Street and Morley Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, Sept. 30th, 1913. 41

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Business Notes

(Continued from page 73)

(Lafontaine St.), owned by R. C. School Board, burned; loss $150,000. Rev. Pere Contant, Chairman. Some insurance.

Ottawa, Ont.
Store and residence owned by Joseph Durocher, Eastview, Ont., burned. Loss $8,500. Will rebuild. Brick veneer construction, concrete foundation, felt and gravel roofing, store fronts and fixtures.

Miscellaneous

Coquitlam, B.C.
Fire alarm system, cost $15,000, contemplated by Town Council. Clerk, J. Smith.

Montreal, Que.
Fire-Chief Tremblay has advised the Board of Control to equip him with motor fire fighting apparatus for four of the down town stations. Sec., L. N. Senecal.

Ottawa, Ont.
Ice breaker, cost $750,000, for Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston. General contractors, Vickers' Sons & Maxim, London, Eng. To operate between Montreal and Quebec.

Toronto, Ont.
Fire alarm apparatus. General contractors, Star Electric Co., Binghampton, N.Y. 10 circuit protection board, 8 circuit storage battery board, motor generator set, 150 cells, storage battery, 12 alarm boxes, etc., $3,774.

Winnipeg, Man.
Fence, cost $2,644.85. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. J. Carruthers, 127 Edmonton St., for material and labor. Board of Control. Sec., M. Peterson.

New Companies

Huronia Beach Resort Company, Limited, has been incorporated with a capital of $250,000 to erect buildings and deal in building materials, with head office at Toronto. The provisional directors are G. H. Gray, J. J. Gray, barristers, and W. R. Willard, law student, all of Toronto.

Co-Operative Brick Company, Limited, has been incorporated with a capital of $1,000,000 to manufacture and deal in brick and building materials, with head office at Toronto. The provisional directors are J. G. Shaw, Jos. Montgomery and B. E. Bull, barristers, all of Toronto.

The Interprovincial Engineering and Contracting Company, Limited, has been incorporated with a capital of $75,000 to carry on business as contractors and manufacturers of building material, with head office at Toronto. The provisional directors are J. T. Jackson, Samuel Jackson, mechanical engineers, and C. E. Howard, broker, all of Toronto.

Gull Lake Lumber Company, Limited, has been incorporated with a capital of $100,000 to erect saw mills and carry on business as lumber manufacturers and dealers in wood products, with head office at Gravenhurst, Ont. The provisional directors are T. H. Wilson, W. H. Ford, barristers, F. L. Tate, bank manager, and W. R. Bird, estate agent, all of Toronto.

Toronto Freehold Lands, Limited, has been incorporated with a capital of $40,000 to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are J. H. A. Blair, Irene Rouse and Marion Forsythe, stenographers, all of Toronto.

Lonsdale Park, Limited, has been incorporated with a capital of $750,000 to carry on business as a general land and building company, with head office at Toronto. The provisional directors are L. F. Black, accountant, H. A. Hall and J. J. Flint, bookkeepers, all of Toronto.

The Pembroke Realty Company, Ltd., has been incorporated with a capital of $100,000, to manufacture brick, lime, gravel, lumber or other building material, with head office at Pembroke. The provisional directors are J. F. Munro, T. H. Moffat, contractors, and E. A. Dunlop, merchant, all of Pembroke, Ont.

The Merritt Lumber Company, Ltd., has been incorporated with a capital of $20,000, to manufacture and deal in lumber and other forest products, to open up timber limits, etc., with head office at Sudbury. The provisional directors are J. S. McKessock, J. H. Clary, solicitors, and Colin Argyle Campbell, recorder, all of Sudbury.

Late News Items

Edmonton, Alta.
Store, cost $3,000, Syndicate. Architect and general contractor, J. A. McBurney, 1335 26th street. One storey, 33 x 50, frame and brick veneer construction. Foundations in.

London, Ont.
Apartment, cost $35,000, Queens ave., for Dr. H. A. Kingsmill, cor. Queens and Park ave. Architect, W. G. Murray, Dom. Savings Bldg. General contractor, Harry Hayman, 491 Ontario Street. Five storeys, brick construction. Excavating done.

Montreal, Que.
Flats, cost $5,000, Verdun, for Mr. Lalonde, c/o D. Lanthier, 1332 Wellington street, architect and general contractor, who will do all work by day labor.

Three flats, cost $6,000, Hutchison, for

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PRESTON - - - - - ONTARIO

Miss Irene Provencher, 135 Mansfield. Architect, Alp. Charbonneau, 27 Casgrain St. General contractor, owner, day labor. Three storeys, 25 x 75, stone foundation. Permit issued.

Six flats, cost $5,000, Cartier, planned for Jos. Chevalier, 140 St. Jerome. 3-storeys, 25 x 45, concrete foundation, felt and gravel roofing. Permit issued.

Ottawa, Ont.
Waterworks supplies required by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. (a) Gaskets, bolts, nuts and rivets (will buy in open market) (b) Sluice gates, etc., T. Lawson & Sons, Wellington Street.

Port Arthur, Ont.
Market building contemplated by the City Council. Clerk, T. F. Milne. Purchase of site is being considered and plans will be prepared.

Robertson, Que.
Geo. Rousseau intends rebuilding saw mill immediately. Machinery required.

St. John, N.B.
Pavements and sidewalks, cost $13,000, Sydney street and Marsh Road, planned by the City Council. Commissioner, Miles Agar.

Bank, cost $20,000, Main street, for Royal Bank of Canada. Manager, J. B. Blair, King street. Architect, K. G. Rea, Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke Street.

Sherbrooke, Que.
Hospital extension, cost $20,000, for Sherbrooke General Hospital. General contractors and architects, Loomis, Dakin, Limited. General Hospital fittings required. Excavating done.

Toronto, Ont.
Sewer planned by Board of Control. Mayor, H. C. Hocken. General contractors, J. H. M. McKnight Constructing Co., 88 St. David St. Earlscourt Drainage System No. 3 Outlet $21,738. General contractors, The Grant Constructing Co., 50 Front St. E., Dufferin Street north of St. Clair, $11,500.

School, etc., cost $125,000, Brunswick ave., for Loretto Abbey, Wellington St. W. Architect, N. G. Begg, Cosgrave Bldg. Mason, M. Manley, 1058 College St. Carpentry, T. J. Sullivan, 552 Ontario St. Steel, Reid & Brown, Esplanade. Painting, J. J. O'Hearn, 249 Queen St. W. Ornamental iron, Dom. Ornamental Iron Co., 1195 Queen St. East. Foundations started.

Machine shop, cost $10,000, Sherbrooke, Owner and general contractors, Toronto Railway Co., King and Church streets. Two storeys, 24 x 80, steel and brick construction, brick foundation.

Asphalt pavements planned by Board of Control. Mayor, H. C. Hocken. General contractors, Godson Contracting Co., Manning Chambers. Rhodes ave., $14,891; Marchmont Rd., $4,947; St. Clair ave., $15,499; Elmer ave., $5,794; Morley ave., $19,908. General contractor, Constructing & Paving Co., Confederation Life Bldg., Ellerbeck, Erindale and Fulton ave., $23,972.

One detached residence, cost $7,000, Oakmount, for J. M. Heale, 307 Lumsden Bldg. 2½ storeys, 28 x 36, brick construction and foundation. Plans drawn.

Three attached stores and residences, cost $10,000, for G. N. Ferrier, 302 Danforth ave. Architect, P. H. Finney, 79 Adelaide St. E. Separate or bulk tenders received by owner until Oct. 8th. Three storeys, 75 x 60, steel and brick construction, brick foundation.

Garage and billiard room owned by Granite Club, 513 Church St., burned. Tenant of garage, The Gibson Electric Co., 517 Church St. Seven English billiard tables destroyed. Main club rooms damaged by water. Loss $65,000.

Victoria, B.C.
Residence, cost $17,000, for Wm. Wallace Blair. General contractor, A. H. Mitchell, 2618 Roseberry. Two storeys and basement, 9 rooms, frame construction.

Winnipeg, Man.
Fence, cost $2,644.85. Engineer, H. N. Ruttan, 223 James ave. General contractor changed from J. J. Carruthers to J. W. Astley, Engineer of Construction. Board of Control, Secretary, M. Peterson.

Residence, cost $4,000, Dudley avenue. Architects and general contractors, Smith Construction Co., Kennedy Bldg. Frame construction, stone foundation, shingle roofing. Excavating started.

Yorkton, Sask.
Implement warehouse, Broadway, owned by Massey Harris Co., Ltd., burned. Loss $6,500.

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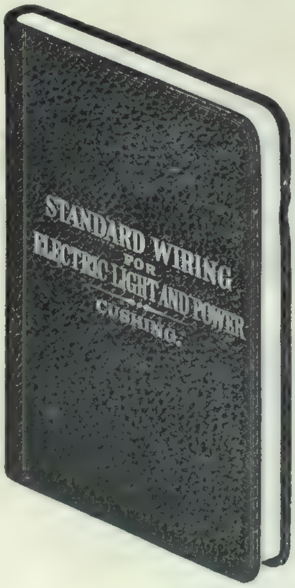

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

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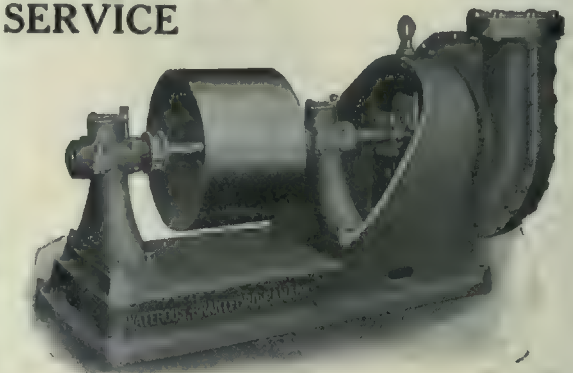

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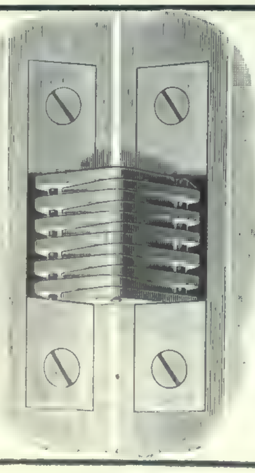

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ESTABLISHED 1886

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Alphabetical Index of Advertisers
Page 16

Vol. 27 October 15, 1913 No. 42

"Open" or "Closed" Competition?

INADEQUATE time allowance has been getting us into trouble again on the other side of the water. This time it is in connection with the proposed government buildings at Ottawa, for which architects were recently invited to submit sketch designs. The notice, or advertisement, calling for sketches, was dated at Ottawa, August 18th, but its first appearance in this journal was September 3rd, and particulars were not announced in the London, England, journals until the week of September 14th. The designs must be delivered in Ottawa not later than noon on January 2nd next, so that Old Country architects have rather less than two months in which to familiarize themselves with all the details necessary for the preparation of a design likely to engage consideration and stand a chance of success.

In commenting upon the competition our London contemporary, "The Builder," praised Canada for limiting the contest to British subjects practising within the British Empire, and expressed the hope that for the credit of English architecture an Englishman would succeed in winning the commission, showing the people of Canada that they had not "lost the best result through their loyalty to the sentiment of nationality."

This complimentary discourse was very nice, but in the following issue "The Builder" had received many complaints from architects that the Ottawa competition came at a time when two important competitions—the new Manchester Exchange and the Board of Trade Offices in Whitehall—were in progress, and that consequently many who would like to compete for the Ottawa work would be debarred. Our contemporary expressed the hope that under the circumstances the Canadian authorities would extend the time for submitting schemes for three or even six months.

We are thoroughly in accord with our London contemporary. In an important national undertaking such as this it should be our aim—and steadfast purpose—to secure the very best British product possible. It is in the first interests of Canada, as also it is in the first interests of Canadian architecture, that the selected design should have an individuality and merit paramount.

We are too hurried in such details. The announcement of such an important competition simultaneously with two other large competitions in England shows lack of foresight on the part of the authorities at Ottawa. We join our plea with the London "Builder" for the postponement of the closing date, fearful lest the impression be created that although we advertise "open British competition" we arrange our plans so nicely that the result is a foregone conclusion.

Something More Than Good Roads

GOVERNOR Ferris, of Michigan, in a recent address before the American Road Congress, committed himself to the remark that the Good Roads movement ran parallel with religious and educational advancement. The explanation was that with better roads we have fewer and better churches, and fewer and better ministers.

This is a new aspect of the question that we had not considered. It requires little reflection, however, to discover much truth in the Governor's observations. Much might be made of the point, for certain it is that hundreds of our good citizens who have shown no interest in the road movement would ally themselves with the cause of fewer (and better) ministers and churches. Governor Ferris pointed out that in New England, where good roads had been built extensively during the last few years, the amount of illiteracy was small compared with states where road work was backward.

These things are worth emphasizing. Not only are good roads indispensable to all forms of constructional development, but social, religious and educational development are impossible without them.

The great Roman Empire was founded and built up by men whose roads remain as a monument to their ability and foresight. Canada has unlimited opportunities in this field.

Great Record of the C.P.R.

OPTIMISM and progressiveness are the governing factors in the policy of the Canadian Pacific Railway, as revealed in the company's report presented at the annual meeting in Montreal. The address made by Sir Thomas Shaughnessy was brief but pregnant, containing, as it did, a masterly grouping of the important facts, a statement of what had been accomplished, and an outline of the company's policy in future development. Sir Thomas referred briefly to the high-water mark reached in the earnings of late, which, however, he said, could in no way be taken as an indication of permanent conditions. On the contrary, recent developments had been such as to give every justification for anticipating another satisfactory year.

Unparalleled progress was shown in the figures quoted by Sir Thomas Shaughnessy, who expressed every confidence in continued and proportionate growth. In ten years the annual gross income of the

C. P. R. has increased from forty-three to one hundred and thirty-nine million dollars. President Shaughnessy pointed out that the expenditures for the purpose of roadbed, equipment and general facilities need not approach those of the past, because, when the lines now being built are completed, the constructional programme may be modified. But the general activity now being created will remain, and retrenchment on the one hand will be offset by greater development on the other—moreover, the expense of maintenance is rapidly assuming enormous proportions.

The optimism and example of the C. P. R. should inspire the rest of the constructional field to greater endeavor. We can surely follow the lead of men whose belief in Canada has enabled them to build up the greatest organization of its kind in the world.

It was remarked, with significance, at the annual meeting, that the men in the Board Room represented assets of nearly one thousand million dollars.

The record of the C. P. R. is the most brilliant history of achievement of the kind ever made.

Merit of Contract System

AFTER adhering obstinately to the day labor system of doing its works for many years, the City of Fort William has discovered at last the saving that can be effected with contract work. As an experiment this season the contract system was put into operation for practically the whole schedule of improvements undertaken, and now the City admits, through Mr. Piper, Chairman of the Board of Works, that a considerable saving has been effected, both as regards time and money. Just what the saving is will not be divulged, we presume, until the annual report of the department is issued, but from the Chairman's admissions it is evident that it is considerable.

Rather curiously, at the same time we hear that there has been considerable dissatisfaction at Calgary over the cost of paving laid by the city. The ratepayers discover that a system of figuring is in operation which prevents their getting at the actual cost. If the city plant is actually laying paving as cheaply as it pretends, they ask why there should not be some explanation of the varying assessments on property. The price of asphalt paving last year in Calgary was fixed by the City at $2.10 per square yard, but the assessment levied against property for such paving is higher in cases than similar assessments against property on streets of the same width paved by private concerns.

The present administration at Calgary is defended on the ground that the estimate of $2.10 was made last year, and that it was largely speculative. After reading the report from Fort William, such arguments leave one unpersuaded still.

WE learn from a western correspondent that the City Engineer of Regina is enlisting in the "good roads" cause Boy Scouts who are now patrolling different sections of the city reporting where improvements are needed in the roads. The educational and general value of such work is tremendous, and the example of Regina might be emulated by certain eastern cities, particularly Montreal and Toronto. But the question arises: how large an army of Boy Scouts would be required to patrol the bad sections of the streets in either city? We can think of two streets in Toronto the bad spots in which would hold all the Boy Scouts in the Dominion.

Calgary Adopts Commendable Policy

IT has been the policy of a number of the Canadian cities, including Calgary, to sanction the construction of sidewalks and the installation of water mains and sewers in country sub-divisions before the latter are sufficiently built up to warrant the expenditure involved. There are many instances in the West in which modern improvements have been put in before there were any residents to use them, the advent of the latter merely following more or less slowly the accomplishment of the former. Such a policy may tend to the development of new residential districts, but it means benefiting the individual at the expense of the public, and enriching the sub-division owner from the pocket of the rate-payer. Rightly viewed, improvements should follow the populace and not the populace the improvement. The latter policy is invidious, and favors one sub-division at the expense of another.

The recent policy of the city commissioners at Calgary in putting a stop to the installation of improvements before the population of a district warrants them, is highly commendable. It leaves the growing population to extend in whatever direction it deems most suitable, and does not favor any particular sub-division. The same amount of work will be necessary under this policy as under the older one, the difference being that the work will follow settlement instead of settlement the work. It also means that the people who will benefit by the improvements will pay for them, or at least pay for a part of them, and that the real estate speculator will cease to benefit at the expense of the public. There are other Canadian cities which would do well to follow the example of Calgary.

Greater Winnipeg Water Supply

SPECIAL attention is directed to the announcement relating to the "Greater Winnipeg Water Supply," published in the Tenders Department of this issue. The important features of this great work, which involves an expenditure of $13,500,000, are set forth in the notice. Full details may be obtained and reports, maps and drawings examined at the office of the Contract Record.

October and November are about the best months of the year to examine the pipe-line route, and therefore it will be well for prospective bidders to improve the opportunity instead of waiting until winter sets in, when the country will be difficult of access. The conduit will be of concrete for about 85 miles, with reinforcement in some sections. This portion will have a daily capacity of 85,000,000 Imperial gallons. From the end of the concrete portion, at the site of a reservoir proposed for construction later on, 5-ft. steel pipe, and beyond that, 4-ft. cast-iron pipe, will lead into the city. The aqueduct will serve a few small municipalities besides Winnipeg, lately formed into the Greater Winnipeg Water District.

The record manner in which the project has been put through by the officials concerned is engaging wide attention. On May 10th Messrs. Rudolph Hering and James Fuertes, of New York City, and Frederick P. Stearns, of Boston, convened in Winnipeg. They made investigations on the ground, studied existing and subsequent surveys made by the city, and signed their report in New York on August 20th. The report was read in Winnipeg August 29th, adopted by the officials of the water district September 6th, approved by the Winnipeg City Council September 8th, and ratified by popular vote October 1st.

Tunnelling Record at Montreal Again to the Fore

On the editorial page of our issue of June 11th, 1913, we referred to a number of interesting features in connection with the Canadian Northern tunnel through Mount Royal. In the course of our observations we claimed that the record of the American continent for a heading in hard rock had been broken on June 5th, when a heading 8 ft. by 12 ft. in hard limestone reached 810 ft. in thirty working days. We contended that the previous record had been made at the Arizona Copper Mines, where a heading, 8 ft. by 8 ft., had been driven 799 ft. in thirty working days.

Shortly afterwards, Mr. E. E. Sands, of Brooks, Alta., in a letter published in our issue of July 9th, 1913, took us to task for the claims made in our previous issue, and stated that the American record for hard rock tunnelling was about 900 ft. a month, made in very hard blue shale, on the Gunnison tunnel in Colorado, built by the U. S. Reclamation Service.

For some time we have been endeavoring to collect data with a view to establishing the point conclusively, but the way is cleared for us by our Chicago contemporary, "Engineering and Contracting," who discuss the matter editorially as follows:—

Any claimant of a record in driving rock tunnel offers himself as a target. For one reason it is not agreed what establishes a record. We anticipate therefore, that the claim to the world's record for fast tunnelling, which was made in our issue of September 17th, 1913, in the article describing the Montreal tunnel of the Canadian Northern Railway, will not go uncontested. It is meanwhile worth noting what this claim is. To do this intelligently it is necessary to note the previous best record and we shall do this first for the world's tunnels and second for American tunnels. We shall further limit the consideration to hard rock tunnels. This excludes certain tunnels of the Los Angeles aqueduct which were held up two or three years ago as records of rapid rock tunnelling, but which because of the soft rock penetrated are not rightly comparable with other rock tunnels of record for fast driving.

Until claim for precedence was made for the Montreal tunnel, the world's record for fast tunnelling has been credited to the Loetschberg tunnel. Driving in limestone a heading 10 ft. wide and 6½ ft. high, a maximum month's advance of 1,013 ft. was made. At Montreal driving in hard rock a heading 12 ft. wide and 8 ft. high, a maximum month's advance of 810 ft. was made. A round of 13 holes was drilled at Loetschberg, and at Montreal a round of 18 holes was drilled; the yardage per lineal foot of heading at Loetschberg was 2.41 cu. yds., and at Montreal it was 3.29 cu. yds. The two records compare then as follows:

	Lin. ft., heading	Cu. yds.	Hole, lin. ft.
Loetschberg	1,013	2,441	13,169
Montreal	810	2,665	14,580

In this tabulation the comparison of footage of hole drilled is not quite true, first, because the actual footage drilled is not often the exact product of the number of holes by the length of heading driven, and, second, because at Montreal the number of holes per round was sometimes more than eighteen.

The best record of advance for an American tunnel previous to the new Montreal tunnel record appears to be the record of the Laramie tunnel. Driving in granite a heading 10 ft. wide and 8 ft. high, a maximum month's advance of 653 ft. was made. A round of 23 holes was drilled. From these figures we may extend the above tabulation as follows:

	Lin. ft., heading	Cu. yds.	Hole, lin. ft.
Loetschberg	1,013	2,441	13,169
Montreal	810	2,665	14,580
Laramie	653	1,933	15,019

We stated above that it is not agreed what establishes a record in rapid tunnelling. What does establish such a record? One claimant has it that record is established by maxima in yardage excavated and footage of hole drilled regardless of length of heading driven; another has it that record is established by a maximum of heading driven, although the yardage excavated and footage of hole drilled are less than in the first instance. Which basis of determination is more correct or is it more correct to integrate all three factors—footage of heading, yardage of excavation, and footage of hole drilled—and if this is more correct, why not extend the list of factors considered to include all variables?

We have set down the above figures and comments not to criticise any claims made but to indicate that in discussing tunnel records no comparisons are complete, fair and conclusive. To our mind there are features of far more general engineering interest in the Montreal tunnel work than its claim to the record of speed in driving heading.

There is first the use of the bottom heading which is quite unusual in American practice and nearly universal in European practice. Second, there is the adoption of a drill carriage, which is distinctly a European device also. It is worthy of note that the heading in which the record, which has been discussed, was made was not that in which the drill carriage worked. Instead the drills were mounted in movable arms on a horizontal heading bar. The best record made using the drill carriage was 510 ft. of heading in 27 working days. One feature of the Montreal tunnel drill carriage which distinguishes it from its European prototypes is its combination with a belt conveyor for handling spoil. The service of this conveyor is reported to have been satisfactory, and it is important that this fact be noted, for usually tunnel men look with disfavor on incumbering a tunnel heading with any large device for mucking, and in the past such devices have usually proved of doubtful service.

The Loetschberg, the Laramie and the Montreal tunnels have one feature alike, which is the use of water drills, or more accurately, drills through which alternate pulsations of water and air are forced to the bottom of the drill hole. It is interesting to note how this type of drill is gaining general use in tunnelling, and it is important to distinguish between this drill using air and water and drills using air alone or water alone for chip removal. The advantage of the combination is that air is furnished to freshen the heading atmosphere; that the combination of water with air prevents a dusty chip discharge; that the combination of air with water reduces the fogging of the heading with water vapor; that the combination current removes the cuttings more rapidly. These are all familiar claims, but they are mentioned because of a common confusion in the meaning of the term water drill.

The Montreal tunnel has structurally two exceptional features. Its flat roof profile to provide for the use of pantograph trolleys is one and the partitioning of the section into two parts by a reinforced concrete centre wall is another. The objects of these two details need no explanation. Altogether the Montreal tunnel is one of the most interesting tunnel constructions of America and it is to be hoped that its builders will on its completion give to engineers a description and analysis of methods and results which will enable a complete understanding of the worth of its several unusual structural and constructional features.

The Design of Large Bridges, with Special Reference to the Quebec Bridge—Part II.

By Ralph Modjeski, Consulting Engineer, Chicago.

WITH regard to the distance between trusses and their position relative to each other, the trusses of the new Quebec Bridge will be in two vertical and parallel planes. The distance, center to center of trusses will be 88 ft. One of the first preliminary sketches made after the board was created contemplated placing the trusses in planes inclined in the same manner as in the Forth Bridge, namely, with the tower posts converging toward the top and the bottom chords of both the anchor and the cantilever arms converging toward their respective ends. Another sketch contemplated trusses in vertical planes, but converging for the anchor and cantilever arms toward their respective ends. Both these plans would be economical in the amount of metal required in the finished bridge; but erection of a structure of this magnitude is extremely difficult, and some sacrifice of economy is necessary to make the field work as safe and easy as possible.

It was during the erection that the old Quebec Bridge collapsed. The board consulted several of the best authorities on erection of large structures, and, while their opinion differed somewhat, it was decided, after much deliberation, to make the trusses parallel throughout. In doing so we had in mind not only the erection, which was the principal consideration, but the greater simplicity of details at such important points as the pier posts and the points of suspension of the suspended span. The connections at these points become quite complicated when the anchor arm, cantilever arm, and suspended span trusses are not all in the same plane. It would have been possible to design the bridge with trusses in two planes inclined toward each other, parallel to the axis of the bridge and passing through the end supports of each truss. In this manner all connections of truss members would have been nearly as simple as in the adopted design. Such a design was also suggested and considered. But it was soon decided that the erection of heavy members in an inclined plane of the truss would be too hazardous, and this plan was abandoned.

Effect of Labor Conditions

A question may fairly be asked: Since the Forth Bridge, with its curved bottom chords, inclined and flaring trusses, has been so successfully constructed, why was it not possible to follow a similar design in the Quebec Bridge? The difference is all in the labor conditions prevailing on the two continents at the respective times of building these bridges. At the Forth Bridge 3,200 to 4,100 men were employed when the work was proceeding full swing; their number attained 4,600 for a short period. At Quebec such a large force could not be mustered. The contractors contemplate now using approximately 400 men in the field and not over 1,000, including men in the shops. In the Forth Bridge the material was all manufactured at the bridge site. By using a large force of men it was possible to build up the various members of single plates or shapes so that no heavy pieces were handled.

The admirable design, consisting principally of tubes, of which there are nearly 6 miles in the bridge, was built up by employing the method used in building boilers, piece by piece. The connections were laid out in the field, plates bent to suit, drilled and riveted on. This method of procedure would be impossible in Quebec. Not only are the men not available, but while on the Firth of Forth the climate is such that work may go on at all seasons of the year, in Quebec work aloft is impossible during more than seven months in the year. Here, then, the bulk of the work must be done by machinery to save manual labor, and must be done in the shops to permit a continuous progress. The work in the field must be reduced to the minimum or to the assembling of large pieces—as large as it is practicable to handle. The American type of pin-connected construction lends itself best to these conditions, but with that type the details will be much simpler and the erection much easier with trusses situated in two vertical and parallel planes.

System of Trussing.—The system of trussing was from the beginning the object of discussion and diversity of opinion among the members of the board; so much so, that before a definite agreement was reached it was decided to work up a plan which, though not satisfactory to all the members of the board, would, when detailed, give the first accurate estimate of weights, which would be also sufficiently accurate to serve as a start in designing any other plan of the same general dimensions. The plan thus detailed, though not approved, will be referred to as the official design.

A discussion of the proceedings among the members of the board and the government officials, which led to the ultimate result, would be out of place here. Let it suffice that, in addition to asking for tenders on the official design, the bidders were requested to submit their own designs in accordance with specifications furnished by the board. The time allotted for preparing such designs was shorter than the time it took the board to prepare the official design; but it should be remembered that the official design furnished to the bidders information which it took months of study to prepare. Not the least important information thus furnished was the estimate of weights computed from the details of the official design.

Selection of Design.—Several designs were submitted with the tenders; the design submitted by the St. Lawrence Bridge Company, with what may be called a "K" system of trussing in the cantilever arms and anchor arms, was finally recommended by the majority of the board and later endorsed by an enlarged board appointed by the Minister of Railways and Canals for the special purpose of selecting the best tender. The main reasons for recommending the design in question are given in the enlarged board's report as follows: (a) The type of design offers greater safety to life and property during erection, as well as economy and rapidity in construction. (b) The design contains the minimum number of secondary members and requires few, if any, temporary members during erection. (c) The system of triangulation, by dividing the web stresses, reduces the members to more practical sections and simplifies the details of connections. (d) The design economizes material, as shown by the calculated weights of the two designs. (e) The general appearance of the structure is, in our opinion, improved.

Uniform Deflections

There are two advantages of this "K" design which are not clearly brought out in the above reasons, and on which I wish to lay considerable stress, namely, uniform deflections and regularity of erection operations from panel to panel. The uniform deflections can best be seen by comparing the Williott's diagrams which show the deflections of the anchor arm under dead load and under dead and full live load in the old, the official, and the final designs. The deformations are, of course, on an exaggerated scale. A comparison of these diagrams will show that secondary members, or those which receive their maximum stress from partial live load only, such as the vertical suspenders carrying one panel of floor, or members which carry dead load only, such as vertical sub-posts supporting the top chord, or members which normally have no stress in them, such as struts which serve to reduce the unsupported length of main compression members, are the source of local bending in the main members to which they connect. This is because the variation in length of the secondary members as the loads are applied is independent of the variation in length of the main members. For instance a secondary member carrying dead load only receives its full deformation in length when the span is finished, but its length remains constant under any condition of live load, while the adjoining main members compress or elongate with each application of live load. In the same manner a suspender carrying one panel of the floor, for instance, will receive its maximum elongation under concentrated live load in this panel whether the remainder of the bridge is loaded or not, while the adjoining main members will receive their maximum deformation under quite different conditions of loading. The bridges are generally designed in such a manner that the secondary stresses are either entirely eliminated or largely reduced when the main members are subject to greatest direct stresses. This is done by determining the lengths of the various members, both main and secondary, in such a way that the truss, under the maximum load, will assume as nearly as possible the geometrical shape. This requires, however, an initial displacement of the main members, which during erection may be very objectionable.

The diagrams referred to show the situation as reversed, namely, as if the loads were applied to a truss having the true geometrical form. In order to obtain the true geometrical form, after the loads are applied, we should begin with a truss deformed under condition of no load.

The comparatively large distortions of the truss in the old design are due not only to greater unit stresses used but also to the cruved bottom chord and the large number of secondary members. I have explained the reason why curved bottom chords were used in that design. Of the three designs shown in the diagrams, the new design has the least number of secondary members. It should be remarked that the same advantage could have been obtained with a double intersection Warren truss by arranging the panel lengths in such a manner as to eliminate the intermediate vertical secondary members supporting the chords.

It would be interesting to know the extent of secondary bending stresses produced in the tubular bottom chords of the Forth Bridge by those vertical members, but unfortunately the necessary data for their calculation are not available.

The regularity of erection operations consists in the fact that, starting from the pier, the position of members in each panel in the "K" design is just like the preceding one, and that coupling up of members in each successive panel, as the traveller moves forward, requires the same succession of motions as in the preceding one, except that pieces become lighter as the erection proceeds. Experience shows that the oftener an erection crew goes through a series of the same motions, as, for instance, in erecting a succession of simple spans all alike, the more rapid their progress becomes.

Features of Quebec Design

Some of the more important features of the Quebec design will be of interest. The lateral wind-bracing has been omitted between the top chords of the cantilever and anchor arms. All wind forces are taken directly to the pier through substantial bracing between the bottom chords. This arrangement not only makes the distribution of wind stresses perfectly definite but permits the spreading of tracks to 32 ft. 6 in., center to center, instead of the usual 13 or 14 ft. which results in a saving in the floor system, and consequently in the entire structure. With the tracks spread, a load on one track only produces a torsion in the cantilevers, and the presence of wind-bracing between the top chords would produce undesirable and excessive stresses which would have to be taken care of by a large addition of metal to the lateral and sway systems and to the trusses.

The floor system is of carbon steel throughout. It is, therefore, stiffer than if made of nickel-steel. The long floor beams deflect less and the secondary stresses produced by their deflection are thus reduced. Even then some of the connections of floor beams to posts had to be made by means of pins. The top chords of the cantilever arm and of the anchor arm as now designed are of carbon steel eyebar. The originally submitted design contemplated nickel-steel plates riveted throughout for the cantilevers, and carbon steel plates for the anchor arms. By substituting eyebars a better design is obtained and much easier erection assured, and, although nickel-steel is replaced by carbon steel in the cantilever arm, the substitution results in a saving when both the cantilever and anchor arms are considered. Carbon steel will be used in the entire anchor arm, in the top chord and pier members of the cantilever span, in the top lateral system of the suspended span, in all the floor system and in all sway bracing. Nickel-steel will be used in the trusses and bottom laterals of the suspended span, in the trusses except top chords and pier members, and in the lateral system of the cantilever arm. The anchor bars which hold down the ends of the anchor arms have been made very long to reduce bending stresses from expansion.

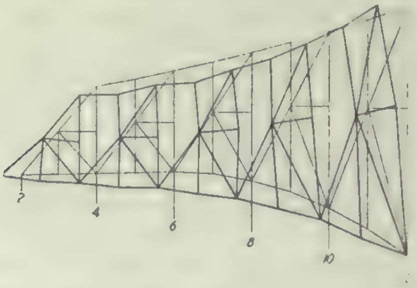
The suspender eyebars which support the suspended span are subject to oscillation in the plane of the trusses, due to expansion. A total expansion of 16 in. must be taken care of at these two points of suspension, besides the extension of the bottom chords under the live load. Manganese bronze bushings will be provided in these eyebars to permit of easy turning on the pins. But, even should these fail to turn, there is sufficient metal in these eyebars to prevent overstress from bending.

Friction brakes will be installed to prevent excessive longitudinal oscillations of the suspended span under tractive forces of trains.

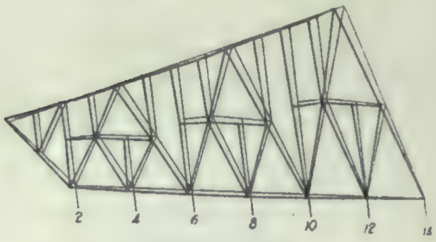
All latticing of compression members is designed in proportion to the sectional material of each member. The latticing is made strong enough to transmit in transverse shear 2 per cent. of the direct stress of the member.

Determination of Dead Load

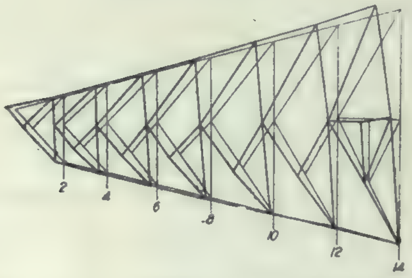
After the designer has determined the principal dimensions and has designed the skeleton outline of the bridge, the next necessary step is to calculate the stress sheets and proportion the various members. Assumptions must first be made on the dead load of the various portions of the span. In simple spans and in suspension bridges a first assumption of a uniform load per foot is generally sufficient except in very long spans, in which the concentrated loads should be calculated after the details are designed, and the sections should be checked and modified if necessary. In cantilever structures the distribution of the dead load is quite far from uniform.



Phœnix Bridge Company's design.



Official design.



St Laurence Bridge Company's design.

DEFORMATION DIAGRAMS OF QUEBEC BRIDGE
Live load reversed. Scale of deformation is 120 times greater than scale of truss.

The Forth Bridge weighs 2 tons per foot at the center of each span and 13½ tons per foot near the towers. The new Quebec Bridge weighs 8.7 tons per foot near the center and 38 tons per foot near the piers. The original Quebec Bridge was underestimated—the calculated dead load stresses were too small; it was to guard against a similar error that the official design of the new bridge was worked out in detail before even the system of trussing was quite agreed upon.

In calculating the weight of a span from the known weight of a shorter span it is customary to assume that the total weight of steel in trusses and bracing increases as the square of the span. This rule of thumb is sufficiently correct for small spans, not to exceed 200 or 300 ft. in length, but is obviously wrong for very long spans. If it were true for all spans, then a span 100,000 ft. in length could be built by providing 100 times more metal than a span of 1,000 ft. would require. We know that a span of such length is impossible with materials now known and that it would fail under its own load. As a matter of fact, in a cantilever system of the size of the Quebec Bridge the weight of the steel increases more rapidly than the cube of the length. This power or exponent increases still further for longer spans until it becomes infinite for a span which is just long enough to carry its own weight only at the allowable unit stresses without being able to carry any live load.

The principal dimensions being fixed and the preliminary stress sheets calculated, the details of the structure must be worked out. Needless to say that all these determinations which I have mentioned as taking place in succession are correlated to each other, and frequent retracing of one's steps is necessary before the detail plans are matured. The general order of procedure, however, is always about as described.

Bottom Chords.—The bottom chords of the anchor and cantilever arms and their details were the subject of a great deal of study and of many tests. Little is known about bridge compression members when compared to tension eyebars. The Quebec compression chords are members of unusual size. It is only in work of great magnitude that the engineer has an opportunity to make tests on a large scale; the expense of such tests is trifling in comparison with the importance to the structure of the results obtained. It is not sufficient to know that in some bridges a compression member is still standing and is subjected to a certain stress. What we should know is how much greater stress it would take to destroy that member. Such a member may be in the stage of danger from the last straw. The board made a number of tests on models of chords and posts, both for the official design and for the final one. The tests gave generally better results for model members representing the latter. The board feels, therefore, that a good design for these heavy members has been obtained.

There never was any serious doubt among the members of the board as to the advisability of making the bottom chords of the anchor and cantilever arms rivetted throughout without pin joints, except at the main pier bearings, to avoid excessive secondary stresses. This was done and will result in a stiffer bridge.

Top Chords.—The original design as submitted by the St. Lawrence Bridge Company contemplated top chords built of plates entirely. While this was approved at the time, later studies proved that by building the top chords of carbon steel eyebars there will be a slight saving of weight and cost, and the change was authorized. A tension member built of eyebars is the most reliable type by reason of the large number of full-size eyebar tests which have been and are constantly being made. It is the logical form of construction for transmission of tensile stresses. Their use reduces the secondary stresses. In a chord built up of wide plates with riveted joints, making it continuous, the secondary stresses resulting from bending due to the deflection of the span would be considerable, but owing to the uniform deflection of the "K" design they could easily be taken care of.

One of the guiding principles of the designers of the new Quebec Bridge was the elimination of untried features and experiments. In a span of this length some new features must necessarily be introduced, but they are limited to those only which grow out of the unprecedented length of span.

Suspension Bridges.—With the length of the Quebec span of 1,800 ft. and with the materials now at the disposal of the engineer, the practical limit of cantilever construction has very nearly been reached. In fact, if economy alone is to be considered, a cable suspension bridge would have been cheaper for a span of 1,800 ft. The cantilever structure presents a greater rigidity under moving load, and this greater rigidity was the determining factor in the decision of the board to adhere to the cantilever type. Tentative plans of the suspension type with wire cables were, however, partly worked out by the board in the way of study.

The comparative rigidity of the cantilever system on one hand and the suspension type on the other may be gauged by the deflections at the center of the span under full load.

Deflection at Span Center, Full Load

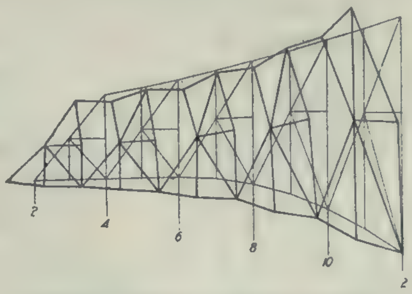
New Quebec span, total live load	11¾ in.
Cable suspension bridge, trial design—live load only, over	2 ft.
Cable suspension bridge—with 120 deg. variation in temperature and full live load—between highest and lowest position, about..	7 ft.

There are two reasons for the large deflections in suspension bridges—first, the deflection due to variations of temperature in the cables of a suspension span, which in a cantilever span is inappreciable; and, second, the fact that higher unit stresses are permissible in the wires of the cable than in the members of the cantilever span. The working unit stress in the wires is generally taken at from 55,000 to 60,000 lb., while less than one-third of this is permissible in rolled carbon steel.

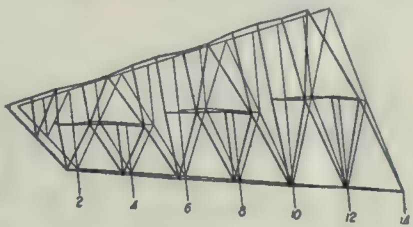
Moving Load

When a moving load travels on a suspension bridge it subjects it to partial deflections which may be compared to a wave motion. This motion is greatly obviated by the use of deep stiffening trusses. The deeper those trusses are, the smaller will be the partial deflections. It is, therefore, an advantage to make these stiffening trusses as deep as practical considerations will permit. But, on the other hand, the deeper the truss the more equalizing will it perform and, therefore, the heavier will it have to be. Each particular case must be studied in this respect, taking into consideration the relative importance of the live load which produces these local deflections to the dead load. A suspension bridge generally consists of one main span and two side spans. There are two distinct types of side spans—one where these side spans are suspended from the cables,, as in the Manhattan bridge in New York, and one where they are supported independently of the cables, as in the Williamsburg Bridge in that city. There are also two types of stiffening trusses for the main span—a continuous truss, as in the Manhattan Bridge, and a truss hinged at one or more points, as in the Brooklyn Bridge. For a bridge for highway and street car traffic, even though interurban trains are to use it, the most suitable type is the one with comparatively shallow stiffening girders continuous over the main span, with side spans suspended from the cables; this because of the absence of concentrated moving loads which would be heavy enough to cause appreciable local deflections. On the other hand, a bridge for railroad use, single or double-track, should preferably be built with deep stiffening trusses over the center span, hinged at center or continuous, with side spans supported independently of the cables. It is perfectly practicable to build an efficient and economical suspension bridge for railway use if these principles are adhered to.

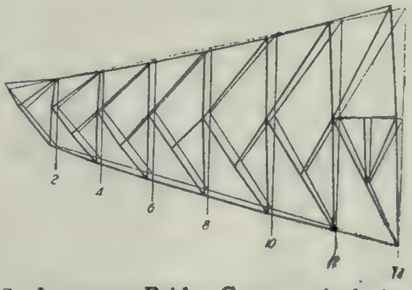
The main parts of a suspension bridge are the cables. These are sometimes replaced by eyebar chains. The longest eyebar suspension bridge is in Budapest and has a span of 981 feet. The longest cable span is 1,600 feet, and the one built by Roebling Brothers is still giving excellent service. There is no doubt, therefore, that the wire cable has been successful for long spans. It is doubtful if an eyebar chain suspension bridge of 1,800-ft. span would prove economical as compared with the cantilever type unless some special steel with which we have had little experience be used. The impact from moving load in the chain would be within 10 per cent. of the impact produced in the top chords of the cantilever arms, so that much higher unit stresses in eyebar chain links than those used in eyebar top chords of the cantilevers would not be justified. The allowable working stress in cables is not less than 55,000 lb. per square inch, while it is not over 30,000 lb. in nickel-steel eyebars, or a little more than one-half.



Phœnix Bridge Company's design.



Official design.



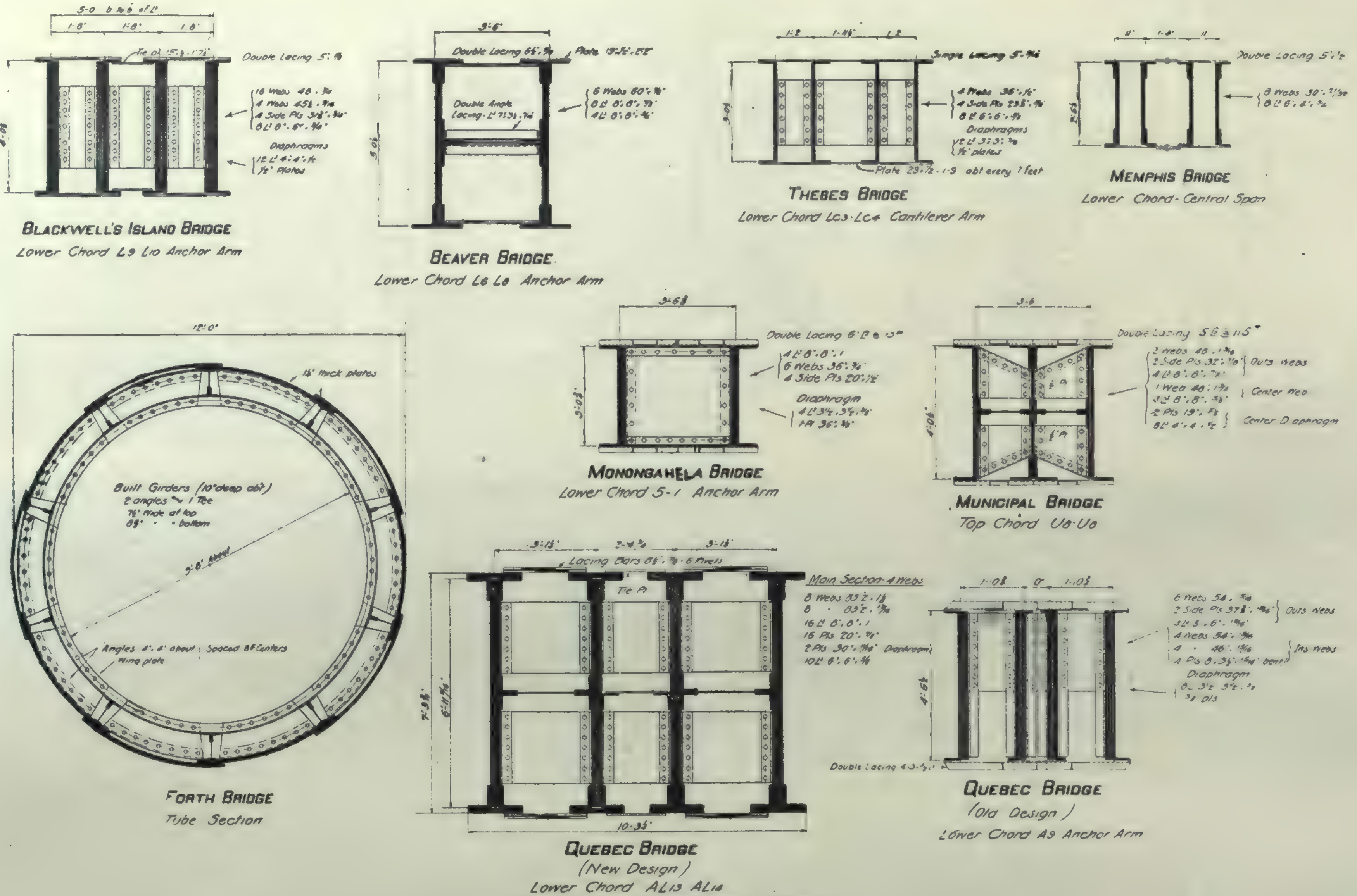
St. Laurence Bridge Company's design.

DEFORMATION DIAGRAMS OF QUEBEC BRIDGE

Dead plus live load reversed. Scale of deformation is 60 times greater than scale of truss.

Span Limits

From what was said throughout this paper it is obvious that the longer the span the greater the need of materials of high resistance. For plate girders and short spans ordinary medium steel does very well and is used exclusively; for longer spans, beginning with



BLACKWELL'S ISLAND BRIDGE
Lower Chord L9 L10 Anchor Arm

BEAVER BRIDGE
Lower Chord L6 L8 Anchor Arm

THEBES BRIDGE
Lower Chord Lc3-Lc4 Cantilever Arm

MEMPHIS BRIDGE
Lower Chord-Central Span

FORTH BRIDGE
Tube Section

MONONGAHELA BRIDGE
Lower Chord 5-1 Anchor Arm

MUNICIPAL BRIDGE
Top Chord U8-U8

QUEBEC BRIDGE
(New Design)
Lower Chord AL13 AL14

QUEBEC BRIDGE
(Old Design)
Lower Chord A9 Anchor Arm

Sections of large compression members.

400 feet, alloy steel, such as nickel steel, nickel chrome, vanadium, etc., may be used to advantage, this advantage increasing with the length of span. The practical limit of cantilever system for known materials is reached at about 2,000 feet for a railroad bridge. For longer spans, suspension bridges should be used, and are made possible by the high resistance of wire cables. The practical span limit of a wire cable suspension bridge has been calculated at 4,335 feet, assuming a working stress in the cables of 60,000 lb. per square inch.

The breaking load of the cables was assumed at 180,000 lb. per square inch. If an alloy wire be used of a still higher resistance the practicable limit will exceed the one given above. The limit of a cable alone without any load except its own, stressed at 60,000 lb. per square inch, is 15,160 feet. This assumes the versed sine of the cable to be ⅛.

An eyebar chain of alloy steel, such as now in use, should not be stressed beyond 30,000 lb. per square inch. Assuming this stress and a versed sine of ⅛, the limit of length of such a chain will be 7,010 feet. Hence, the limit of span length of an eyebar chain suspension bridge to carry live loads would be considerably below that of a cable suspension bridge.

The suspension design lends itself better to graceful treatment than a cantilever bridge, and may often be preferred for ornamental highway bridges even where a cantilever would make a cheaper bridge.

Considering the purely utilitarian structures, such as the majority of railroad bridges, the present knowledge of metals and its alloys, and the present loadings, we may sum up the various types of large bridges as follows:

For span up to 750 ft.	Simple spans
For spans from 650 ft. to 2,000 ft. . .	Cantilever spans with suspended span.
For spans from 1,500 ft. to 4,000 ft. . .	Cable suspension spans,

Arch spans have their place only where natural conditions are favorable, or for ornamental bridges.

Chain suspension bridges may be used for ornamental highway or city bridges, but for railroad service and for spans below 1,500 ft. the cantilever is to be preferred as giving a stiffer and generally a cheaper structure.

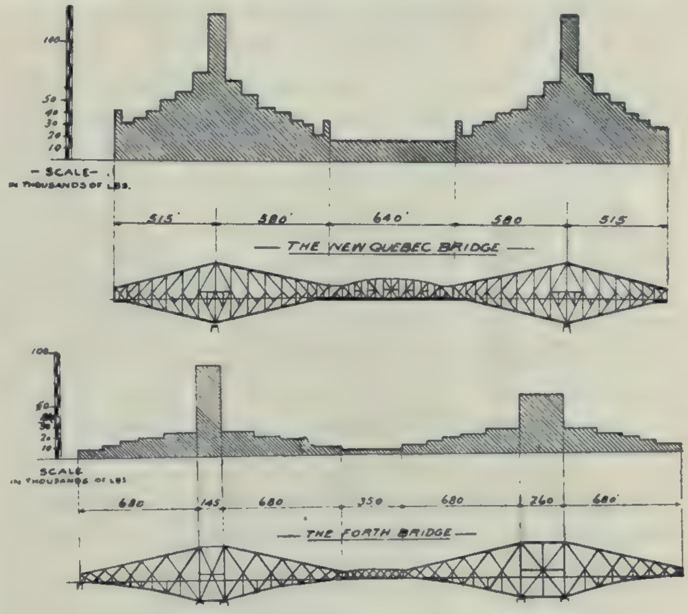
It will be noticed that the above limits overlap. Local conditions in each particular case will be considered in deciding whether a span between 650 feet and 750 feet should be simple or cantilever, or whether a span between 1,500 and 2,000 should be cantilever or a suspension span.

Secondary Stresses.—I shall not dwell long on this latest addition to bridge calculations. That secondary stresses exist is a fact. They may be from three sources: First, weight of member; second, temperature; third, bending from loads.

In the new Quebec design all secondary stresses were calculated and taken care of, but as a result of tests made by the Quebec Board, the stresses in tension members due to their own weight will be neglected. It is quite possible that if similar tests could be made for other secondary stresses it would be found that the metal adjusts itself to a large extent in such a manner as to reduce the importance of those secondary stresses and their influence on the elastic limit of the member. Personally, I feel there is a tendency at present to overrate the importance of secondary stresses. They should, of course, be considered in designing a structure; it should be the aim of the designer to reduce these secondary stresses to the minimum, but excessive refinement should be avoided, and unit stresses for direct loads should be made low enough to include these secondary stresses where they may exist.

Materials

The proper selection of materials for a structure is an important part of the design. The ordinary commercial steel will do for rough plate girder work, but for large bridges a metal of higher quality should be used. The metal or alloy should have a high elastic limit, a high ultimate stress, and possess sufficient ductility, which is characterized by the elongation and the reduction of the cross-section of specimens tested, to allow its being worked in the shops without fear of injury. Here, perhaps, climatic conditions should be mentioned. Intense cold makes steel brittle. This is shown by the greately increased number of rail fractures during severe winters. The use of high carbon steel should therefore be avoided in northern climates.



Diagrams of weights per foot of bridge.

The behavior of the various alloys in freezing weather needs yet to be studied.

In all that precedes I have endeavored to avoid speaking of matters which are usually given in textbooks. I have also avoided mathematical deductions, leaving them to better mathematicians, and I have attempted to deal with this vast subject from a practical standpoint only. When the final report of the Quebec Board is published it will give in detail what I have merely been able to outline. Numerous most interesting tests and mathematical analyses have been made and will be published in the course of events. It will then, perhaps, be realized, even by the members of the engineering profession who had no opportunity to design a very long span, that, while it is very easy to draw a diagram and a few of the principal details, it takes months of study, of retracing one's steps, of tests and calculations, to make a complete design and to learn that the preliminary diagrams and sketch details must often be changed entirely to make a practicable and an efficient structure.

Remodelling sewage works at Manchester, Eng., is involved in a plan contemplating the expenditure of $5,000,000, according to a recent report. It is proposed to alter the Davyhulme sewage works, which have an area of 221.5 acres.

Market in Australia for Canadian Asbestos Lumber or Asbestos Cement Flat Sheets

IN a comparatively recent period, a rapidly increasing demand has arisen in Australia for asbestos flat sheets for building purposes. So far it may be stated that this material is passing successfully through the trial or initiatory stage. When the Australian people become better acquainted with the advantages to be derived in using asbestos sheets, under certain climatic and other conditions, in preference to wood and other materials, the trade is sure to show marked development. In tropical and sub-tropical Australia asbestos sheets will, in the opinion of experts, supply a much desired want by providing a cheap and enduring building material, not only easy to erect but also impervious to wind and water and unaffected by high atmospheric temperatures. The greatest curse of many parts of the Commonwealth is the ravages of white ants, which rapidly eat up and destroy any wood structure they succeed entering into. At the present time numbers of suburban villas and country cottages are being faced with asbestos sheets and their roofs covered with asbestos shingles. Ready to erect and portable motor car garages composed of almost entirely asbestos materials are being constructed, and this applies to buildings of other character.

From investigation made it appears that Canadian manufacturers of asbestos lumber have not yet submitted quotations to Australian buyers to meet competition from the United Kingdom and the continent. Canada is the largest producer of crude asbestos, and it seems an anomaly that manufacturers of the finished product in the Dominion, with shipping facilities almost at the doors of their factories, are (through some inexplicable reason) unable to capture some of the Australian trade. The explanation may be in the active domestic demand; surely it cannot otherwise be attributed to inability to compete or indifference to oversea trade.—D. H. Ross, Canadian Trade Commissioner, Melbourne.

Simplified Bridge Design

The channel piers of the Hawthorne Avenue lift bridge, Portland, Ore., are pairs of concrete cylinders connected at the top by reinforced-concrete vertical diaphragms transverse to the bridge axis. They support tall steel towers carrying the counterweights and ropes for operating the lift span. The vertical tower columns are in the planes of the bridge trusses, but are braced by inclined posts in vertical planes transverse to the bridge axis. The lower ends of these braces are supported on long reinforced cantilever extensions or solid web brackets projecting from the up and down stream sides of the pier cylinders. This construction simplifies the structural steel work, without increasing the volume of submerged substructure, and requires a minimum of reinforced concrete. Messrs. Waddell & Harrington, of Kansas City, were the designing engineers.

Hardening Steel by Compressed Air

A process whereby steel is hardened by means of compressed air is now in use by a German firm in cases where only certain parts of the metal require hardening. The customary methods of hardening by chilling the steel in water, oil, or special baths is not satisfactory in such cases, owing to the tension created between the hardened and unhardened portions of the treated metal. In the new procedure the compressed air is sprayed over the metal through specially designed nozzles, by means of which, by varying the number and spacing of the openings, the degree of hardening may be accurately graded. The claim is made that a wide range of results can be obtained by adapting the shape of the nozzle to that of the work.

Massive Proportions of Panama Locks

The massiveness of the Panama Locks was graphically depicted in a lantern slide presented by Mr. William McNab, principal assistant engineer of the Grand Trunk Railway and past president of the American Railway Engineering Association, in the illustrated talk he gave at the president's reception at the recent convention of the association. The view showed a cross-section of the side wall and floor of one of the locks, with a pigmy man standing on one of the steps of the back wall. In the lock was an imaginary six-storey building, the top of which was about even with the top of the wall. In the circular section of the culvert in the base of the wall appeared the front of a locomotive, and in the longitudinal section of the transverse feed pipe was a team of horses with a truck.

Proposed Large Suspension Bridge

Up to the present time the Williamsburg Bridge over the East River between Manhattan and Williamsburg is considered the largest structure of its kind, with a span of 1,600 ft., having six tracks, two drives and two sidewalks. In a lecture before the Liverpool Engineering Society Mr. L. H. Caase proposed the construction of a larger bridge across the Mersey River at Liverpool, and gave arguments to prove the feasibility of the scheme. The proposed bridge would have a span of 2,660 ft. and a width of 50 ft.; the height above the water surface would be 200 ft., the towers being 490 ft. high. The live load on this bridge would only be a fraction of the heavy traffic that the Williamsburg Bridge has to carry. It is calculated that the bridge would accommodate about 600 cars and carriages per hour. At the towers the cables would be spaced 100 ft. apart, and they would be braced at the vertical center of the wind pressure. This would cause a slight torsion in the structure for eccentric loadings.

A note worthy arrangement is that of the approaches, which are designed have a length of 335 ft. and form a helical curve with four and one-half windings. This helical roadway is supported on a reinforced-concrete tower of 200 ft. inside and 300 ft. outside diameter. It is estimated that the structure proper would cost about $4,000,000.

Franklin Rods

New lightning conductors have been installed on St. Paul's Cathedral. In the course of the operations part of one of the original iron bar conductors erected more than 140 years ago under the supervision of Benjamin Franklin was discovered. This bar, having been inside one of the towers and so not exposed to the weather, was still in a good state of preservation. The Times recalls that the fixing of these "Franklin rods," as they were called, led to a heated controversy as to whether lightning conductors should have points or balls as terminals. The President of the Royal Society, who advocated points, had to resign. King George III. was a strong adherent to ball terminals.

Separate and Combined Sewers in Their Relations to the Disposal of Sewage

By John H. Gregory, Consulting Engineer, New York

IN the construction of a new sewerage system, or of new sewers, one of the problems which first arises is the question whether the sewers shall be built on the combined or on the separate system, or partly on both. The question often cannot be answered without careful study, as consideration has to be given to numerous factors. Two factors of the greatest importance are the questions of cost and of sewage disposal. It is the purpose of this paper to discuss briefly some phases of the subject as well as some of the relations which the sewers bear to the problem of sewage disposal.

As a general proposition, where both sewage and storm water are to be removed in artificially constructed channels, it is probably safe to say that the cost of building a combined system, in which both the sewage and storm water flow in the same channel, generally spoken of as a combined sewer, is less than that of constructing a separate system, in which the sewage flows in one set of pipes, frequently called sanitary sewers, and the storm water in another set, called storm water drains. This is especially true where the territory to be served is more or less closely built up and the streets are already surfaced or paved.

On the other hand, in suburban territory, not closely built up and not likely to be so built up in the near future, and where storm water is easily and quickly diverted into natural water courses, the separate system will in general cost less for the reason that only the sanitary sewers need be built at first, the construction of the storm water drains being deferred for a period of years, or only such drains built as are immediately required. The cost of building a combined system in such a territory might easily be so great as to be actually prohibitive, whereas the construction of the sanitary sewers of a separate system, as just outlined, could be carried out and would serve all requirements for a considerable period of time.

Topographical Considerations Important

One factor, however, should not be overlooked and that is the character of the topography. With steep grades and relatively high velocities in the sewers it might prove more advisable, on account of the relatively small additional cost, to build combined rather than separate sewers, although the character of the development of the territory might hardly be such as to require the removal of the storm water by this means.

In narrow streets and in congested districts combined sewers have an advantage in that only one sewer is required, thereby reducing to a minimum the amount of sub-surface obstructions. True, the combined sewer will be slightly larger than the corresponding storm water drain which would be required, but the increase in size of the latter is generally so small as to be of little importance. With the separate system, however, two pipes are required, and sometimes three, when a sanitary sewer is laid on each side of the storm water drain, this condition being forced when the storm water drain has to be built so close to the surface of the street as to prevent the carrying of house connections over it.

Again, with the combined system, but one house connection is needed, whereas with the separate system, especially in closely built up districts with paved yards and areas, two are required, one for the removal of the sewage and the other for the removal of the storm water from roofs, paved areas and other impervious surfaces. The practice of discharging storm water across the sidewalks to the gutters is not one to be recommended. The storm water is, however, sometimes removed by pipes laid just below the surface of the sidewalk and discharging at the gutter. Such pipes frequently give trouble, and often would not be low enough to drain paved areas adjacent to or in the rear of buildings. Two house connections, of course, cost more than one but not necessarily twice as much as one.

With a combined sewer laid in the middle of the street, as is generally the case, the cost of the house connections to the abutting property owners on each side of the street is equalized. With a separate system the cost of the house connections may be greater to the property owners on one side of the street than on the other unless the sanitary sewer and storm water drain are equally distant from the center of the street. If the connections to the curb or property line are put in at the expense of the municipality the cost to the abutting property owners as a whole is as nearly equalized as possible.

Combined sewers are generally laid on flatter grades than separate sewers and may increase the area which can be served without pumping. They may even eliminate pumping entirely. It sometimes happens that combined sewers can be advantageously adopted for a part of the system and separate sewers for the remainder. The writer has in mind one of the large cities in the east where no pumping is required and in which three-quarters of the city is sewered on the separate system and one-quarter on the combined system. The section of the city sewered on the combined system was too low to be sewered on the separate system without pumping and it was in order to avoid pumping that this section of the city was sewered on the combined system.

Higher velocities are required in combined sewers in order to prevent the deposition of grit. Velocities which would be permissible in sanitary sewers would not give satisfactory results in combined sewers. Deposits would be likely to accumulate, especially if a great variation existed between the minimum rate of dry weather flow and the maximum rate of storm flow. When deposits occur in combined sewers, organic matter is likely to be held back and settle out or become stranded. If putrefaction of this organic matter takes place before it is washed away, malodorous conditions arise. With a long-continued very low dry-weather flow, deposits may cause the sewage to be ponded, with the result that the sewage may become stale, or possibly septic. a condition which should by all means be avoided, independent of whether the sewage is to be treated or not.

Disposing of Sewage

So far the subject has been considered without reference to the question of sewage disposal, but one of the most important factors of all is what is to be done with the sewage after it has reached the sewers. If the sewage is to be discharged into a body of water without any treatment whatsoever, a condition less and less likely to arise in the future, combined sewers would frequently offer the simplest and cheapest solution of the problem. If, however, the sewage is to be treated, separate sewers have certain advantages. In order to limit somewhat the scope of the paper it will be assumed that the sewage must receive some treatment before final discharge and that the treatment will be at one point. Further, that ample opportunity is afforded for the discharge of storm water without having to carry it any great distance.

Sewage treatment works cost money. It is therefore desirable to keep them as small as possible, and in order to do this the volume of liquid to be handled must be kept at a minimum. Rarely, if ever, would it be the case that all of the storm water would have to be treated; hence in this discussion the question of treating other than the first wash of the streets, in addition to the sewage, will not be considered.

With a separate system the volume to be handled at the treatment works is the total sewage flow in the sanitary sewers. The liquid is made up of house sewage, ground water leakage and trade wastes. The flow may, however, be increased in times of storm by taking in the first wash of the streets from the storm water drains should it be found necessary or desirable to treat the first wash.

With a combined system, under dry weather conditions, the volume to be handled ordinarily is what is commonly spoken of as the dry weather flow and is also made up of house sewage, ground water leakage and trade wastes. In times of storm, however, the flow in the combined sewers is increased by the storm water from the streets. The liquid then consists of a mixture of house sewage, ground water leakage, trade wastes and storm water.

The effect of the storm water in combined sewers is two-fold—it not only increases the volume of liquid flowing but it changes its character. The first wash from the streets is often exceedingly foul and may increase the organic content of the liquid flowing in the sewers, giving what may be called a stronger sewage. As more and more storm water enters the sewers the storm water becomes cleaner and cleaner and with the greatly increased flow in the sewers the organic content of the liquid is decreased, resulting in what may be called a weak or dilute sewage.

The volume of liquid to be handled at the treatment works from a combined system depends on whether only the dry weather flow or the dry weather flow plus some storm water is to be intercepted. If only the dry weather flow is to be intercepted then the volume to be handled at the treatment works would, in general, be substantially the same from the combined system as from the separate system.

A Fundamental Difference

One fundamental difference between the two systems, however, exists. With the separate system no raw sewage escapes to the streams or water courses, while with the combined system raw sewage must at times be discharged into them. If it is planned to intercept only the dry weather flow, then, during storms, just as soon as the flow in the combined sewers exceeds the maximum rate of dry weather flow, the surplus flow, over and above that which can be intercepted, escapes, with the result that a mixture of sewage and storm water must reach the streams.

It is true that the overflow of raw sewage from combined sewers into the streams ordinarily would take place only during periods of storm, but even the occasional discharge of raw unscreened sewage into a stream is a question which must be carefully considered. It might be the case, and probably often would be the case, that as far as the temporary reduction of dissolved oxygen in the stream is concerned no harm would be done, but floating particles of paper and faecal matter are offensive to the sight. If, however, the stream into which the overflow of sewage would take place is sluggish and with but little velocity it may easily be that the continued overflow of sewage into it, from time to time, with the accumulation of sludge deposits on the bottom, would lead to offensive conditions.

While considering the question of the overflow of raw sewage from combined sewers, one point of view of the public should not be overlooked. In general, the public knows but little of the difference between the separate and the combined system. They know that sewers are needed, that the sewage must be treated before being finally disposed of and that a disposal works must therefore be built. Their natural inference is then that all of the sewage will be treated at all times. If the separate system is adopted, well and good. But if, instead, the sewers are built on the combined system and the public sees raw sewage, even if dilute, discharged into the streams from time to time will they be satisfied? And again, will the state authorities be satisfied? The question is one, aside from dollars and cents, which should and must receive the most careful consideration.

With a combined system, in order to reduce the number of times during the year that raw sewage would have on the sewage treatment works would be to increase their size, and consequently their cost, over and above that which would be required if the separate system had been adopted.

If it is found desirable or necessary to intercept and treat the first wash from the streets the separate system is more advantageous than the combined system as by its adoption no overflow of raw sewage to the streams will take place. The storm water drains receive only storm water and the first wash from the streets can be intercepted in the storm water drains and discharged either into the sanitary sewers, or into the intercepting sewer leading to the treatment works. As the flow in the storm water drains increases, the surplus water, over and above that intercepted, overflows to the streams but carries no sewage with it.

The separate system, under certain conditions, offers greater flexibility in the disposal of trade wastes than does the combined system, unless the first wash of the streets is to be intercepted and treated. Some trade wastes are offensive and if discharged into the sewers in such a condition must be treated. On the other hand some trade wastes are inoffensive and can be discharged direct into the streams without causing any nuisance or trouble.

With the separate system the offensive trade wastes can be discharged into the sanitary sewers and the inoffensive wastes into the storm water drains. The offensive trade wastes only would then be carried to the treatment works. With the combined system all of the trade wastes, the inoffensive as well as the offensive ones, would have to be intercepted and carried to the treatment works, with the result that the treatment works would have to be somewhat larger in size, and hence ould cost more, than would be the case if the separate system had been adopted.

With a community which is largely residential in character, the volume of trade wastes would affect but very little the total sewage flow. With a manufacturing community, however, the trade wastes might amount to quite a large percentage of the total flow and in extreme cases might equal in volume the house sewage. Under such conditions it is evident that, if any considerable percentage of the trade wastes is offensive, separate sewers would be of decided advantages as they would permit of the inoffensive wastes being discharged direct into the storm water drains, the offensive wastes only being discharged into the sanitary sewers and by them carried to the treatment works.

With a combined system, automatic regulators are generally used on the connections between the combined sewers and the intercepting sewer to limit the amount of flow from the combined sewers to the intercepting sewer. With a separate system automatic regulators are not required unless the first wash from the streets is intercepted in the storm water drains. Automatic devices in sewers, as a general proposition, no matter how well designed, are to be avoided whereever possible.

Removal of Grit

The presence of grit at a sewage disposal works is generally more or less of an annoyance, especially when the sewage has to be pumped and passed through settling tanks. With combined sewers, receiving as they do storm water from the streets, a considerable amount of grit must be expected to reach the disposal works, not only during wet weather but during dry weather also. With separate sewers the amount of grit received at the disposal works is relatively small unless the first wash from the streets is intercepted in the storm water drains and carried to the disposal works.

It has been suggested that a considerable amount of grit could be prevented from reaching the disposal works from combined sewers by inserting a catch basin or sand catcher on each connection between the combined sewers and the intercepting sewer. It is probably true that such would be the case but it is a question whether this would be a good method of removing grit. In the first place, these sand catchers would sooner or later fill up and unless cleaned at proper intervals would fail to serve the purpose for which they were built. Again, it is very probable that more or less organic matter would be deposited in them, especially when only the dry weather flow, consisting as it would mainly of sewage, as passing through them. The retention of organic matter would lead to offensive conditions as soon as putrefaction began.

The inserting of sand catchers between storm water drains and an intercepting sewer would seem to be a more practicable proposition, as the possibility of retaining offensive matter from sewage would then be eliminated. The sand catchers would still, however, have to be cleaned in order to make them effective.

With combined sewers or with separate sewers in which the first wash from the streets is intercepted in the storm water drains, grit must be expected. Such being the case, it is a question if the simplest way of handling the grit is not to admit it into the intercepting sewer from the combined sewers or storm water drains, without attempting to intercept any portion of it, and then to transport it with a good velocity in the intercepting sewer direct to the sewage disposal works. Even with sand catchers on the connections between the combined sewers or storm water drains and the intercepting sewer, enough grit is sure to reach the sewage disposal works to require its removal before the sewage is pumped or passed through settling tanks. The removal of grit at one point instead of at numerous points has many advantages.

The common practice of removing grit at a sewage disposal works is to pass the sewage at a slow velocity, roughly about one foot per second, through a grit chamber, the grit settling out and being retained on the bottom of the chamber. In large works mechanical means are provided for removing the grit from the grit chamber but in smaller works it is common practice to drain out the liquid from the grit chamber and then to shovel the grit out by hand.

Grit Chambers

With a separate system, in which the first wash from the streets is not intercepted from the storm water drains, a question arises as to the necessity of providing a grit chamber at the sewage disposal works. Practice varies. At some disposal works grit chambers have been provided and at others not. If the sanitary sewers are properly designed and built and are provided with tight covers, very little grit should get into the systems; but with macadam or dirt streets and perforated covers some grit must be expected. The safest plan, under ordinary conditions, seems to be to provide a grit chamber, even it be a small one. The grit would require removal only at more or less infrequent intervals.

Perhaps the question may arise as to the necessity of removing the grit. It would, of course, be perfectly possible to pump the grit along with the sewage but this would cause unnecessary wear and tear on the pumps. Again, if the grit is not removed before reaching the suction well, it may easily settle in and clog up the suction well, causing thereby a shut-down until the well is cleaned out.

If the grit is admitted to the settling tanks it may cause trouble there. It depends, of course, on what type of tank is used and on the method of operation. If the tank is an Imhoff tank, the grit, by settling down into the sludge digestion chamber, may check or prevent the proper digestion of the sludge and consequently affect the satisfactory operation of the tank. The admission of grit to a septic tank also may interfere with its satisfactory operation. If admitted to a plain settling tank, which is cleaned out at frequent intervals, the main trouble to be expected would be in the cleaning out of the tank.

With sewage from a combined system, the volume of sludge accumulating in settling tanks is greater than with sewage from the separate system. It may even be nearly twice as much, as has been found to be the case by comparison of the quantities of digested sludge removed from different Imhoff tanks, some of which have been connected with combined systems and others with separate systems. The greater volume of sludge from the combined system may mean that less organic matter has reached the streams than would have been the case if the sewers had been built on the separate system. If, however, the first wash from the storm water drains of a separate system is intercepted and carried to the treatment works then the volume of sludge should be approximately the same as if the sewage came from a combined system. Similarly the amount of organic matter reaching the streams should be approximately the same, although it is possible that it might then be somewhat less.

In many instances, probably in the majority of cases, pumping is required in order to pass sewage through a treatment works. This is generally due to the fact that the site of the treatment works is more or less distant from the territory sewered and by the time the sewage has reached the treatment works enough head has been lost to prevent passing the sewage through the works by gravity. It may even be that the sewage would be delivered at an elevation below that of the stream into which the effluent was to be discharged.

With a combined system the total height to which the sewage would have to be pumped would probably be somewhat less than with a separate system, but the difference would not be great. Some saving in fuel might therefore result from the adoption of the combined system but the same operating force would be required in either case. So long as pumping is required the actual saving in cost due to pumping the sewage against a less head, due to the adoption of the combined system, would be slight compared with the total cost of pumping, including fixed charges.

In conclusion, no hard or fast rules can be given for the adoption of either the combined or the separate system. Each has certain advantages. These, as well as local conditions and cost of construction and operation, must be taken into account. Other things being equal, especially as more and more attention is being given to the question of sewage disposal, the separate system seems to offer greater advantages. With either system, however, to secure satisfactory results too much stress cannot be laid on the necessity of not only proper design but satisfactory maintenance and operation.

Report on the Pollution of the Niagara River

In August, 1912, the International Joint Commission was requested by the Governments of Canada and the United States to determine to what extent, by what causes and in what localities the boundary waters between the two countries have been polluted so as to be injurious to public health, and to propose remedies. Numerous hearings and conferences with sanitary experts have shown that at least five waterways should be investigated, but the Niagara River is the only one that has thus far been studied in detail. A preliminary report of the entire investigation has been made under date of September, 1913, by a committee consisting of Messrs. Frank S. Streeter and Henry A. Powell and issued by the commission. The following notes as to the Niagara situation are taken from the report.

New York Side

Within the State of New York the area draining into Lake Erie and the Niagara River above the falls is estimated at 2,050 sq. miles but the part from which all sewage and surface drainage is discharged directly into the river is somewhat less. The population on this area is estimated at about 615,000, of which somewhat more than 500,000 are in the cities of Lackawanna, Buffalo, Tonawanda, North Tonawanda and Niagara Falls. All the sewage of the cities, except Lackawanna, are discharged in raw state directly into the river, and the sewage of Lackawanna, also untreated, is discharged through Smokes Creek, whose outlet is 1½ miles above the head of the river. All the above cities, with Lockport (which had a population or 17,790 in 1910) and a part, if not all, of the villages near the river bank, take their public water supplies for drinking and domestic uses directly from the river.

Below the falls the waters of the river are uniformly and dangerously polluted from bank to bank and the municipalities on both sides of the river are thereby affected. Above the falls the waters at varying distances from the American bank are polluted by the raw sewage of the above-named cities, and the public water supplies of each of them, when taken from the river without purification, are in varying degrees and at varying times injuriously, if not dangerously, affected by the sewage pollution from the cities further up the river.

The location at Buffalo at the head of the Niagara River, its population (now estimated at more than 460,000) and the fact that all its sewage is untreated and is discharged into the river above the intakes of the public water supplies of all the cities below make Buffalo the most important factor in the problem of the pollution of Niagara River. Of the population within the drainage area of the river in New York, Buffalo has nearly or quite four-fifths. A large increase in the population of this territory in the near future may reasonably be anticipated and, with such increase, the necessity of diminishing the pollution of the river is apparent. What changes can be made is being officially and seriously considered. An expert report, under date of June, 1913, on the availability of Squaw Island as a site for sewage-disposal works for the city has been made. Mr. Rudolph Hering has recently been consulted by the city with reference to its sewage conditions, and his report is expected at an early date. Examination is being made of the recent progress of other cities in methods of sewage disposal.

The committee's examination of the Niagara situation is not completed and no certain conclusions can be reached. One important fact seems to have been conclusively established, however, namely, that the further discharge of raw sewage at Buffalo and other cities into the Niagara River is unwise and that it should be treated to some extent at least before its discharge into the river. The extent of such treatment is still an open question.

Related to this question is another which, from the standpoint of public health, is still more important, namely: What purification of water supplies to safeguard public health should be adopted by the cities taking such supplies from the river below Buffalo? Whatever conclusions may be reached as to the necessary requirements of sewage treatment before discharge into the river, the commissioner's present view is that all cities and municipalities taking their public water supplies from the Niagara River for drinking and domestic purposes should be required to safeguard such supplies by proper methods of purification. This seems to be demanded in any event because of occasional inevitable contamination of the river waters from the surface drainage and washings from the drainage area above described which cannot be collected in any sewer system, but must flow directly into the river.

The committee therefore believes that, to secure a safe water supply from the river for cities on the Niagara frontier, two things are essential—(1) a proper disposal or treatment of the sewage and (2) filtration or other purification treatment of the public water supplies taken from the river.

It is obvious, however, that if the maximum requirement of complete sterilization of sewage of Buffalo and other cities is attempted two serious practical difficulties must be faced: (1) The great and overburdensome expense of installing and maintaining the necessary plant, and (2) the fact that complete sterilization of the sewage would not make the river a safe source of public water supply without purification.

It is hence believed that the inquiry of the commission should now be directed, first, to the extent to which sewage permitted to go into the river should be treated, and second, to the extent of purification required for water supplies taken from the river.

Grouping the Cities

In working out a comprehensive plan by the commission for remedying the pollution of Niagara River another matter, it is pointed out, should be considered. On the American side above the falls are the four cities, Buffalo, Tonawanda, North Tonawanda and Niagara Falls (N.Y.), named in the order of their location on the river. For practical purposes, the city of Lackawanna may also be included in this group, its sewage discharging near the head of the river. It may be assumed that each of these cities is under legal obligation not to pollute the water supplies of its neighbors on the river below. While Buffalo, from the amount of its sewage discharge, is the greatest offender, Lackawanna, the Tonawandas and Niagara Falls each in lesser degree is also delinquent.

Each of these cities will have its individual problem, but any plan to safeguard the public health by requiring artificial purification of sewage discharge into the river, or both, must be made applicable not to some but to all these cities. Because of diverse conditions it may not be reasonable to make the same requirements of each city, either with reference to the extent of the treatment of its sewage or the purification of its water supply. Each city contributes to the common danger, however, and each city should be required to contribute its share to the removal of that danger. To secure an equitable adjustment between the cities of those preventive measures which they must necessarily and concurrently furnish to remedy the common danger, the cases of all the cities contributing to the pollution should be heard and considered together as parts of a single case.

Canadian Side

As to the municipalities on the Canadian shore—namely, Fort Erie, Bridgeburg, Chippewa, Niagara Falls (Ont.), and Queenstown—the water supplies of all these places are taken from and their sewage (untreated) is discharged into the Niagara River, but no examination on the other side has been made except with reference to Niagara-on-the-Lake, at the mouth of the river, where the injurious effects of the pollution from the upper cities on the river have been seriously felt.

The Erie & Ontario Sanitary Canal Company proposes for the consideration of the commission a specific remedy for the pollution of the Niagara River by the construction of a canal starting at the mouth of Smokes Creek in the city of Lackawanna and passing around the city of Buffalo northward through a tunnel 6 miles long to Lockport, and thence over the escarpment into Eighteen-Mile Creek, emptying into Lake Ontario. A full statement of the company's purposes, what it asks for and why are set forth in its application to the Secretary of War, April 23rd, 1912, for the diversion of 6,000 sec.-ft. of water from Lake Erie and Niagara River, for sanitation, navigation, and power. Notwithstanding the provisions of the treaty and the United States statutes relating to the diversion of navigable waters, the canal company desired to submit evidence and statements upon which it might urge the commission to recommend the adoption of its plan, and several hearings for this purpose have been held. The committee believes that these hearings should go forward to determine the feasibility of the company's scheme.

Publicity and Engineering

ONE of the surest ways of securing popular support for bond issues for engineering work is to put the facts clearly before the voters and appeal to their good judgment, says The Engineering Record. Often conditions that must be rectified are so bad that they give all the publicity that is needed. A dangerous or bad-tasting water supply is a sufficient argument for the development of a new source or the construction of a filter plant. Impassable streets do not need to have their shortcomings preached to the populace. In transient matters, however, it may be necessary to institute a publicity campaign to remind the people of dangerous or insanitary conditions, which grow less important in their minds as time passes. This is quite likely to be the case with reference to flood-protection measures. Immediately after the heavy floods of last spring the city of Olean, N.Y., which had suffered considerable damage, retained Mr. George C. Diehl to make a study of conditions and to recommend abatement and protection measures. His report was rendered some time ago. Realizing the danger of apathy, the Chamber of Commerce has taken up the matter and is conducting a vigorous educational campaign by means of circulars and illustrated lectures, all under the direction of a trained publicity man. The reasons for the flood and the methods of abatement are being explained. It is hoped in this way to work up sentiment in favor of the appropriations which will be necessary to carry on the work. The same idea is being applied in a somewhat different way in Dayton, where a demand was found for information as to the progress of the flood-prevention studies. Accordingly a competent man—an engineer with newspaper training—was engaged to put the data in shape for distribution to the newspapers. Doubtless his functions can well be widened when the report is finally rendered, though in a city so badly hit as Dayton was there is less likelihood of apathy than in places where the damage was less. The plan is well worth while for engineers to bear in mind.

A large dry dock was opened at Singapore, Straits Settlements, on August 26th. This dock, known as the King's Dock, is the largest in the Far East. It is situated in Keppel Harbor at Singapore. It has an overall length of 852 ft. with a length of 800 ft. on the blocks and by means of an intermediate caisson it can be divided into two compartments, one 486 ft. and the other 325 ft. in length. At the entrance it has a width of 100 ft. Between the coping stones and the body of the dock there is a distance of 128 ft. while the width of the floor is 90 ft. At low water the depth on the sill is 25 ft. and at high water 34 ft., and the approaches are dredged to a depth of 33 ft. below low water.

Purification of Large Water Supplies by Means of the Ultra-Violet Rays

IT appears that the new method of sterilisation of water by means of the ultra-violet rays has been developed to such a point, and has reached such a stage of practical usefulness, as to make it desirable to describe "the state of the art and principle on which the modern apparatus is constructed." Mr. Max von Recklinghausen has done so in an article contributed to the Engineering News of New York.

The bactericidal power of the rays is stated to be far greater than is usually credited, the exposure of clear, but infected, water for a small fraction of a second within 1 in. of the source of the ultra-violet rays being sufficient for sterilisation. One of the first principles is the avoidance of any undue cooling of the lamp by the water. The lamp has therefore to be protected. The quartz mercury vapour lamp is used because it is economical, and also because the manufacture of these lamps has been standardized. Generally speaking, the hotter the lamp—i.e., the more energy it absorbs—the higher will be its production of ultra-violet rays. This is limited only by the corrosion of the quartz, which begins to take place at 1,200 deg.

Another of the elementary principles is to allow the maximum amount of light to enter the water. In order that all microbes present in the water may be struck by the rays it is essential that the water should be free not only from large floating bodies, but also from the small visible suspended matter. Thus in many cases the water must be filtered as a preliminary step. "Ordinary sand filters perform this function well, and at a much higher speed than formerly for the production of potable water." Thus we are advised to use ordinary sand filters at from three to ten times the ordinary speed. The size of filters may be considerably reduced where the ultra-violet rays treatment is to follow filtration. In order to ensure that such particles as pass through the filters are exposed to the light on all sides, it becomes necessary as another first principle to bring the water near the light several times, and to create a circulation close to the light by means of baffles.

An apparatus constructed on these principles has been utilised for serving several public water supplies. One installation is mentioned—viz., that at Marommes les Rouen, a suburb of Rouen, France, which installation has been working for nearly three years. Here the water is filtered through sand at the rate of 50 ft. in twenty-four hours, and the ultra-violet rays apparatus sterilises the water at the rate of 100,000 gallons per day by means of a single 1 horse-power lamp. Particulars are also given of a much larger unit. It consists of a sterilising channel, in the walls of which are inserted several lamps. The quartz lamp projects into the water, but is covered with a quartz protecting tube to keep the lamp tube from contact with the water. These lamps each require three amperes at 500 volts direct current. The ultra-violet production of the lamp is ten times as great as for the above-mentioned 1 horse-power lamp. One of these canal units, with twelve 2 horse-power lamps, is sterilising the water supply of a fairly large town. The raw water is obtained from a river, filtered over sand, and then passed through one of these units at the rate of 1,700,000 gallons per day. A large part of the time only a few lamps are in operation, but when the quality of the water demands it all the lamps are used. Thus the degree of treatment can be varied to suit the colour of the water.

Auxiliary Water Supply for Fire Protection

Earthquake-Proof System

IN addition to a high-pressure pipe distribution supply, which includes more than 70 miles of main, an auxiliary water supply system is being installed at San Francisco as a further safeguard. The reason for this is that, owing to the breakdown of the old water supply system, enormous damage occurred after the great earthquake in 1906. It was therefore evident that an earthquake-proof system ought to be provided in view of the fact that the new high-pressure system might conceivably fail at a critical moment in the future.

Reservoirs

Besides two fire boats for the protection of the water front and shipping, a storage system, comprising a series of cisterns specially designed to withstand severe shock, is being constructed. The work is described in a recent number of the Engineering Record of New York. The underground cisterns are intended for use only in case of serious damage to the high-pressure pipe system.

Formerly, when San Francisco had no adequate domestic distribution system, several underground brick cisterns were constructed and used. These, however, fell into disuse, and at the time of the fire most of them were filled with debris instead of water, and their positions were unknown. Since the fire these have been repaired and will be re-used. The new cisterns are made of reinforced concrete, and are eighty-five in number. They are circular in plan, and are built beneath the surface at street crossings, their exact positions being indicated by a distinctive type of pavement over them. Their inside diameter averages 30 ft. The top and bottom are domed, the rise of the top dome being 5 ft., with a 30-ft. span or diameter, the rise of the inverted dome being 3 ft. The maximum inside depth is 18 ft. 1 in., and the average capacity is 75,000 gallons. The walls are 12 in. thick, and the domes are 18 in. thick at the crown and 2 ft. 5 in. at the springing in the case of the roofs, and 18 in. thick at the crown and 2 ft. thick at the springing in the case of the floors. No fixed pipes for filling and emptying are rigidly connected to the cisterns, thus eliminating, should an earthquake occur, the disrupting stress excited by a rigid connection upon the concrete structure, which should thus vibrate as a whole without injury. During the construction of one of these cisterns a rain storm occurred which caused the tank to float, and to rise 6 ft. above its foundation. After the water had been drained away the cistern was found to be perfectly sound. This is taken as a satisfactory proof of the trustworthiness of the cisterns for the purpose for which they are designed.

Pipes

"The same precautions which was taken in designing the cisterns to provide for resistance to vibration was exercised in designing the high-pressure distribution system." Cast-iron pipe has been used throughout, and is considered to be best for the purpose. In the chert formations, and in the solid sand clay formations, it was found that the oscillation in the earthquake was not nearly so pronounced as in the filled-in area, which constitutes a considerable part of the lower districts. Thus, a different type of joint was considered desirable in each of these two classes of ground. For solid ground a spigot and socket leaded joint was chosen, while for the filled-in area a double spigot sleeve joint with steel sleeves was used. This double-socket joint is capable of withstanding, without excessive leakage or injury, twice the amount of lateral distortion that the spigot and socket joint can undergo. The standard joint for each case was decided upon after an elaborate series of tests had been made. The socket is of great strength, and there are double ring grooves to hold the lead in the interior of the socket; otherwise there does not appear to be any great difference between these and the ordinary socket joint. Where it was necessary to lay pipes with sockets pointing downhill, lead wool was used. In testing these mains the joints were left exposed, and if the leakage amounted to more than .0055 gallons per lineal foot of "pipe joint" in twenty minutes, while water was being pumped in by a force pump, the joints had to be recaulked. The mains used for a head of from 600 ft. to 760 ft. were subjected to a test pressure of 450 lb. per square inch; this test pressure was lessened according to the working head on the main, the lowest test pressure being 150 lb. per square inch.

Recent Progress in Methods and Character of Street Cleaning

By S. Whinery, Consulting Engineer, New York

THERE has been no radical or particularly noteable advancement during the last few years in the machinery and methods of street cleaning in American cities. But no little progress has been made in improvements upon methods and appliances that have become standard, and their more efficient and economical use, in complying with the public demand for cleaner streets than had heretofore been tolerated, and in a more careful study and analysis of the business, especially with reference to detailed cost of the work, for the purpose of effecting economies.

Machinery and Appliances

The flood of patents issued for street cleaning devices continues unabated, but these patents relate largely to details and disclose little of value for practical use. This is somewhat surprising in this land of inventors. Most of our street cleaning apparatus is admitted to be more or less crude and unsatisfactory, and there would seem to be possibilities for material improvements, if not radical innovations. The applications of mechanical power in the place of horsepower to street cleaning work has received attention and has been tried in a number of cities, but the results do not seem to have sufficiently commended themselves to municipal officials to warrant their more general use at present.

The application of the vacuum or suction principle to the picking-up and collection of street dirt is also being experimented with to a small extent. Such machines, if they can be perfected so as to do the work satisfactorily and economically, would have the great advantage of removing the dust from the street without resort to the use of large quantities of water, which is a consideration of importance where water is scarce or high in cost.

Thoroughness and Efficiency

There has been in the past few years a decided advance in the standards of cleanliness of streets demanded by the public and attained by the municipal authorities. This is noticeable both in the large and in the smaller cities of the country.

In towns and the smaller cities, and the suburban section of the larger cities, where earth and broken-stone street surfaces prevail, the use of oil to suppress dust has greatly increased, and is now quite general. While this is not, strictly speaking, a street-cleaning process, it serves as an effective improvement in the comfort of using such streets, and eliminates the sanitary danger, and the inconvenience and damage from flying dust.

Accounting and Analysis of Cost

Perhaps the most promising and fruitful advance that has been made in recent years is the greater attention given to the study of the details of street cleaning and the keeping and analysis of more complete and itemized accounts. In an increasing number of cities the accounts of the street-cleaning department have been revolutionized and expanded so that the total and unit cost of every important detail of the work may be ascertained and analyzed. This requires, of course, greater attention to the collection of exact data of quantities and costs, and involves no little additional expense, but it is becoming more and more appreciated that the money so spent is wisely invested, since the main reliance for increased efficiency and economy in this, as in most other lines of business, must be upon small savings in many details rather than upon any radical changes in methods and machinery.

The value of the results of practice and experience in other cities for comparative study is becoming more appreciated, and there is, therefore, growing up a strong demand for the general adoption of a uniform system of accounting, and for more complete and detailed printed reports of street-cleaning departments.

Some of the important matters that have more recently, and are now receiving increased attention may be mentioned:

One considerable source of the dirt and waste that must be removed from the streets is commonly called street litter, consisting of miscellaneous wastes thrown upon the streets and sidewalks by those passing along the streets, or swept out of business houses and residences. Street littering is effectively prevented in most European cities by the rigorous enforcement of laws or ordinances prohibiting it. Most of our American cities have such laws and ordinances, but they are practically "dead letters."

The possible utilization of street sweepings in some way that will partly repay the cost of street cleaning is another matter that is receiving more attention than heretofore. The most promising outlook for such utilization lies in the direction of filling low lands, or building up new and very valuable areas of land by filling in shore areas now covered by shallow water and at present not useful for any purpose. Contrary to the prevailing opinion, experience and investigation have shown that street cleanings free from garbage may, if properly handled in the dumps, be so used without danger to the public health and without serious inconvenience or offense to the public.

Street sweepings from paved streets contain very considerable quantities of valuable fertilizing elements, the value of which at the market prices of these elements, probably averages at least two dollars ($2) per ton of sweepings. The cost of transporting and handling the raw sweepings is usually too great to permit of their profitable use as fertilizers in the farming districts, but some satisfactory method ought to be and probably will some time be discovered to profitably recover these fertilizing elements.

Attention is being urged in many cities toward preventing the large accumulation of dirt and debris, and the inconvenience and expense of street-cleaning department, caused by building operations. Custom seems to have given builders the idea that they have a right to deposit the waste from their operations upon the fronting streets and that it is the duty of the street-cleaning department to remove and care for it. A number of cities have taken suitable action in this matter and others will doubtless follow.

Demolition of a Tunnel

The demolition of a tunnel which hitherto has prevented the widening of the Great Central Railway Company's main line from London to Sheffield has just been completed at Darnall, an east-end suburb of Sheffield. The removal of the tunnel, which was 300 yards long, has occupied seven months, and the work of providing two extra permanent tracks for a distance of three miles will now be undertaken. According to The Times Engineering Supplement, the demolition of the tunnel has proved very difficult, owing to the fact that on account of a number of trains passing—averaging 330 in twenty-four hours—the blowing up and clearing away of the masonry has had to be confined to the period between 11.25 on Saturday nights and 1.40 on Sunday mornings. The work has been completed without delaying a single train and without an accident. The greatest length removed at one time was 118 ft., necessitating the removal of between 500 and 600 tons of debris. Altogether upwards of 600,000 tons of material have been removed, and the cutting thus left is 85 ft. deep from the top to the rails. A 15-ton derrick on bogies, with a crane having a dip of 82 ft., was employed, and also a giant steam navvy capable of removing 1,500 cubic yards—nearly 3.000 tons—in ten hours.

Municipal versus Contract Street Cleaning

By J. W. Paxton, Superintendent of Street Cleaning, Washington, D.C.

STREET cleaning by city labor in Washington, D.C., superseded the contract system on July 1st, 1911. Notwithstanding the changes in methods and the first cost of new equipment, the expenses for the first year were lower than those for the years when the work was done by contract. At the end of the second year, June 30th, 1913, the records disclosed that for the expenditure of the same amount of money more than 25 per cent. more work was accomplished than during the last year of the contract system.

Under the contract system in Washington changes in specifications and methods of doing the work took place very slowly, and usually only when specifications were made up for new contracts, which was once in five years; but in the municipal work of the last two years improvements have been of daily occurrence. Each blockmen's work has been studied individually. Time studies with odometers have been made of all vehicular movement. Collections are all made working toward the dumps. Schedules are arranged for all machines, squeegees, flushers, etc., so as to do effective work every moment from the time they leave the stable until their return. Each gang is arranged with the view of having the number of sprinklers, machines, broomers, shovellers and carts in proper proportion. It has been found that some of the wider alleys can be swept to advantage with one-horse brooms, and schedules have been very carefully worked out to do the work with as little loss of time as possible in going from one alley to another.

The area of each square, intersection and alley has been carefully computed and card-indexed, and a cost-keeping system has been established which assists in comparing the cost of cleaning 1,000 sq. yds. each month or oftener with the cost in previous months, or one foreman's work with that of another doing similar work, or one method of cleaning with another. The office is supplied with a multigraph printing machine, so that schedules may be changed and reprinted on a day's notice.

The most radical change in methods has been to increase the hand-cleaning combined with an occasional washing and to decrease the machine-broom areas. The machine brooms raise so much dust that heavy sprinkling is required; the fine dust mixes with the water to form a fine mud, which is smeared on the street by the broom, and, becoming dry, turns to dust again. The brooms only sweep the coarser particles, and many of these are thrown by centrifugal force over the broom back to the pavement.

Hand-cleaning work is capable of better distribution than any other method, more attention being given to the dirtier areas by simply increasing the number of men, who only clean the portions of the street which are dirty and work on these portions until they are clean. There is a fine scum which becomes plastered to the pavements, particularly sheet asphalt, which is not apparent when the pavements are dry but rises up in a thin sheet of mud when moist, making the pavements very slippery. This and fine dust cannot be removed by the hand cleaners; but by washing about twice per week, in addition to hand cleaning, these troubles can be eliminated.

Time Studies and Increased Efficiency

Establishing Tasks and Inducing Workmen to Accomplish Them—A Particular Method from Which General Principles may be Derived

By Ralph W. Langley

THE purpose of these informal notes is to give an account of some difficulties met in establishing tasks and inducing operators to accomplish them. It is not assumed that the methods of meeting these difficulties would succeed equally well in all industries. However, they have been found to be at least partially successful in the particular industry to which they have been applied; namely, the manufacture of coils for electrical purposes.

The Collection of Data

The first step taken in establishing tasks was to collect data by means of time studies. Before the results of these time studies were filed as permanent records, however, every effort was made to supply the operator with the best facilities for doing the work. In fact, several days were largely taken up in recording conditions which needed improvement. This part of the work has continued to call for attention even after it appeared that every possible improvement had been made, and a list of things to be done is kept and checked off as accomplished.

The various departments were taken up separately, an important operation was chosen in each, and the operator who was said to be the most skillful was studied first. Various operators were chosen at random, studied in the same kind of work, and the time taken by each operator for a given element was compared with that taken by the others. The results were often surprising, for the operator who was considered the most efficient by the foreman was often found to be inferior to one with no apparent claim to merit.

Best Operators for Time Study

The choice of operators to be timed was limited to those who were proficient in the kind of work to be studied; of these, the operator was chosen who most often repeated the various elements in the same order. The objects of the time study were explained to the operator as clearly as possible in the beginning and especial emphasis was laid on the statement that a piece-work rate was not contemplated. It was noticed that when an operator starts, even on work to which he is accustomed, the time taken at first is longer than after the first six or eight pieces have been completed; as the operator becomes fatigued, the time taken to pick up small objects is the first to become longer. If the work was such that several sequences of the various elements could be used, the operator was induced to try them all in order that the one shown to be the shortest might be selected and studied. After some experience it was possible to tell off-hand, in most cases, whether the usual method was the best.

The Attainment of Accuracy

For accuracy, reliance was placed on a large number of observations made at various hours of the day on one operator. When the same operation had been observed 30 or 40 times the elementary times were selected and the minima chosen. These elements were found valuable in starting new work to determine whether or not the operator was trying to mislead the observer.

More concordant results were obtained by using a "running watch" whenever possible, that is, to start the watch and read it at intervals during the operation, and to start again when the operation is repeated. Elements as small as could accurately be recorded while the watch was running were chosen, but it was found much more important to choose an element with a sharply defined ending than to take one shorter and less well defined. The individual time for each of a series of elements chosen primarily, because they are sharply defined, will invariably be more concordant and accurate than if the operation had been separated into the shortest possible elements without regard for clearness. That time which occurred most often was selected as the so-called minimum.

If it was necessary to find the time taken for an element too short to be determined with a running watch, it was obtained independently on another series of operations. The elements were recorded as fast as they were accurately determined and while still fresh in the memory of the observer. It was found best to tabulate them primarily according to the operation, and, secondly, according to the type of coil.

Fatigue Allowances

Another difficulty is to determine the fatigue allowance. If the time allowed for a task was the sum of the minimum times for all the elements involved, only the most expert operators would accomplish the task, and only when no unavoidable difficulties arose. In order to enable the expert operator to accomplish the task consistently and the less experienced operator to accomplish it at all, a certain additional time must be allowed. This is a more or less arbitrary percentage of the sum of the elements called the fatigue allowance.

The necessary fatigue allowance for any class of work was determined by making detailed time studies of the less expert operators at various hours of the day. Any avoidable delays were deducted and the difference between the actual time consumed in completing an operation and the theoretical time calculated from the elements was called the fatigue allowance in the task as set for an average operator it was assumed that increased skill due to practice would in a measure offset physical fatigue.

The Advantage of Definite Sequences

A strict sequence of elements for a given operation seems to be of great advantage to the operator. This becomes irksome to some who vary the monotony by using various sequences, but this is never done by the most successful. In fact, a uniform sequence of moves is a good criterion of the operator's skill.

Having collected enough data to make a start, the most skillful operator was assigned to a task. Fortunately, Mr. H. K. Hathaway pointed out the importance of encouraging the operator and directed that each piece be timed at first until the operator gained confidence. The task was accomplished, and other less skillful operators became interested and increased their output even before being assigned a task, apparently to see what they could accomplish. Inexperienced operators on bonus began to exceed the former output of the most skillful.

At first the task seems so difficult in comparison with what is tacitly considered a fair day's work that it is hard to induce anyone to consider it seriously. If one operator can be induced to accomplish it others will follow, but unless especial attention is given to this in the beginning it soon becomes a tradition that the task is impossible because no one ever did it—because no one ever tried.

On the other hand, a group of earnest operators will soon gain confidence in the fairness of the time allowed on new jobs and will attempt the task without question.

In the coil-assembling department the variety of work done by each operator was great when the system was first established. The principle was that any operator should be able to do all kinds of work equally well. Absolutely no tasks worth mentioning were accomplished until this theory was abandoned. The operators were separated into zones with an instructor for each zone. As far as possible each zone specialized in one kind of work. An increase in the number of tasks accomplished followed at once. This was increased as soon as an instructor earned a bonus.

Difficulties of Task Work

The most serious difficulties in the way of accomplishing every task are as follows, assuming that the time allowed is correct:

1. Selection of earnest operators.
2. Selection of suitable instructors.
3. Operators' lack of confidence with new work, fear that time will be cut, and lack of initiative to try to accomplish a new task; cliques among the operators to obtain more time for a job by failure to accomplish it.
4. Routing of work to operator least fitted to do it.
5. Preparation of instructions that will be detailed, concise, and impossible to misconstrue; and the inducing of operators to follow them carefully.

As regards the selection of operators a process of elimination has been followed. The choice of instructors is limited to the operators. Both of the conditions need attention. Lack of confidence and initiative, as well as cliques among the operators, should be followed up and reported by the instructor to the time-study man. It is hard to induce the instructor to keep the time-study man posted on prospective failures to earn bonus, and many tasks are lost because the operator does not know whether or not he is falling behind. The most successful instructors are those who keep close watch on the output of each operator until he gains confidence. Instructors who can use a watch are of great assistance. Often operators will refuse to attempt the task, and when it is demonstrated will say that they can do one or two pieces in the time allowed but not the batch. When the observer is positive that the operator is deliberately trying to mislead him and that he is perfactly able to accomplish the task, he informs the operator that he can accomplish the task or leave. In some cases the operator will proceed to work and finish in 70 per cent. of the time allowed. It would seem that a book of shop rules to be given each operator, outlining clearly the policy of the management as well as the rules of the shop, would help to solve this problem, and eliminate many misconceptions.

If it is possible to assign work to the operator best suited to it, the chances are naturally more in favor of success. A tag with each operator's name and, as far as possible, a list of work on which he is most expert, is kept on the bulletin board to help in this respect. This tag moves to the hooks together with the job ticket on which the operator is at work.

Instructions that are both complete and concise as well as detailed are difficult to prepare; some quality must suffer as the others improve. It proved necessary to sacrifice detail, at least temporarily, because of continuous changes in the specifications and rush on new work.

Minutely detailed instructions were found invaluable in training new operators when the instructors would use them as follows:

The instructor gives the instruction card to the operator and tells him to read, as the instructor demonstrates slowly and names the various objects as they are handled. This method accomplishes several things; it fixes the names in the operator's mind, insures a definite sequence of moves, prevents mistakes, and at the same time it increases the instructor's efficiency. If the operator forgets how to start a thirty-minute operation after the instructor has finished it, he is more apt to consult the card than appear stupid by calling back the instructor.

In short, it was found that the duty of the time-study man had only begun when he had accurately set the task. Unless he makes it a point to visit each department and see each instructor, daily if possible, a great many details which are vital to success will be ignored, and unless he makes every effort to exercise tact he may only succeed in defeating his own purposes. The utmost conservatism in his views as expressed regarding the tasks is essential, up to the point where he is able to satisfy himself that the task is a fair one. This offers an excellent opportunity to exercise his powers of patience as well as observation; and he is constantly reminded by circumstances that it is just as easy to be mistaken as it is necessary to be right.

It has been our experience that much trouble can be caused by setting a task on new work, and using elements selected from similar work, if there is any doubt that the two jobs are exactly alike. If the operator fails to earn the bonus he will usually take twice the time allowed even if he could finish in a little more than the allotted time. This is possibly due to a feeling of resentment. It is not unusual to find that a liberal time allowance on bonus will double an operator's output over that accomplished on day work. If the time allowed is so short that only the one expert can finish in time, the three other operators of average skill will consume twice the time allowed. It would seem that the greatest good for the employer and the greatest number of employees demands a liberal time allowance with a fair bonus rate rather than an extremely close time allowance and high bonus rate.

Surface finish for concrete was given attention by the Board of Water Supply of the City of New York in connection with bridge construction on the Catskill aqueduct, and of several methods examined for securing even, clean textures the use of selected aggregate of pink granite for mortar facing was successful in special cases, according to the board's annual report for 1911. The mixture was poured by the aid of a sheet-iron diaphragm, moved as the backing was poured, the facing and backing being thus placed as a monolith. Experiments showed that the most practical ways of treating concrete surfaces were by pneumatic hammers and by sand blasts.

The Analogy Between Horse-Racing and Estimating

By G. Alexander Wright

MAY it not truly be said that there is very little difference between horse racing and bidding on buildings? Are they not "gambles?" The invitation to figure and the jockey's start are similar; both events arouse a like interest; both hope to win. The odds are long, for there are many entries. There is the usual horse racing talk about the "dark horse," the "favorite," the "pull," the "inside track," and so forth, none of which is probably ever true, in either case; but it is horseracing talk.

At last the start is made, and away they go! The bidders and the ponies over the same ground, the same course, and the owners look on and speculate. The primary object is to get ahead of each other, win at any cost, and each competitor does his best to beat the other fellow. If the first jockey in has forgotten or omitted anything, he is disqualified. If the bidder forgets or omits anything, he "gets the contract." It amounts to about the same thing, and the bidder is quite as much of a real sport, for he takes "his medicine today and gambles again tomorrow." But this is not what I started out to say. If, perchance, it has had the effect of seriously arresting the reader's attention to a most important subject, some good purpose may yet be served.

And now to be serious: Speaking of estimating in competition, an experienced and well respected western contractor recently described our present estimating methods to me as "a horse racers' gamble." Few architects, if they will look squarely at the facts, can honestly differ with the candid western contractor. Owners, and persons not over kindly disposed toward architects, claim that we know but little about the "cost" of a building; but these same people do not themselves know anything of the mysterious and devious processes involved in the obtaining of a bid, which, unfortunately, they too often think is to be the "cost" of the building. Architects, however, know of these things, and that the word "estimate" or "bid" does not really mean the "cost," when the work is finally completed. Architects, however, seldom deem it their duty to enlighten clients upon such matters, and this is especially so in the case of the architect who, by whatever means he may choose to employ, is able to persuade owners into believing that he can give them cheaper and quicker results than some other architect having offices round the corner.

Architects to Blame

It is not an unusual circumstance for a contractor to sign up for a job, when even the best of us are morally certain that the work as shown and specified, can never be properly done for the money. But we as architects are paid to see that it is so done, are we not? Why then should we allow an owner, or ourselves, to accept such a bid, and so to place this burden upon any contractor, who, for want of a systematic method, underestimates his quantities, or, as too often happens, omits something entirely? Some owners (happily not all) are looking for these mistakes, and are ready to seize the advantage, usually in the mistaken idea that they are to get something for nothing. Some architects will be perfectly content with the thought (more is the pity!) that it is none of their business; that it is up to the contractor to look out for himself.

It is well known that under our uncertain system of estimating, by which the contractor is made to take all the chances, these things do and must occur; that they are winked at, and that they cause much unnecessary trouble. But is this good practice, or sharp practice? Surely our ethics should extend beyond the mere personal equation; so, to put it plainly, is it "honest?"

Is it just, when we, in a sense, undertake to act as architects and arbiters of the contract? If not, can we wonder at the thousand and one questions, difficulties and extras which occur in the supervision of such a contract, under the present system? Can we wonder that contractors are sometimes suspicious?

But, not to dwell too long on this picture, let us seek a practical remedy for removing these and other similar conditions which make such a picture possible. The individual architect or owner, let it be said, is not solely responsible. The entire trouble lies in our senseless, wasteful, unscientific, and wholly faulty methods of inviting bids, and in the encouragement to gambling which we, who should be the first to condemn, still extend to bidders. That the contractors do not rise up and smite us, is really a source of wonder to me. Not our business, indeed! It is our business to encourage better and more honorable methods.

The scope and character of our construction has advanced so rapidly and considerably of recent years, that scarcely anything is done now as it was even twenty years ago; and the time now allowed to a contractor for estimating is altogether too short; conditions are not conducive to accurate results. Without accurate quantities, there can be no accurate bids, and with our rough-and-ready guess-work methods, wide differences in bids must necessarily prevail. The lowest bid is usually by no means the most accurate, and frequently it is out of all proportion to the quantity and character of the work under contract. Before the work proceeds very far, the mistake is discovered; then there arises the natural desire of the contractor to save on his contract.

But the difficulties, and sometimes friction, which we meet with upon our buildings in progress are not usually caused by the effort of the lowest bidder (sometimes spoken of by the daily press as the "fortunate" contractor) to make a larger profit than that to which he is entitled; the difficulties are quite as often due to his not unnatural wish to keep his loss on the contract within the smallest possible limit.

Therefore, is it not indisputable that incorrect quantities are in the first place largely responsible for unnecessarily low, and consequently inaccurate bids, which, in their turn, cause so many of the architect's troubles?

Another factor is the too short time allowed to bidders for estimating, while a third and very important factor is found in the fact that our modern methods of construction require special training in order to take off quantities accurately. Few contractors possess these advantages, and even if they did, fewer still could find time to put the principles of scientific quantity-taking into profitable effect.

The ridiculous—even the ludicrous—side to our present way lies in the fact that when contractors are invited to submit a bid in dollars and cents in competition, off they go (like the race horses) to compete against each other, neck and neck, as to the quantity of material the job will take; and the more careful a bidder is in taking off his materials accurately, the less chance he has, under present methods, of getting the job!

The whole business seems absurd to any one with any pretense to experience in quantity taking. There can only be a certain amount or quantity of material necessary, and no amount of figuring can make it less; it is folly, therefore, to think that a number of bidders on a piece of work will all succeed in taking off just the right quantity; one person might, but not a dozen or more.

If some system could be adopted whereby each bidder would be furnished with a complete, detailed list of the exact quantities of materials and labor required (thus placing all bidders on the same basis), then the competent, careful contractor would get more contracts at proper prices, and so be able to do better work, while the incompetent and the shoe-string bidders would either have to become more competent or seek other fields of industry, a result which would prove quite as much of an advantage to architects as it would to the remaining contractors.

It is obvious that some such system must in time displace our present wasteful and primitive method, if for no other reason than for the benefit such a system would confer upon both architect and client. It would seem that much good would result if the chapters throughout the country gave some consideration to this vital subject and familiarized their members with the advantages that would follow the adoption of some standardized method or system of estimating upon quantities. This and other kindred subjects have recently been receiving consideration in certain chapters, while many architects and contractors in different States are well known to favor the adoption of an estimating system, based upon accurate bills of quantities, which shall become the true basis of the contract. This will certainly be done some day, and then we shall all wonder why so much time, effort and money have been thrown away in the past.

Concerning Water in Concrete Mixtures

THE occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand, and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid without adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand, and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement "float" in the water filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the coarse aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroughly drenched. Following thorough mixing, water as needed, is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.—Municipal Engineering.

G. T. P. Station at Regina

Architects: Messrs. Ross & Macdonald

PLANS have been prepared by Messrs. Ross & Macdonald, architects, of Montreal, Toronto and Winnipeg, for the Grand Trunk Pacific Railway station at Regina. The building, which will occupy an area of about eight thousand square feet, is to be erected at the corner of Albert and Sixteenth Streets. It will be two storeys in height, the lower part being reserved exclusively for the service of the travelling public and the upper part divided into offices for the railway officials. The main waiting room, however, will extend through the two storeys of the building.

The station will be constructed of buff brick and limestone trimmings throughout, with large windows and wide entrances. On the front and the Sixteenth Street side there will be huge canopies of iron and glass, extending out over the entrance steps and the sidewalks. The front will be surmounted by an ornamental clock.

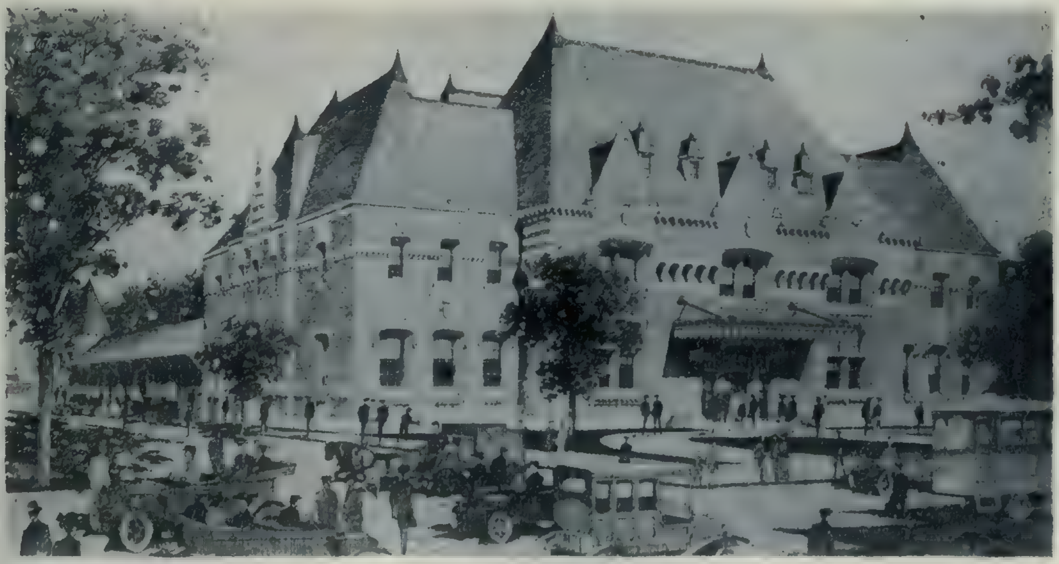
The front entrance will lead into a vestibule, with walls and floor of marble and ceiling of ornamental plaster work. From the vestibule there is direct communication with the main waiting room, the walls of which will be entirely of Caen Stone, the floor of different colored marbles, and the ceiling of decorated plaster. Around the room there is to be a gallery, with a handsome bronze rail in front, from which will open the various offices in the second storey.

On the right of the main waiting room, entering from the street, a commodious restaurant and ladies' waiting and retiring room will be situated, while on the left will be placed the men's waiting room, main stair to the offices above, elevators, shoe shine parlor and second-class waiting room. Directly ahead on either side of the main waiting room the ticket and parcel offices will be located, and at the end the exit to the train platforms. On each side of the main entrance vestibule two alcoves will be provided. The one to the left will contain the news and cigar stand, and that on the right will contain three telephone booths. Outside the station proper and opening directly off the concourse the baggage room will be built, this being conveniently situated for both outgoing and incoming baggage.

Pipe Break at Lockport

A serious pipe break occurred in the 30-in. steel lock-bar force main at the crossing under the International Railway Company's tracks in Lockport, N.Y. Workmen for the railway company were excavating holes for trolley poles, and the rupture in the pipe, according to information received from City Engineer Julius F. Frehsee, was the result of a concussion caused by blasting the rock close to the pipe line. The rent in the pipe was about 5 ft. long and the sheets of steel were forced inward about 11 in. The lock-bar was broken completely in two in several places. The centre of the rupture was located 5 ft. east of a butt strap. The blast caused the steel sheets in this 30 ft. section of pipe to separate, or pull out of the lock-bar practically the entire length of the pipe. It was necessary to remove two 30-ft. sections of lock-bar pipe which were replaced by five 12-ft. lengths of 30-in. cast-iron pipe.

A 40-ton girder 8 ft. deep and 63 ft. long was hoisted 255 ft. above a street in New York and set over an occupied building in twelve minutes by Milliken Brothers, Inc.



Proposed G.T.P. Station at Regina

The Normal School, Regina, which has been erected at a cost of $250,000. Architects, Messrs. Storey & Van Egmond; contractors, The Parsons Construction Company.

Constructional Operations Proceeding Apace at Regina

Correspondence of the Contract Record.

ALTHOUGH building conditions have been affected by the financial stringency, present conditions are much better, and the prospects of a large crop have given business a brighter tone.

A number of important projects are under consideration. The most important of these is the City Council's schedule for local improvements, which involve an expenditure of nearly $800,000. The Federal Government has purchased a site upon which a Customs House will be erected at a cost of $200,000. The structural details will be announced later.

We reproduce herewith views of the Connaught and Normal schools, now nearing completion. The Connaught school was erected for the Public School Board according to designs prepared by Mr. J. P. Puntin, architect. Messrs. Cotter Bros. were the general contractors.

The Normal school, which is costing $250,000, was erected for the Provincial Government by the Parsons Construction Company, Regina, according to plans prepared by Messrs. Storey & Van Egmond, Regina. The Normal school is three-storeys high and is of red pressed brick construction. It is faced with Bedford stone.

Plans are now being prepared for an up-to-date apartment block on Victoria Avenue for Mr. W. M. Williamson.

City Engineer McArthur has decided on a novel plan to keep the roadways of Regina in proper condition. The assistance of the boy scouts has been enrolled. Boy scouts patrol different sections of the city at stated times, and report where improvement is needed in the roads. These reports are handed over to what is now called the "road repair gang." This gang of men is employed for the specific purposes of making repairs, and is kept busily engaged on fixing all the bad spots reported on by the scouts. It is expected that by this system the roads throughout the entire city will be in good repair by freeze-up.

The sewer work contracted for by the Regina city council early in the year is nearly all completed, and already the city engineer and his staff are busily engaged on planning the extensions for next year.

Building Regulations at Victoria, B. C.

In the building by-law amendment which is to be considered shortly at Victoria, B.C., provision is made for the limitation of buildings to 100 feet, except those of steel frame construction.

A limit of 100 feet from street grade to top of coping is

The Connaught School, Regina. The Saskatchewan capital's latest and most creditable type of school building. Architect, Mr. J. P. Puntin; contractors, Messrs. Cotter Brothers.

imposed for all buildings except of this character, the maximum of any kind being 130 feet.

Most of the provisions deal with constructional improvements which have developed in the experience of the last 15 months since the present by-law was approved. Most concern the actual construction of buildings, while others are of general importance.

Stairways in class B buildings, not more than three storeys in height, not including basement, may be built of wood, provided that this sub-section shall not apply to buildings used wholly or in part for hotels, apartment houses, lodging and rooming houses, public halls, theatres, dance and concert halls.

No signs are to be erected on roofs within the fire limits Nos. 1 and 2 without permission from the council. The regulation with regard to removal of wooden buildings being taken away for new structures is made much more stringent in view of certain experiences which arose last year and caused the council a great deal of trouble.

Further regulations with regard to repairs are established, and the important provision is made that during the construction of any building of more than three storeys in height, the joists, beams or girders on each floor below the level where work is being done are to be adequately covered with scaffold planks laid closely together to prevent workmen from falling between the joists and girders, and protect them from falling material. Guard rails not less than three and a half feet in height are to be placed on all swinging, suspended, or outside scaffolds, and around elevator, stair or other openings in the interior of such buildings.

It is probable that several bodies of citizens interested in constructional work will desire to express their opinion before the amendments are finally ready for adoption.

Mainly Constructional

The News in Brief—From Coast to Coast

Good progress is being made on the new civic abattoir at Toronto and it is hoped that it will be in operation early next spring.

Building permits for the first nine months of the year in Winnipeg amounted to just over $16,000,000, as compared with $18,407,450 for the same period of 1912.

Vancouver's building permits for September totalled $1,318,796 and for the first nine months of 1913 $9,752,738, as compared with $1,570,395 and $12,722,997 for 1912.

The Montreal Board of Control have decided to experiment with wooden blocks, creosoted, for paving. Some years ago tests were made, but the report was unfavorable.

The Alberta Home Builders' Company is building seventeen new houses at Ogden. Work is expected to start almost immediately, and a suitable location has been selected on the flats.

The Montreal Chambre de Commerce has suggested the appointment of additional building inspectors as a means of reducing the number of fires, which have recently increased considerably.

During the period, January 1st to September 30th of this year, 5,594 permits were issued representing a total expenditure of $22,410,289. The corresponding figures for last year were 5,592 and $22,240,383.

A two-hundred-brick per day unit of the Mount Royal Brick Company is being completed at Vearennes, Que. The construction work is now finished, and the installing of the machinery will commence very shortly.

Price Albert building returns for the nine months period just closed are $1,328,990. This compares with $1,859,425 for the corresponding period of last year. Mr. H. L. Fitzsimmons is building inspector for Prince Albert.

There is now only one more of the big spans across the St. Lawrence, in connection with the Lachine bridge to be put in place. The double track across the bridge itself is expected to be ready at the end of the month.

An order for 50,000 barrels of cement has been placed with the Edmonton Portland Cement Company by the Government of Saskatchewan for use in building the provincial university buildings to be erected at Saskatoon.

A company is now being formed in Aylmer, Ont., which will ask the Dominion Parliament to grant a charter for an electric railway to run from London to Aylmer, Ont., via Belmont and continuing on to Port Burwell. This electric line has long been deemed a necessity.

Plans for a comprehensive sewerage system for the whole northern half of the city of Toronto, including old North Toronto, Moore Park and Cedarvale, have been completed by the Works Department. It is estimated that the cost of the work will run into several million dollars.

At Toronto the approximate value of the buildings for which permits were taken out between January 1st and September 30th was $22,410,289. This is a slight gain over the 1912 return for the corresponding period, which was $22,240,383. Last month's total of $1,577,518 compares with $2,922,563 for September, 1912.

The oldest house in Montreal, the Lacroix mansion, built about 1636, on a site granted to a wealthy merchant of those days by Paul de Chomedy, Sieur de Maisonneuve, first governor of the city, has been saved by the efforts of the Numismatic and Antiquarium Society from the encroachments of the street extension campaign.

Building permits issued at Vancouver, B.C., during the nine months of the current year, ending September 30th, represented a total value of $9,774,038, compared with $12,722,097 for the corresponding period of last year. The September figures are $1,340,096 and $1,570,395 respectively. Mr. S. H. Jarrett is building inspector at Vancouver.

An important contract was let recently to the R. J. Lecky Company, of Regina, this being for the construction of the new traffic bridge over the river at Twenty-fifth street, Saskatoon. The contract price was $398,000. Three tenders were received for the work, that of T. J. Robertson amounting to $604,000, and that of Parsons Bros. to no less a sum than $837,000.

Messrs. Nicholas & Sproat, architects, of Vancouver, have put in a claim to the Winnipeg board of control for $800, for plans for a new city hall which they submitted during a recent open competition here. The plans did not win a prize, and while on their way back to the Vancouver firm were lost in transit by fire at Medicine Hat. The architects hold that the city is responsible.

Plans for two additional pumps are being prepared by the waterworks department of the Montreal Council. The consumption of water is rapidly increasing, and provision is being made for pumping a further ten million gallons per day. Two pumps of 12 million gallon capacity are being made by the John McDougall Caledonian Ironworks Company, Limited, and the further two pumps for which plans are being drawn up will be required by June next.

Building permits in Toronto for September amounted to $1,600,000, as compared with $2,922,563 for September, 1912. Statistics for the year to date are much more promising. Permits to the value of $23,898,642 were issued in the first nine months of 1913, while in the same period of last year the total amounted only to $22,240,383. The total value of permits issued in the whole of last year was $27,401,761, so that approximately $3,500,000 will be required in the coming three months to equal that record.

Messrs. J. G. White & Company, the eminent British harbor engineers, have secured a contract involving some six million pounds sterling, for a scheme of harbor extension in Vancouver, where the provincial government recently granted shore rights to the Vancouver Harbor and Dock Extension Company. Huddleston & Vigers, and Hansley Heenan, late British admiralty engineer, are also joint contractors. It is intended to provide 25 miles of dockage at Lulu Island and Sea Island, and many miles for industrial sites and railway terminals.

Having secured transfer of the city hotel license, Mr. J. C. Tapping, licencee, will proceed as soon as possible to build a new and up-to-date hotel in the city of Revelstoke. This modern structure will be erected on the property close to the corner of First street and Orton avenue, at an approximate cost of $40,000. Plans and specifications are now being drawn. It is intended to have frontage on First street of 75 feet and a depth of 65 feet. The building will consist of either brick or concrete, with a basement and three floors. It is hoped to have the contract completed in time for occupancy by the coming Christmas.

Montreal's water consumption is increasing so rapidly that, though two new twelve-million gallon pumps are being added this autumn to the existing plant, plans are already being prepared for the purchase of two more pumps of the same capacity, which will be delivered next June. During the past summer the maximum daily consumption reached the high figure of 53,000,000 gallons, which is an increase of about 7,000,000 gallons over last year, and, as it is anticipated that the water consumed in Montreal next year will show even a greater increase than has been the case this season, arrangements are being made to cope with an augmentation of about 10,000,000 gallons. Hence the necessity of ordering two more pumps.

A. Robertson, superintendent of construction at the Hudson's Bay company's store and warehouse at Edmonton, where extensions and improvements estimated to cost $250,000 are being made, reports that the two buildings will be ready for occupancy in December. The store, which is being remodelled, will be four storeys high in front, 105 by 100 feet, and 50 feet in the rear. Three passenger elevators and one for freight will be installed. These will all be operated by electricity generated on the premises. Other improvements are electric ventilating fans throughout the building. Twenty feet north of the store and connected with it by an underground passage, a substantial brick warehouse of five storeys has been erected. The second floor, in which the district offices will be opened, is being subdivided into suitable spaces. The other portions of the building will be used for wholesale purposes, without subdivision. The basement of the warehouse contains the plant by means of which the combined buildings will be heated, also a complete plant for the generation of electricity to be used in many direct ways for lighting and power. Heat is obtained from two 150 h.p. return tubular boilers. The boilers are also to be used to provide power for driving the machinery by means of which electricity for light and power is generated. The electrical power is obtained from two 100 kilo. turbines, supplied by the Westinghouse Company. A refrigerating plant, with a capacity of 10 tons, will be put in for use in connection with the cafeteria, and an air-compressor, by means of which the cash boxes to be used in the store will be operated, will be connected with the same set of machinery.

Canadian Railroad Development

The new C. P. R. elevator at St. John will be ready to handle grain by December. It will have a storage capacity of 1,032,000 bushels. The cost will be $600,000.

The new Canadian Northern line between Toronto and Ottawa is now completed and a regular service has been installed. The new route shortens the journey between Toronto and Ottawa by sixteen miles.

Good progress is being made on the main line of the Grand Trunk Pacific Railway towards Prince George. Steel is now at mile 1200 from Winnipeg and it is expected that the track will reach Prince George in a month or so.

The fourth and last span of the C. P. R. bridge across the St. Lawrence at Lachine has been placed in position by the Dominion Bridge Company, which have the contract for the steel work. The placing of the span—400 feet long—was under the direction of Mr. P. B. Motley.

The Canadian Pacific Railway have awarded a contract to the John S. Metcalf Company, Limited, constructing engineers, Montreal and Chicago, for the extension of the Glen Arch at Westmount, P.Q., in order to provide for a width of four tracks. The estimated cost is $50,000.

The officials of the Grand Trunk and Grand Trunk Pacific Railways are said to be considering the removal of their terminals and offices from Boston and Portland to St. John, N.B. Mr. E. J. Chamberlin, president of the Grand Trunk Railway, is expected to visit St. John within the next few months.

Messrs. Warren & Wetmore, of New York, have been appointed architects to draw up plans for the new C. N. R. station to be constructed in connection with the Mount Royal tunnel and the proposed electric train service from Montreal to the Model City. Plans will shortly be drawn up, but construction of the station will not be commenced until the spring.

Track-laying on the Regina-Moose Jaw & North Westerly Branch of the Grand Trunk Pacific Railway has just been completed to mile 91, a short distance beyond Mawer, Sask., fifty miles west of Moose Jaw, and within a few miles of the Saskatchewan River. Permission has been granted by the Board of Railway Commissioners for operation of this line, and as this is one of the greatest grain-producing lines in the west, a heavy traffic will move this season.

Two contracts in connection with the extension of the Montreal & Southern Counties Railway Company have just been let to Messrs. Ross & McComb. They will build the sub-structure of the bridge to be constructed across the Yamaska River at Cesaire, P.Q. The bridge will have four piers and two abutments, and is to be completed by the spring. Ross & McComb will also construct the company's extension through the town of Granby. A new sub-station is to be erected at Rougemont, and the company are adding a dozen new coaches to their equipment, some being the largest yet used on the line.

Work on the new Grand Trunk Railway station now undergoing construction at Stratford, Ont., is proceeding rapidly. The main station building is 151½ feet long and 60 feet wide. The tower will reach to 60 feet in height. The building is being constructed of granite and vitrified brick on a heavy concrete foundation. The roof will be of green slate. The umbrella roof connecting station and express building will have 43 feet spread. In connection with the new station the extensive railway yards are to be entirely relaid, although this will only be partially done this year, a portion of this work being deferred to next spring.

The grade revision of the entire system of the Intercolonial Railway will be started on the Cape Breton section of the road as soon as authority for the expenditure has been obtained from parliament, while the surveys are about completed for the change between River du Loup and St. Flavie, where the grades are heavy. Engineers are, in fact, going over the whole system and in good time better grades and curves will be secured. The Intercolonial management is also improving the stations, which are being generally overhauled, while fine new structures are being built at Bathurst and Sussex, in New Brunswick, and at Truro, in Nova Scotia. The last-named will be one of the finest station buildings in the Dominion.

Track-laying on the main line of the G. T. P. Railway is proceeding towards Prince George at a rapid rate. Steel is now at mile 1200 from Winnipeg. A short check was experienced at mile 1190 where the railway for the second time crosses the Fraser River. Track-laying was held up for a short time while the steel bridge across the Fraser River was completed. This obstacle has now been successfully passed and the track-laying machines are steadily pushing their way forward. The Fraser River is crossed for the third time about forty miles west of the second crossing, but the bridge here will not be allowed to delay track-laying, temporary trestle being erected to get the steel across the river. The steel bridge will be put in place shortly after, and towards the end of November the track should reach Prince George.

The C. N. R. have let the contract for the electrification of the Mount Royal tunnel and terminals to the Canadian General Electric Company, Toronto, the cost being about $500,000. The contract includes the supply of seven electric locomotives, in addition to multiple unit cars, and the complete installation of apparatus. The cars, eight in number, will be used for the local service between the Model City and Montreal. Yards will be established near Back River, and will give facilites, in the case of the C. N. R. ordinary service, for changing from steam to electric locomotives, as no steam locomotives will enter the city. A direct current of 2,400 volts will operate the system, and a seven-minute service through the four miles between the city and Mount Royal will be given. Provision will be made for the extension of this system at any time to any part of the service.

C. P. R. Five-Mile Tunnel in B. C.

The building of the C. P. R. tunnel, five miles long, at Rogers' Pass, B.C., in connection with the double-tracking work between Calgary and Vancouver, has been let to Messrs. Foley, Welch & Stewart. In addition to the boring of the tunnel, the contract calls for the construction of 11.1 miles of double track approaching the eastern portal and 2.3 miles of double track approaching the western portal.

The work will reduce the height of the summit at which the line crosses the Selkirks by 537 feet; will eliminate 4.4 miles of distance and 2,500 degrees of curvature, and on 15 miles of track the gradient will be reduced from 2.2 per cent. to 1 per cent. Nearly five miles of snow sheds will be eliminated from the system by the work of the tunnel. Nothing will be done this year in the way of starting work on the approaches to the tunnel; but the camps have been set up, and the boring machinery has arrived, and, as far as this important work is concerned, there will be no delay. The tunnel, which will be on a tangent throughout its entire length, will be on a .93 per cent. gradient, ascending west, and will be a single one, carrying a double track, 30 feet wide by 20 feet high.

A new method of construction has been adopted for boring the tunnel. Instead of boring simply from the two ends, it has been decided to bore a pioneer tunnel, 7 feet by 8 feet, parallel with the main tunnel and cross-cut at short intervals so as to enable several headings to be worked simultaneously. In the case of this particular tunnel, which will be an exceedingly interesting piece of work, the height of the mountains through which it passes precludes the possibility of vertical shafts being used. The pioneer tunnel will aid in the ventilation of the railway tunnel during its construction. The boring of the pioneer tunnel has actually been started and the first cross-cuts will be made when these have been driven about 2,000 feet. About the end of December of this year this part of the work will have been completed. The plant for boring the tunnels alone will cost half a million. Before the work is complete, it will cost the C. P. R. in the neighborhood of $10,000,000. Thirty feet of boring per diem is the estimate of Mr. A. C. Dennis, who is in charge of the work. Sometimes the men in the Canadian Northern tunnel make as much as forty and fifty feet per day; but, again, when they strike a difficult piece of rock they are lucky if they make thirty feet in the day. It will take three years to complete the bore, from which about 250,000 cubic yards of material will be taken out by way of the pioneer tunnel.

One of the features of the work, which will be of the greatest interest and value, considering that it means the piercing of the heart of a great mountain range and is on a parity with the boring of the Alps many years ago, is the erection of model villages at the two portals of the tunnel at a cost of $50,000. The floors of the houses at Glacier, are to be eight feet from the ground, with bridges to connect the houses with the work.

Personal Mention

Dr. Karl Imhoff, of the Emschergenossenschaft, Germany, arrived recently in New York City to spend his annual vacation in the United States and Canada. He will remain several weeks and will probably visit Atlanta, Cleveland, Toronto and several other eastern cities before returning.

To Lecture in Railway Engineering at McGill

Mr. W. C. Willard, who, as announced recently in this journal, has just been appointed Assistant Professor of Rail-

Mr. W. C. Willard, new Lecturer in Railway Engineering at McGill University.

way Engineering at McGill University, is a graduate of Lehigh University, where he obtained the degree of C.E. and M.S. Further in the matter of qualifications, Mr. Willard is an Associate Member of the American Society of Civil Engineers and of the American Railway Engineering Association. Mr. Willard's experience has been of a varied character. One of his earliest appointments was as chief of a locating party on the Tidewater Railroad in Virginia. Later he became instructor in railway engineering at the summer school of surveying at the University of California. Another academical post was that of professor of railway and highway engineering in the State College of Washington. His municipal experience has been obtained in the cities of Hot Springs, Ark., Portland, Ore., and Oakland, Cal. The position which he resigned in order to accept his present appointment was that of engineer of transportation facilities for the Panama-Pacific International Exposition, San Francisco. Mr. Willard has been a frequent contributor to the technical press of the United States.

Mr. Geo. Janin, chief engineer of the Montreal Council, has received an increase in salary of $1,000, making a total of $7,000 per annum. The salary of Mr. Stuart Howard, head of the Sewers Department, has been raised from $4,000 to $4,500; that of Supt. Lesage, of the Water Department, from $4,000 to $4,500; and that of Mr. Parent, superintendent of lighting, from $3,000 to $3,500.

Trade Notes

In the notice of Parian ware published on page 67 of our issue of October 1st we omitted to say that the Canadian General Electric Company, Limited, Toronto, were the selling agents.

The Raymond Construction Company, Limited, of Montreal, are opening a Toronto branch office, which will be in charge of Mr. H. C. Wotherspoon. The company have a number of contracts in hand at Montreal and in extending their field there is every argument in favor of their success. Mr. Wotherspoon was formerly with the William Grace Company, the Chicago contracting firm, as manager and superintendent in charge of work at Hamilton and Niagara Falls.

The B. F. Sturtevant Company of Canada, Limited, have shipped the first fans constructed at their factory at Galt, Ont. The company have opened an office at 919 New Birks Building, Montreal, being now directly represented instead of through an agency. The following orders have recently been secured: Dandurand Building, Montreal, fan, motor, etc.; Chapleau, Ont., C. P. R. round house, fan, engine, heater, etc.; Station H Post Office, Bishop and St. Catherine Streets, Montreal, fans, motors, heater, and air washer; National Breweries, Limited, Colborne and William Streets, Montreal, fans for ventilation of new stable, motors and sheet metal work.

H. B. Hebron & Company, of Montreal, and the Canadian Bitumastic Enamels Company, of Toronto, have joined forces, and are now operating under the name of the Canadian Bitumastic Enamels Company, Limited, at 55 St. Francois Xavier Street, Montreal, and 720 Traders Bank Building, Toronto. This firm holds the agency rights for the provinces of Ontario and Quebec of the famous Bitumastic materials manufactured by Wailes, Dove & Company, Limited, and have made plans to take contracts to apply their own materials where specified. In this they are following the plan of Wailes, Dove & Company, who have found that the success of their materials in every instance is largely due to their refusal to sell any of their products—with the exception of Bitumastic Solution—unless it is applied by their own men.

Book Reviews

Text-Book on Highway Engineering. By Arthur H. Blanchard, Professor of Highway Engineering, Columbia University, New York, and Henry B. Drowne, Instructor in Highway Engineering, Columbia University. 762 pages, 234 figures. Cloth $4.50 net. Publishers' Agents: Renouf Publishing Company, 25 McGill College Ave., Montreal.

Professor Blanchard has been so active in promoting the science and art of highway engineering, and he has done such excellent work at Columbia University—work whose influence has been felt in Canada and more remote fields by virtue of frequent contributions to the technical press—that this book cannot fail to be received with much interest. The book is written primarily from the standpoint of the instructor and the student, giving, first, the logical order and arrangement of the subject matter, and second, sufficient detail to thoroughly acquaint the student with the particulars and practice of modern highway engineering. At the same time the book is sufficiently broad in its scope and content with reference to the materials, construction, maintenance, specifications and cost data, to serve as a comprehensive reference book for the experienced engineer. All phases of the subject of modern highway engineering are treated.

Several chapters will be found that are somewhat of an innovation in books on roads and pavements, as, for example, the chapters on "Preliminary Investigations," "Surveying and Mapping," "Design," "Bituminous Materials," "Dust Prevention by the Use of Palliatives," "Bituminous Surfaces," "Bituminous Macadam Pavements," "Bituminous Concrete Pavements," "Concrete Pavements," and "Economics, Administration and Legislation." Two hundred and forty-two pages have been devoted to the subject of bituminous materials and their use in the construction and maintenance of roads and pavements.

The writings of eminent engineers and chemists have been drawn upon in order to transmit directly to the reader the views of experts on special subjects. Standard specifications and reports of national societies have been quoted liberally.

Hydraulic Turbines. By R. L. Dougherty, Assistant Professor, Sibley College, Cornell University. Price $2.00 net. McGraw Hill Book Company, Inc., New York.

A practical treatise which should prove of value both to the student and to the practising engineer. The book is designed especially for those who find it necessary to be familiar with the construction of turbines, to understand their characteristics, and to be able to make an intelligent selection of the type and size of turbine for any given set of conditions. The broad problem of the development of water power is treated in a very general way so that the reader may understand the conditions that bear upon the choice of a turbine.

The purpose of the text is to give the following: a general idea of water-power development and conditions affecting the turbine operation, a knowledge of the principal features of construction of modern turbines, an outline of the theory and characteristics of the principal types, commercial constants, means of selection of type and size of turbine, cost of turbines and water power and comparison with cost of steam power. A chapter is also added on centrifugal pumps.

The following is the programme of the 1913-14 winter session of the Canadian Society of Civil Engineers, the meetings being held at the rooms of the society, 176 Mansfield Street, Montreal; Oct. 16, Monthly; Oct. 23, General Section; Nov. 6, Monthly; Nov. 20, Electrical Section; Dec. 4, Mechanical Section; Dec. 18, Monthly; Jan. 8, Mining Section; Feb. 5, Monthly; Feb. 18, General Section; March 5, Monthly; March 18, Electrical Section; April 2, Mechanical Section; April 9, Monthly, and April 23, Mining Section.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

London, Ont.
Asphalt pavement, Clarence and Richmond Sts., for City Council. Mayor, C. M. R. Graham. Chairman Board of Works, B. W. Bennett. Engineer, W. N. Ashplant. Plans in progress.

Montreal, Que.
Sewers, Queen Mary's Park, for City Realty Investing Co., Ltd., 41 Mayor St. Engineer, Thos. Iverson, 10 Cathcart St., Montreal. Tenders closed on Sept. 15th for this work but it was decided to hold it over until spring.

Water pump. Engineer-in-charge, Supt. Lesage, Water Works Dept., City Hall. Plans being prepared to supply four 12,000,000 gal. pumps. Two to be installed this year and 2 next June.

Peterboro, Ont.
Sewage Disposal Plant. Chairman Board of Works, Wm. Buller. New plans to be prepared by Engineer, R. H. Parsons, owing to certain recommendations made by Prov. Board of Health.

Stamford Twp., Ont.
Waterworks, cost $30,000, for Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, J. C. Gardner, Queen St., Niagara Falls. Ratepayers will vote on by-law Oct. 29th. About 1½ miles, 4, 6 and 8 in. iron pipe.

Toronto, Ont.
Works Commr. Harris recommends cement concrete sidewalks on 25 streets. Estimated cost $35,500. Board of Control. Mayor, H. C. Hocken.

Pavements for Board of Control. Mayor, H. C. Hocken. Commr. of Works recommends asphalt pavement on Tyrrel, Hain, Oakwood and Eastmount, cost $14,152. Brick block on Inkerman Ave., cost $2,505.

Water and sewage plants planned by Town Council of Leaside. Mayor, R. J. McRae. Plans have been approved by Ontario Board of Health. Tenders for installation to be called shortly.

Street grading. Works Commr. Harris recommends grading Roxton Road. Estimated cost $19,000, also Colina Ave., Hallawell, Ardagh, Main and Minto Sts. Estimated cost $7,672. Board of Control. Mayor, H. C. Hocken.

Winnipeg, Man.
Water system, cost $13,500,000, for Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. Bylaw carried by ratepayers to raise above sum for bringing water from Shoal Lake.

CONTRACTS AWARDED

Ottawa, Ont.
Asphalt pavements planned. Mayor, J. A. Ellis. Engineer, Archibald Currie. Pavement on Clarence St., between King and Chapel, awarded to Union Construction Co., Bank St., $12,904. Pavement on O'Connor St. between Queen & Laurier, to Ottawa Construction Co., Elgin St., $8,378.

Sydney, N.S.
Addition to pumping station for City Council. Clerk, J. J. Curry. Engineer, D. McD. Campbell. General contractor, Owner.

Toronto, Ont.
Pavement, cost $31,000, Terauley St., for Board of Control. Mayor, H. C. Hocken. Work to be done by day labor under Works Dept. Treated wood block, between Queen and Agnes Sts.

Winnipeg, Man.
Granolithic sidewalks for Municipality of Assiniboia. Clerk, Frank Ness, Kirkfield Park P. O. General contractors, Dominion Constr. Co. Sidewalks on Portage Ave. from Albany Ave. to Deer Lodge.

Block pavement, cost $1,005.75, for Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, Engineer of Construction, J. W. Astley, City Yards. Cedar block paving, Strathcona St., from Talbot Ave. to part 135 ft. N.

Railroads, Bridges and Wharves

Berlin, Ont.
Conduits for C. P. R. and G. N. W. Telegraph Companies and Bell Telephone Co. Dominion Railway Board ordered wires to be placed underground on Queen St. N. The City applied for order to compel B. T. Co. to place its wires underground on King St. from Wellington St. to Waterloo Boundary. Order reserved.

Brantford, Ont.
Grand Trunk Railway will build siding into premises of the Ham & Nott Co., Ltd., Block G, North of Bruce St.

Cariboo Dist., B.C.
Wye track for G. T. P. Railway at mileage 29 west of Yellowhead Pass.

Edmonton, Alta.
Grand Trunk Pacific Railway will construct spur for the Park Lumber & Planing Mills Ltd. Block 10, Cromdale Subdivision of River Lot 24.

Foremost, Alta.
Station for C. P. Rly. Approved location of station on Weyburn, Sterling Branch.

Glace Bay, N.S.
Dredging for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until 4 p.m. Oct. 23rd. Plans, etc., at Dept., Ottawa.

Montreal, Que.
Spur for G. T. P. Rly. Siding and spur for Oglivie Flour Mills Co., west of Mill St.

Ottawa, Ont.
Boiler and engine house, cost $12,000, Middle St., for Ottawa Elec. Rly., 248 Albert St. 90 x 71, solid brick construction. Plans ready.

Stratford, Ont.
G. T. P. Rly. will construct siding near Gore Street.

Station, cost $60,000, Shakespeare St., for G. T. Rly. Dist. Engineer, W. A. Siegner. Supervisor, Wm. Cayley. Foreman E. Chandler, in charge of mason and brick work; Foreman H. Ellison, in charge of carpentry work. 151½ ft. x 60 ft., concrete foundation, granite and vitrified brick construction, green slate roofing. Railway yards to be entirely relaid.

Swift Current, Sask.
Canadian Pacific Railway will construct spur for Swift Current Grocery Co., Ltd., and Winnipeg Paint & Glass Co., Ltd., subject to condition of town.

Toronto, Ont.
Bridge, Gerrard St., for Board of Control. Commissioner of Works, R. C. Harris, City Hall. Tenders addressed to Chairman, Mayor H. C. Hocken, received until noon, Nov. 25th, for the supply and erection of structural steel work. Specifications, etc., at office of Railways & Bridges Section, Dept. of Works, City Hall.

Bridge, Centre Island, for Board of Control. Mayor, H. C. Hocken. Tenders received by Board until October 21st for a reinforced concrete bridge between Centre and Olympic Islands. Plans, etc., at office of Railways and Bridges, City Hall.

Winnipeg, Man.
C. P. Rly. will construct spur for Northern Elevator Co., Ltd.

Canadian Pacific Railway will construct spur into the premises of G. F. Stephens & Co., Ltd., on lot 64 Parish of St. Boniface. Subject to certain conditions.

CONTRACTS AWARDED

Brandon, Man.
Street car barns, cost $20,000, for City Council. City Clerk, Harry Brown. Chairman Street Rly.'s, Ald. Cater. Engineer, Supt. Antonisen. Masonry, carpentry and plastering, Willows & Co., 44 Clement. Block steel and roofing, Brandon Machine Co., 13th St. Steam heating, J. E. Yates, 29 9th. Plumbing, Brandon Heating Co., Bell Block. Electrical, Brandon Elec. Light Co., 10th St. One storey, 95 x 145.

Public Buildings, Churches, Schools, etc.

Fredericton, N.B.
Extension to hospital contemplated by City Council. Architect, F. Neil Brodie, 42 Princess St., St. John. Plans are not yet prepared, nothing will be done this year.

Guelph, Ont.
New school contemplated by Board of Education. Chairman, J. M. Duff. Plans will be prepared for additions to present Collegiate Institute and also plans for new building.

Hamilton, Ont.
Young Women's Christian Assn., Main St., will canvass the city to raise $50,000 for new building on Main St. Architects, Mills & Hutton, Room 804, Bank of Hamilton Bldg.

Lethbridge, Alta.
Church, cost $6,000, 7th Ave. and 12th St., for Mormon Congregation. Architect, E. Carrer. One storey, 35 x 55, Lethbridge brick construction, concrete foundation. Plans in progress.

Milverton, Ont.
Public Building for Dom. Govt., Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa, until 4 p.m., Nov. 3rd. Plans, etc., at offices of J. S. Russell, architect, Stratford, Ont., Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto. Postmaster, Milverton and at Department, Ottawa.

Montreal, Que.
Fire station contemplated for the Town of Maisonneuve. Mayor, Mr. Michaud. To be equipped with latest fire apparatus. Plans will be prepared.

Gymnasium club for L'Association Athletique Hochelaga, Inc., c/o J. A. Santoire, 1892 St. Catherine E. Work will not start until spring.

Public bath, extended time, 179 Ontario St. W., planned by Board of Commissioners. Sec., L. N. Senecal. Architect, Dalbe Viau, 76 St. Gabriel St. Tenders received by Commrs. till Oct 17th. Plans, etc., at office of Architect.

Alterations to City Hall, Notre Dame St., for Board of Commrs. Sec., L. N. Senecal. Architects, Marchand & Haskell, 164 St. James St. Plans will be ready to call for tenders in about two weeks.

Fire station, Young and Ottawa, for Board of Commrs. Sec., L. N. Senecal. Architect, D. J. Spence, 46 Beaver Hall Hill. Plans ready, tenders to be called about Oct. 16th.

Peterboro, Ont.
Orange hall, cost $12,000, for Black Knights of Ireland Lodge, 137½ Simcoe St. Further information from J. Batten, 189 Simcoe St., or R. Wilson, 584 Charlotte St. Brick construction.

Powell River, B.C.
Lock-up planned by Prov. Govt. Dept. of Public Works. Engineer, J. E. Griffith. Plans and specifications at office of Mr. T. Baird, Govt. Agent, Cumberland, Prov. Constable, Powell River, or at Dept., Victoria. Tenders received until noon Oct. 15th.

St. Thomas, Ont.
Tenders received by Architect, John T. Findlay, until Oct. 24th, for construction of Y. M. C. A. building. Plans at office of Architect.

Toronto, Ont.
School, College and Brock, for Separate School Board. Chairman Bldg. Com., Joseph Cadaret, 24 Duke St. Plans, etc., at office of Architect, C. J. Read, 404 Confed. Life Bldg. Tenders received by Chairman until Oct. 15th.

School, Annette and Evelyn, for Separate School Board. Chairman. Bldg. Com., Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Plans, etc., at office of Architect. Tenders received by Chairman until Oct. 15th.

Commercial High School, cost $200,000, planned by Board of Education. Sec.-treas., W. C. Wilkinson, City Hall. Plans provide for 24 class rooms with assembly room in centre, kitchen and lunch rooms in basement. Principal Eldon and Building Supt. Bishop will go over plans and present any necessary alterations at next meeting of Advisory Committee. Tenders will be called shortly.

Windsor, Ont.
Theatre and stores, cost $100,000, Pitt St. E., for Empress Theatre Co. Promotor, E. E. McEwan. Architect, J. C. Pennington. Plans under way.

Winnipeg, Man.
School, cost $25,000, planned, St. James, for Rural Municipality of Assiniboia, St. Charles, Town Hall. Sec.-treas., F. Ness, Kirkfield Park P. O. By-law to be voted on shortly. Provision will be made for extension. Four rooms.

General hospital for City of Winnipeg. Sec. of Hospital Board, Geo. Stoker. By-law to raise $275,000 defeated Oct. 1st.

CONTRACTS AWARDED

Coquitlam, B.C.
School, cost $12,000, James Park, for School Board. Architect, J. Z. Long. General contractor, A. L. Larsens.

Hamilton, Ont.
Addition to theatre, cost $5,000, Mary St., for Dominion Theatres, Ltd., Mary St. Manager, E. R. Marshall. Architect and general contractor, Owner. Additional storey to be built over front of theatre for offices. Brick construction.

Main Duck Island, Ont. (Lake Ontario)
Station, cost $17,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Alex. McMaster, 74 Victor Ave., Toronto.

Montreal, Que.
Army hall, cost $30,000, City Hall Ave., for Salvation Army, 341 University. Architect, Major Miller, Toronto, Ont. General contractors, Reid, McGregor & Reid, Guy Block. Roofing, Richardson, Simard & Son, 745 Clarke Ave.

School, Longueuil, for School Commrs. of Longueuil. Architect, A. Prefontaine. Montreal. General contractors, mason, carpenter and painting, Guertin & Bouchard, 414 Parthenais. Steel, MacKinnon Holmes Co., Sherbrooke, Que. Roofing, heating, plumbing and electric, Bissonette, Coallien Laviguer, 803 Mt. Royal E. Three storeys, 60 x 80.

Ottawa, Ont.
Lavatory, cost $12,000, City Hall Sq. Mayor, J. A. Ellis. Architect, F. C. Sullivan, Castle Bldg., Queen St., has recommended awarding contract to Alexander & Campbell, 597 Lisgar St.

Regina, Sask.
Lodge hall, Retallack, for Sons of England. Sec.-Treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol St.

Simcoe, Ont.
Sunday school, cost $7,000, for Baptist Church Congregation. Chairman Bldg. Com., W. A. Skirrow. Architect, L. D. Barber, Brantford. Work being done by day labor under supervision of Com. and Mr. Doughty.

Sydney, N.S.
Hospital. Builders and Owners, Dominion Iron & Steel Co., Ltd. Owners doing all work. Equipment for an up to date operating room will be purchased. One storey, 20 x 25, concrete foundation, Sydney grey brick construction.

Toronto, Ont.
Theatre, cost $8,000, Queen St. W., for "Bentley" (in trust), 16 Victoria Street. Architect, F. R. Cowan, 202 Crawford St. General contractor, Thos. Essery, Confederation Life Bldg. Brick and steel construction, brick foundation.

Welland, Ont.
Church, cost $40,000, Hellems Ave. and Griffith St., for A. W. Holmes, 10 Bloor St. E., Toronto. Contract to be awarded shortly.

Yorkton, Sask.
Monastry and church, cost $35,000, for Redemptionist Brothers. General contractors, Newert Constr. Co. Two stys., brick and stone construction.

Church, cost $5,000, for German Lutheran Church. General contractor, E. A. Rahn. One storey, brick construction and foundation.

Business Buildings and Industrial Plants

Berlin, Ont.
Factory, for Walter G. Rumpel. Will erect felt factory in North Ward. Plans under way.

Calgary, Alta.
Garage, cost $6,000, East Calgary, for Calgary Malting Co. One storey, 92 x 42, reinforced concrete construction. Plans ready.

Dairy barn, cost $3,000, for J. A. Knolpfle. Two storeys, 28 x 40, frame construction. Plans ready.

Warehouse, 10th Ave. W., for Gray Campbell, Ltd. (J. J. O'Grady, McLean Block). Two storeys, 100 x 50, pressed brick construction. Contract to be awarded shortly.

Fredericton, N.B.
Coal shed, Aberdeen St., for The Northfield Coal Co., Minto, N.B. Pres., Hon. Jas. Barnes. Contract to be awarded shortly.

Goderich, Ont.
Extension to organ factory, for Goderich Organ Co., Ltd. Manager, Alex. Saunders. By-law carried by ratepayers Oct. 4th, granting fixed assessment of $20,000 to above company for 10 years.

Hamilton, Ont.
Office building, King St. W., for G. R. Hazelwood, 5 Osborne Chmbrs. Architects, Brown & Fryer, Clyde Block. Nine storeys, stone foundation, brick construction, felt and gravel roofing. Plans in progress.

Store, cost $10,000, King St. E. Architects and owners, Sparks & McKay, 122 Cannon St. E. Three storeys, stone foundation, brick construction.

London, Ont.
Garage, cost $15,000, Dundas St., for Arthur McClary, 400 Queens Ave. Archi-

tect to be selected. Two storeys, 40 x 120.

Montreal, Que.
Garage, cost $5,000, rear 240 Drummond, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason, carpenter and steel, Reid, McGregor & Reid, 14 Guy Block. Painting, none. Tenders for roofing, heating and electrical work received by General Contractor after Oct. 15th.

Store and ice cream parlor, cost $15,000, 322 St. Catherine W., for Geo. Nicholas & Co., 322 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg., Montreal. Contract to be awarded in about two weeks.

V. Boydell & Co., Manchester, Eng., contemplate erecting a factory here.

Alterations to bank, cost $5,000, 365 St. Catherine W., for Bank of British North America, 30 St. James St. Architects, Cox & Amos, 6 E. T. Bank Bldg., St. Catherine W. Nothing further will be done till next year.

Two garages, cost $12,000, Outremont (Ainslie), for R. Tourville and E. Ouellette, 58 Cherrier St. Architects, Barott, Blackadder & Webster, New Birks Bldg. Work will be started in spring. Two storeys, 25 x 70, concrete foundation, stucco and brick construction.

Orangeville, Ont.
Knitting factory for J. N. Doods, Alton, Ont. Architect, J. Francis Brown, Board of Trade Bldg., Toronto. Owner supplies material. Plans prepared.

Ottawa, Ont.
Store and residence, cost $6,000, for August Boehmar, Creighton St., New Edinboro. Double brick veneer construction. Plans in progress.

Regina, Sask.
Wholesale warehouse, cost $35,000, for Canadian Equipment & Supply Co., Ltd., Calgary, Alta. President, T. Alfred McAuley. Four storeys. Plans in progress.

Addition to warehouse, cost $20,000, for Regina Plumbing & Heating Co., Ltd. Architects, Storey & Van Egmond, Credit Foncier Bldg. Brick construction and foundation. Plans ready.

Sarnia, Ont.
Store, cost $10,000, for Jno. Felsinger, 144 Christina N. Two storeys and basement, 28 x 55, red pressed brick front, brick foundation, plate and prismatic glass, store fronts and fixtures, office fixtures. Plans in progress.

Stratford, Ont.
Factory addition, Erie St., for The Avon Hosiery Co., 82 Erie St. Local manager, W. Pearson. New building, 4 storeys, 95 x 60. City will be asked to guarantee $25,000 bonds.

Toronto, Ont.
Alterations to store and workshop, cost $6,000, for A. E. F. Sawtell, 882 College St. Architect, E. G. Giles, 26 Carling Ave. Work not to start for some time. Two storeys, brick construction and foundation, felt and gravel roofing. Plans drawn.

Vancouver, B.C.
Bank building, Dunsmuir and Granville, contemplated for Dominion Bank. Architect not selected.

Office building, cost $20,000, Hastings and Hornby, for E. A. Moris. Architect, Thos. Hooper. Eight storeys, concrete construction. Plans ready.

Victoria, B.C.
Garage, cost $4,000, for Sam McCrumond. Architect, C. Coates. Plans ready.

Store and apartments, cost $7,000, 1056 Caledonia Ave., for Scott & Sinclair. Two storeys, brick construction. Plans in progress.

Walkerton, Ont.
Foundry for Isadore Ellinghausen. Architect to be selected.

Welland, Ont.
Two stores and offices, cost $15,000, Main E., for Hugh A. Rose, Jr. Tenders received by architect, Thos. L. Nichols. Two storeys, 34 x 70, brick construction.

Winnipeg, Man.
Stores and offices, Main St. N., for N. Johnson, care architect, G. W. Northwood, 502 Northern Crown Bank Bldg. New plans being prepared.

Wyoming, Ont.
Box and basket factory planned for Daniel Senecal. By-law granting bonus to owner carried by ratepayers.

CONTRACTS AWARDED

Calgary, Alta.
Stores and bachelor apts., cost $50,800, 7th Ave. E., for P. O. Sullivan. Architect, J. B. Henderson, 812 Beveridge Block. General contractors, McDougall & Forster. Two storeys, 75 x 130, brick and reinforced concrete construction.

Edmonton, Alta.
Store and apartments, cost $6,000, 24th St., for C. R. Horne, 1700 24th St. Architect and general contractor, Owner. Two storeys, 32 x 50, frame and brick veneer construction.

Addition to office and rooms, cost $10,000, Jasper Ave., for Runnals & Nichols. Architect, E. C. Hopkins, 32 Jasper Ave. W. General contractors, Reed, MacDonald & Brewster, Tegler Block. Three storeys, 100 x 52 ft. 2 in., steel and brick construction.

Hamilton, Ont.
Addition to office building, King St. E., for A. B. McKay. Architects, Bond & Smith, 19 Wellington St. W., Toronto. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Two stys. addition, reinforced concrete and brick construction (Kahn System).

Lindsay, Ont.
Alterations to newspaper office for Allan Gillies, "The Warder." Office furniture required.

Magog, Que.
Business block, Lake St. Owners and general contractors, J. H. Percy & Son. Architect, private plans.

Store, Pine St. Owner and general contractor, F. H. Barlow. Walls started.

Medicine Hat, Alta.
Factory for Canada Cement Co., Hull Block. Manager, Mr. Leigh Hunt. Architects and builders, Hunt Engineering Co., Hull Block. Two storeys, cement, brick and steel construction.

Melville, Sask.
Business block, cost $15,000, for J. G. Jackson, 2nd Ave. General contractors, Melville Construction Co. Three stys., brick construction and foundation.

Montreal, Que.
Stores and flats, cost $20,000, Cote des Neiges Rd. Architect and owner, L. P. Godin, 1217 Cote des Neiges Rd. General contractor, E. Paquette, Maplewood ave., Cote des Neiges. Three storeys, 99 x 48, concrete foundation.

Stores and flats, cost $15,000, Cote St. Paul (Church and York Sts.), for L. Jacob, 1421 De Montigny. General contractor, Nap. Lavoie, 218 Bond Ave., Verdun. All other contracts to be given next week.

Garage, cost $5,000, rear 240 Drummond, for R. B. Angus, 240 Drummond St., Montreal. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, Reid, McGregor & Reid, 14 Guy Block. Other trades will be let shortly. One storey, 33 x 26, concrete foundation, fireproof, stone and brick construction.

Two stores and flats, cost $15,000, Outremont (Durocher St.), for Jos. Lebeau, 100 Parc Lafontaine, Montreal. Montreal. Architect, Z. Trudel, 238 St. Andre St. General contractor, A. Frenette, 212 Fabre St. Painting, J. C. Parent, 2518 Park Ave.

Store, cost $12,000, St. Catherine E., for Mrs. E. Lareau, 267 Mance St. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Painting, S. A. Lanctot, 441 Marquette.

Store, cost $12,000, St. Catherine E., for Mrs. H. E. Vautelet, 69 Victoria Ave. Architect, Chas. Bernier, 70 St. James St. General contractor, A. Pion, 338 Marquette. Painting, S. A. Lanctot, 441 Marquette.

Bank and offices, cost $14,000, Verdun (Ethel Ave.), for Bank of British North America, 30 St. James St., Montreal. Architect and general contractor, C. J. Brown, 4263 St. Catherine W. Tenders for roofing, heating, plumbing and electric received by Architect after Nov. 1st. Two storeys, 35 x 40.

Store and flats, cost $25,000, Sherbrooke W., for Thos. Coggins, 319 St. Antoine St. Architect, Chas. E. Mitchell, 11 Beaver Hall Hill. General contractors, Jas. Adam & Co., 745 St. Catherine W. Roofing and plastering to be let about Oct. 15th. Painting, W. H. Reid, 4093 Sherbrooke St. Foundations in.

Four stores, cost $5,000, Windsor, for J. M. Guerin, 4 Edgehill Ave. General contractor, A. Watson, c/o Owner. General contractor will probably call for tenders on other trades about Nov. 1st. One storey, 29 x 26, concrete foundation, stone and brick construction.

New Denver, B.C.
Extension to powder plant for Steelits Explosives Co., Nelson. General contractor, A. Doucett, Seattle, Wash.

Rouleau, Sask.
Business block, cost $5,000, for W. F. Krauss, Main St. General contractor, E. E. Poole, Railway Ave. 2½-storeys, brick construction, concrete foundation. Excavating done.

Toronto, Ont.
Office building, cost $950,000, King and Yonge, for Guardian Realty Co., 501 C. P. R. Bldg. Architects, Ross & Macdonald, 1315 Traders Bank. General contractor, Geo. A. Fuller Co., New York, and Stair Bldg., Toronto. Steel, Dom. Bridge Co., Toronto. Terra Cotta, Fed-

eral Terra Cotta Co., 111 Broadway, New York. Granite, Stanstead Granite Quarries Co., Ltd., Stanstead Jct., Que. Lime stone, E. F. Giberson Co., Ltd., 10 Cathcart St., Montreal, Que. 20 storeys.

Two stores and 6 residences, cost $28,000, 63-79 Nairn Ave., for R. P. Cranfield, 155 Robert St. Plastering, Wm. Horwood, 491 Concord. Painting, J. O. Dougall, 275 Croft St. Heating, Hall Zryd Foundry Co., Manning Chambers.

Vancouver, B.C.
Store, cost $12,000, Main St., for A. E. Suchling. Architects, Stanley Milton & H. H. Gillingham. General contractors, J. J. Frantz Constr. Co. One storey and basement, reinforced concrete construction.

Victoria, B.C.
Addition to White Horse Hotel, Humboldt and Blanchard Sts., for Mrs. Godfrey. Architect, J. M. C. Keith, General contractors, Parfelt Bros. 36 room addition.

Windsor, Ont.
Office building, cost $30,000, Ouellette, for A. T. Currah. Architect, J. C. Pennington, Windsor. Iron and steel, Canadian Bridge Co., Walkerville. Plastering, Lockwood & Troop, Windsor. Three storeys, 50 x 90.

Addition to paint factory, cost $5,000, for Standard Paint & Varnish Co. Manager, J. A. Straith. Architects, Spier & Rhone, Detroit, Mich. Mason, Wm. James, Windsor. Carpenter, Chas. McNaughton, Windsor. Will purchase drill presses. Two storeys, 45 x 40.

Winnipeg, Man.
Stores and office building, cost $20,000, Main St., for W. Zimmerman, 669 Main St. Architect, M. Blankstein, 450 Dufferin Ave. General contractor, G. Martin, 80 Dubuc St., Norwood.

Alterations to bank, cost $12,000, Main St., for Canadian Bank of Commerce, Alexander Ave. Architect, Victor Horsburgh, Toronto. General contractors, Fraser & MacDonald, Gertrude Ave. Brick construction.

Store and residence, cost $7,000, Rosser and Hugo Sts., for Thos. Crone, 681 Jessie Ave. Architect, c/o Owner. General contractor, Mr. Beach, 228 Garry St. Two storeys, 24 x 42, stone and pressed brick construction.

Store, cost $5,500, Pacific Ave., for T. Ryan, c/o Thos. Ryan & Sons. General contractors and architects, McCabe & McKenzie, McIntyre Block. Pressed brick construction.

Residences

Drummondville, Que.
Apartment house, cost $9,000, for Alex. Mercure. Private plans being prepared. Two storeys, 132 x 50, stone foundation, artificial stone construction.

Durham, Ont.
Four residences, cost $10,000, Countess St. Architect and owner, Wm. McFadden. White brick construction, stone and concrete foundation. Plans in progress.

Galt, Ont.
Double residence for Wm. Dickson, 85 Barrie St. Tenders received by Owner for brick work and plumbing.

Hamilton, Ont.
Residence, cost $9,000, Mountain Top. Tenders received by Architect, F. W. Warren, Bank of Hamilton Bldg., until Oct. 18th. 2½-storeys, 46 x 32, building stone construction, stone foundation.

Montreal, Ont.
Six flats, cost $6,500, for Jno. Galipeau, 506 Moreau. Three storeys, 48 x 72. Plans prepared.

Nine flats, cost $9,000, Christopher Columbus, for Ernest Hamel, 1067 De La Roche. Three storeys, 25 x 60, stone foundation. Plans in progress.

Two flats, cost $8,000, Cote Des Neiges (Maplewood), for J. B. Bisson, Maplewood. Two storeys, 46 x 52. Plans prepared.

Apartment house, Stanley, for Jno. H. Hand, 609 Belmont Ave., Westmount. Architects, Wright & Son, 204 St. James St., Montreal. Building will probably not go ahead until spring. Depends on money market.

Flats, cost $8,000, Park Ave., for A. J. Bibeau, Park Ave., near Bernard St. Architect, A. St. Louis, 80 St. Gabriel St. Foundation, L. A. Ott & Co., New Birks Bldg. Tenders for all other trades received by Architect from Oct. 13th till Oct 18th. Concrete foundation, solid construction, felt and gravel roofing. Excavating done.

Residence, cost $20,000, Outremont. Architect, Chas. Chausse, 17 Pagnuelo Ave. Tenders called by Architect in about two weeks. Concrete foundation, stone and brick construction, felt and gravel roofing. Plans in progress.

Residence, cost $25,000, planned, Outremont. Tenders called by Architect, Chas. Chausse, 17 Pagnuelo Ave., in about two weeks. Concrete foundation, stone and brick construction, felt and gravel roofing.

Two flats, cost $9,000, Melrose, for W. A. Hayman, 225 Notre Dame W. Two storeys, 19 x 58, concrete foundation. Plans ready.

Six flats, cost $6,000, 347 St. Ferdinand, for Ovide Brunel, 425 St. Antoine. Three storeys, 36 x 42, concrete foundation. Plans ready.

Ten flats, cost $8,000, Chabot St., for A. Chausse, 1129 Mount Royal E. Subcontracts to be let as soon as possible. Concrete foundation, brick construction.

Two cottages, cost $25,000, Outremont (Ainslie) for Ouellette & Tourville, 58 Cherrier. Architects, Barott, Blackadder & Webster, New Birks Bldg. Work will be started in spring.

Residence, cost $7,174, Westmount (Grosvenor ave.) for W. S. Boyd, 325 Grosvenor Ave. Architects, Benoit & Girard, 215 St. Catherine W. Tenders will be called in spring.

Moose Jaw, Sask.
Residence, cost $8,000, River Park, planned, for A. Westwood, Walter Scott Bldg., Main St. Architect, Shalto Smith, Room 15, 36 Main St. Two storeys, 55 x 26, and wing, 20 x 15, frame, stucco and brick veneer construction, concrete and waterproof foundation, tile, slate or asbestos roofing.

Oak Bay, B.C.
Residence, cost $6,000, Landsdowne Road, for Henry Gilbert. Plans in progress.

Ottawa, Ont.
Residence, cost $5,000, Driveway, for D. L. Campbell, 141 Preston St. Two storeys, brick veneer and stucco construction. Plans prepared.

Residence, cost $10,000, Blackburn St. Architect and owner, W. E. Noffke, Central Chmbrs., Elgin St. Brick veneer and stucco construction. Plans ready.

Residence, cost $7,000, Monkland, for E. I. Shuttleworth, 24 Euclid. Architect, A. L. Weeks, Sparks St. 2½-stys., brick veneer and stucco construction. Plans prepared.

Residence, cost $5,000, Rosedale, for T. H. & R. J. Patterson, 62 3rd Ave. 2½-storeys, brick veneer and roughcast construction. Plans prepared.

Toronto, Ont.
One pair residences, $8,500, Summerhill, for R. Brown, 24 Carling Ave. Architect, W. G. Hunt, 935 Bloor St. W. Owner will call for tenders. 2½-stys., 39 x 43, brick construction.

One detached residence, cost $2,500, Edwin Ave., planned for O. Hoover, 136 Geoffrey St. Work not to start until spring. Two storeys, 23 x 34, brick construction, stone foundation.

Two detached residences, cost $5,000, Albertus Ave., for A. W. Blakeman, 33 Pears Ave. General contractor and carpenter, Owner. Plastering, painting, heating, plumbing and electrical will sublet. 2½-storeys, 20 x 34, brick construction and foundation.

Residence, cost $4,000, for J. H. McLaren, 7 Briar Hill. Architect, P. H. Finney, 79 Adelaide E. Brick construction and foundation, slate, felt and gravel roofing. Plans in progress.

Vancouver, B.C.
Residence, cost $9,350, Shaughnessy Heights, for J. P. Doherty, 1620 Alberni St. Work to be done by day labor. Two storeys, frame construction. Plans drawn.

Apartment, cost $130,000, Burrard, near Davis, contemplated for Smith & Smith. Architect not selected. Eight storeys, 35 x 120.

Apartment, cost $153,000, Hasting and Jackson, for Mordon & Thornton. Architects, Braunton & Leibert. Six storeys, brick and mill construction. Plans ready.

Apartment house, cost $60,000, Kitsilano, for T. H. Calland. Architect, W. F. Calland. Architect, W. F. Gardiner. Three storeys. Plans drawn.

Victoria, B.C.
Apartment building, cost $80,000, for A. McCrummon. Architect, L. R. Hazeltine is preparing plans.

Windsor, Ont.
Residence, cost $10,000, Ouellette, for A. A. Little. Architects, Leybourne & Whitney. Two storeys, 52 x 32, brick and stucco construction.

Residence, cost $5,000, for Geo. E. Copeland. Architects, Leybourne & Whitney. Brick construction. Plans being prepared.

CONTRACTS AWARDED

Calgary, Alta.
Residence, cost $6,000, Bankview, for J. J. O'Gara, McLean Block. General contractor, W. Cunningham. Two stys., 36 x 39, frame construction.

Edmonton, Alta.

Addition to residence, cost $40,000, Highlands, for W. J. Magrath, Highlands. Builder, Mr. Moorehouse, 27 Jackson Block.

Residence, cost $5,000, 26th St., for C. R. Horne, 1700 16th St. Architect and general contractor, owner. Two storeys, 30 x 32, brick and frame construction.

Hamilton, Ont.

Three residences, cost $10,000 each, Inglewood Drive. Owner and general contractor, L. Donaldson, 229 Bay St. S. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½-storeys, brick construction, stone foundation, slate roofing. Excavating done.

Lennoxville, Que.

Tenement house, cost $4,000, Main, for Mrs. F. McFadden, 2 Fulton Ave., Sherbrooke. Architect, private plans. General contractor, A. Page. Day labor. Frame construction. Walls started.

Montreal, Que.

Residence, cost $8,000, Outremont (Hartland), for Geo. Goodbody, 545 Durocher Ave. Architect, D. O. Mounsey, 4th Ave., Verdun. General contractor, Owner—day labor. Two storeys, 25 x 40, stone foundation, brick construction.

Residence, cost $6,000, Westmount (Western Ave.), for Dr. A. Munroe, 61 Drummond St., Montreal. Architect, D. J. Spence, 46 Beaver Hall Hill. General contractor, mason and carpenter, R. Masson, 381 Victoria Ave. Roofing, Richardson, Simard & Co., 745 Clarke St. Plastering, Watson & Wilson, 1680 Hutchison St. Painting, A. Craig, 41 Jurors St. Heating and plumbing, Mr. Sanderson. Electrical, Goodwins, Ltd., St. Catherine W. Two storeys, 21 x 60.

Residences, cost $16,000, Outremont (Glencoe), for A. Morrison (& Robt. Dykes, 110a Stanley. Builder, G. W. Goodbody, 545 Durocher, Ave. General contractor, Owner. Day labor. Two storeys, 52 x 37 ft. 6 ins., cement foundation, stone and brick construction.

Residence, cost $16,000, Cote Des Neiges, for Carl Riordon, 374 Cotes des Neiges Road. Architects, Mac Vicar & Heriot, 104 Union Ave., Montreal. General contractor and painting, E. B. Evans, 74 St. Denis. Tile, Sanitary Tiling Co., 136 Bleury. Roofing, Sibley & Huot, 34 St. Martin. Electrical, Star Electric Co., 803 St. Catherine W. Interior fittings, H. Morgan & Co., Phillips Sq.

Four flats, cost $8,000, Old Orchard. General contractor and Owner, F. Lachapelle, 2589 St. Hubert. Work done by day labor. Two storeys, 50 x 64, concrete foundation.

Flats, cost $30,000, Verdun (1st Ave.), for J. A. Leclair, 276 Church Ave. Architect and general contractor, Owner. Day labor. Two storeys, 150 x 40.

Residence, cost $28,000, Outremont (Dunlop Ave), for C. H. Branchaud, 19 St. Famile St., Montreal. General contractor, D. M. Long, 39 Windsor Roofing, Richardson Simard Co., 745 Clarke St. Painting, W. J. Chapman, 4151 St. Catherine St. Heating and plumbing, Cadieux & Briard, 1277 St. Dominique St. Electrical, Spencer & Aspinall, New Birks Bldg.

Alterations to apartments, cost $5,000, for Astoria Apts. Architects, Mac Vicar & Heriot, 104 Union Ave. Montreal. General contractor, Wm. Irving, Guy Block. Heating and plumbing, Hickey & Aubet, 93 Dominion St.

Two residences, cost $12,000, Outremont (Querbes), for P. Guidazio, 304 Querbes Ave. Architect, A. Rouillier, c/o Owner. General contractor, Owner. Day labor. Two storeys, 25 x 33, stone foundation, pressed brick construction.

Montreal West, Que.

Residence, cost $8,000, Brock, for E. Garrigan, Brock St. Architect and general contractor, Owner. Cement foundation, encased brick construction, asbestos shingle roofing.

Residence, cost $8,500, Brock, for H. Doriss. Builder and general contractor, Owner. Cement foundation, encased brick construction.

North Battleford, Sask.

Residence, cost $25,000, J. Patterson, general contractor and owner. 2½ stys., brick and stone construction.

Quebec, Que.

Residence, cost $7,500, 61-63 St. Nazaire, for East & Mason, St. Nazaire St. General contractor and mason, owner. Four storeys, 25 x 30, 12 x 12, frame construction.

Regina, Sask.

Two residences, cost $8,000, Cameron. General contractor and owner, H. R. Goodhue, Cameron St. 2½-storeys, brick construction.

Residence, cost $5,000, Robinson. General contractor and owner, Robt. Hellaway, Robinson St. Frame and brick construction.

St. Catharines, Ont.

Alterations and additions to residence, cost $5,000, Queen St., for A. E. Nicholson. Excavation and mason, H. P. Nicholson. Carpenter, Williams and Mesler. Painting and glazing, Leach & Jones. Plumbing, H. A. Bald & Co. Heating, J. Peart. Two storeys, 24 x 45, brick, frame and stucco construction, stone foundation.

Toronto, Ont.

Apartments, Enderby. General contractors and owners, McMillin & Costain, 198 Main St., East Toronto. Owners doing work by day labor. 40 x50, concrete block construction.

One detached residence, cost $5,000, Edgar Ave. General contractor and owner, W. C. Sancto, 21 Isabella Street. Will sub-let some trades. 2½-storeys, 22 x 40, brick construction and foundation.

One pair residences, cost $6,000, Browning Ave. General contractor and owner, Jas. R. Gifford, 190 Pape Ave. Owner sub-lets. 2½-storeys, 32 x 40, brick construction and foundation.

One pair residences, cost $7,000, Havelock St., for Taylor & Nesbit, 18 Havelock St. General contractors and plastering, Owners. Mason, Wm. Woods, 32 Rusholme Park Cres. Carpenter, Deeths, Ltd., 44 Grove Ave. 2½-storeys, 36 x 42, brick construction. Owners will receive tenders for painting, heating, plumbing and electrical.

Residence, cost $3,000, Fairview Ave. Owner and general contractor, T. T. Johnston, 1 Sherwood Ave. Two stys., 20 x 38, brick construction, brick foundation, shingle roofing.

Three detached residences, cost $15,000, High Park. Owner and general contractor, S. Solodinsky, 2122 Dundas Street. Will sub-let plastering, painting, heating, plumbing and electrical. Two storeys, 24 x 52, steel and brick construction, brick foundation, felt and gravel roofing.

Apartment, cost $25,000, College St., General contractors and owners, Donnefield Bros., 62 Spruce Hill Rd. Will sublet plastering, painting, heating, plumbing, electrical. Three storeys, 48 x 62, brick and steel construction.

Three pair residences, cost $15,000, St. Clair Gardens. General contractor and owner, W. Pennock, 5 Burlington Cres. Owner buys all material. Foundation in one pair, excavating two pairs. 2½ stys., brick construction and foundation.

Residence, cost $6,000, Wells Hill Ave. General contractor, J. W. Brown, 229 Christie St. Architect, P. H. Finney, 79 Adelaide St. E. Owner will sublet some trades. 2½ storeys, brick construction and foundation.

Vancouver, B.C.

Residence, cost $5,000, Point Grey, for Dr. W. A. Briggs, 1847 2nd Ave. Architect, A. J. Bird. General contractor, J. E. Wright, 466 10th Ave. E. Two stys., frame construction.

Residence, cost $14,000, Shaughnessy Heights, for McKay Smith, 756 Jervis St. Architects, Maclure & Fox, Pacific Bldg. General contractors, Pudry & Lonergan, 1340 Barclay St. Three stys., frame construction.

Residence, cost $85,000, Selkirk Ave., Shaughnessy Heights, for A. E. Tulk. Architects, Maclure & Fox, Pacific Bldg. General contractors, McPherson & Sinclair. 2½ storeys, Los Angeles brick and stone construction, English tile roofing.

Residence, cost $14,000, for Thos. E. Ladner, 2nd ave. west. Architect, J. W. Kengey, Rogers Bldg. General contractors, R. & F. Watson, Kerrisdale. Three storeys, frame construction.

Victoria, B.C.

Apartments, cost $45,000, Cook and Collinson streets, for A. B. Winch, care architect, C. E. Watkins, Green Block. General contractors, Messrs. Fulton Bros. Four storeys.

Residence, cost $5,000, for M. Henderson. General contractor, J. Robertson. Two storeys, frame construction.

Welland, Ont.

Double tenement house, cost $4,500, Hellems ave., for J. C. Diffin, builder and general contractor. 2½ storeys, 33 x 38, brick veneer construction.

R. C. Parsonage, cost $12,000, Griffith, for R. C. Church Corporation, Welland. Architect, A. W. Holmes, 10 Bloor St. E., Toronto. General contractor, J. H. Gardiner, Welland. Hamilton pressed brick construction.

Residence, cost $7,000, North Main, for The Misses Chapman. Builder and general contractor, J. C. Diffin. 2½ stys., 30 x 40, brick veneer construction.

Windsor, Ont.

Residence, cost $6,000, Ouellette St. Builder and owner, Peter Osterhout. Two storeys, 40 x 40, brick construction.

Apartments, cost $18,000, Ferry, for Fred Dresch & Son. Architects, Leybourne & Whitney. Mason, Geo. Goodman. Three storeys, 34 x 50.

(Continued on page 72)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Kingsville, Ont.," will be received at this office until 4 p.m., on **Monday, October 27, 1913**, for the construction of a Public Building at Kingsville, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Kingsville, Ont.; at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Cor. Yonge and Charles Streets, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 1st, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48549. 41-42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater at Kincardine, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of a Breakwater at Kincardine, Bruce County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of H. J. Lamb, Esq., District Engineer, Windsor, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Kincardine, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46683. 41-42

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada.
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Thornbury, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the Harbour Improvements at Thornbury, Grey County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. H. Armstrong, Esq., District Engineer, Midland, Ont., and on application to the Postmaster at Thornbury, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47674. 41-42

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 2 p.m. on **Monday, October 27th, 1913**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Clerk's office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
41-42 Township Clerk.

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until 4 p.m., on **Wednesday, October 29, 1913**, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation, and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46393. 41-42

ARCHITECT

For an experienced, up-to-date architect, an excellent proposition is offered, by an established Consulting Engineering & Architectural Corporation, **based on a co-operative plan, offices in** Cleveland, Detroit, Buffalo and New York City. The position requires a man who is thoroughly capable of handling an architectural department independently, both inside and outside work. **Highest references and $1,500 investment required. Contract with salary, commission and interest in business guaranteed.** Answer, "Architect," Contract Record, Toronto. 42

Tenders for Steelwork

Gerrard Street Bridge

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, November 25th, 1913,** for the supply and erection of structural steelwork for the Gerrard Street Bridge over the Don River.

Specifications and tender form may be obtained upon application at the office of the Railways & Bridges Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
City Hall, Toronto.
September 22nd, 1913. 42

Tenders for

Construction in Reinforced Concrete of Olympia Bridge

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, October 21st, 1913,** for the complete construction of a reinforced concrete bridge between Centre and Olympic Islands.

Specifications and tender form may be obtained upon application at the office of the Railways & Bridges Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
City Hall, Toronto,
October 8th, 1913. 42

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Milverton, Ont.," will be received until 4 p.m., on **Monday, November 3, 1913,** for the construction of a Public Building at Milverton, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the office of J. S. Russell, Esq., Arcuitect, Stratford, Ont., at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Milverton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. —45635. 42-43

TENDERS

FOR

Pumping Engines, Boilers and Coal Handling Apparatus

Tenders will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on

Tuesday, November 25th, 1913.

for the installation of one or more 7½ and 20 million Imperial Gallon Pumping Engines, three Water Tube Boilers with Piping, and Coal Handling Apparatus at the High Level Pumping Station.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C HOCKEN, Mayor.
Chairman, Board of Contrcl.
City Hall, Toronto, October 9, 1913. 42

Addition to Lawrence's Bakery

Denison Ave., Toronto

Tenders will be received up to 12 o'clock noon, **Monday, October 27th, 1913,** on all trades for extensive alterations and additions.

The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the office of the architect,

GEO. W. GOUINLOCK,
42 1108 Temple Building.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on

Tuesday, October 21st., 1913

for the construction of the following sewers:—

Danforth Ave. Storm Overflow Sewer Sec. No. 2.
Eastern Ave. from Leslie St. to Knox St.
Lane 1st E. Spadina Ave. from Morris Ave. to Sussex St.
Lane 1st N. Davenport Rd. from Elmwood Ave. to McFarland Ave.
Victor Ave. from Carlaw Ave. to 464 feet west.
Lane 1st S. College St. from Crawford St. to Shaw St.
Jersey Ave. from 84 ft. 3 in. S. of Clinton Ave. to 47 ft. further south.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 8th, 1913. 42

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 69)

Winnipeg, Man.

Residence, cost $10,000, Dromore ave. Architects and general contractors, Andrews & Sons, Portage and Victor. 2½ storeys, 30 x 29, frame construction, stone foundation. Foundations in.

Residence, cost $3,000. Architect and general contractor, N. Milligan, 682

Strathcona street. Two storeys, 20 x 28, frame construction, stone foundation. Excavating done.

Residence, cost $20,500, for C. Henback, care architects, Woodman & Carey, Lindsay Bldg. General contractors, Claydon Bros., Furby Place. Two stys., 29 x 90, brick construction.

Apartment block, cost $75,000, Home St., for Roed & Lidholm, Union Trust Bldg. Architect, E. D. Tuttle, 709 McArthur Bldg. General contractors, owners. Work will start immediately. 3-storeys, 66 x 98.

Apartment block, cost $65,000, Grosvenor ave., for D. H. Bradley, care architect, A. B. Scarlett, 797 Jessie ave. General contractors, Winnipeg Stone Co. Elmwood. Three storeys.

Power Plants, Electricity and Telephones

Montreal, Que.
Generator for Board of Commissioners of Pointe St. Charles. Tenders received by Secretary, L. N. Senecal, until 12 o'clock noon, Oct. 23rd, for the supply and erection at Low Level Pumping Station, of 1 direct current electric generator of 35 kw. capacity, direct coupled to steam engine for electric lighting. Specifications and further information may be obtained at office of Superintendent of Water Works, City Hall, Montreal.

St. Catharines, Ont.
Sub-station and distribution system, cost $116,000, planned by City Council. Clerk, J. A. Pay. Ratepayers will be asked to vote on by-law Oct. 30th.

Winnipeg, Man.
Electric Wiring planned by Provincial Govt., Dept. of Public Works. Acting Minister, G. R. Coldwell. Wiring Principal's residence, farm foreman's cottage, swine barn and laying and brooding house, Agricultural College, St. Vital.

Ornamental street lighting, cost $3,109.59, planned by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Willoughby Kelso Co.

Yorkton, Sask.
Electric power house, cost $36,000, for Town Council. Clerk, F. T. F. Atcheson.. General contractors, Ritchie & Watters. One storey, brick construction and foundation.

Miscellaneous

Calgary, Alta.
Cable required by City Council. Engineer, R. A. Brown. General contractors, Imperial Wire & Cable Co., Ltd., Montreal, for supplying 40,000 ft. lead covered paper insulated underground cable.

Stratford, Ont.
Fire apparatus for City Council. Fire Committee's report, recommending purchase of fire apparatus to cost $20,000, adopted by Council.

Business Notes

Clifford, Ont.
Grain elevator owned by E. Tolton destroyed by fire. Loss to building $2,000, little insurance.

Montreal, Que.
Sheds, 2239 St. Hubert St., owned by L. M. Trembly, 2209 St. Hubert St., destroyed by fire. Loss $12,000.

Pembroke, Ont.
Stores, etc., destroyed by fire, owners, W. A. Hunter & Sons, dry goods and grocery store. Loss on building, $10,000; insurance $4,000. S. N. Hunter, hardware, loss $10,000, covered by insurance, also a number of stores damgaed.

Perth, Ont.
Stable owned by Imperial Hotel destroyed by fire. Loss $10,000, partly covered by insurance.

Sturgeon Point, Ont.
Hotel and store owned by Mrs. Fanny Walkey, also boat houses belonging to J. D. & Wm. Flavelle, destroyed by fire.

Truro, N.S.
Hotel owned by Waverley Hotel, destroyed by fire. Loss $6,000, some insurance.

New Companies

The T. Heal Woodworking Co., Ltd., has been incorporated with a capital of $40,000, to carry on business as contractors, carpenters, woodworkers, etc., with head office at Toronto. The provisional directors are W. J. Mitchell, W. S. Thomas and Ernest Constant, brokers, all of Toronto.

Barker Realty Limited, incorporated with a capital of $400,000, to carry on a general contracting and construction business, etc., with head office at Toronto. The provisional directors are Daniel O'Brien, merchant, Mervil MacDonald and Geoffrey Adams, barristers, all of Toronto.

James T. Gilchrist Lumber Co., Ltd., has been incorporated with a capital of $40,000, to carry on a planing mill, woodworking plant and retail lumber business and to deal in builders' supplies with head office at Toronto. The provisional directors are J. T. Gilchrist, lumber merchant, A. S. Winchester and J. W. Broudy, law student, all of Toronto.

Central Contracting Company Limited, has been incorporated with a capital of $50,000, to carry on business as lumbermen, saw millers, lumber and woodenware manufacturers and contractors in all its branches, with head office at Fort William. The provisional directors are E. R. Wayland, broker, C. E. Smith, contractor, and Dr. J. D. Chisholm, all of Fort William.

Upper St. Lawrence Power Company, Limited, has been incorporated with a capital stock of $3,000,000, with head office at Toronto. The incorporators are Wm. Bain, bookkeeper, Robt. Gowans, J. J. Dashwood, clerks, and J. S. Lovell, accountant, all of Toronto.

North American Development & Construction Co., Ltd., has been incorpor-

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220 King Street West - TORONTO

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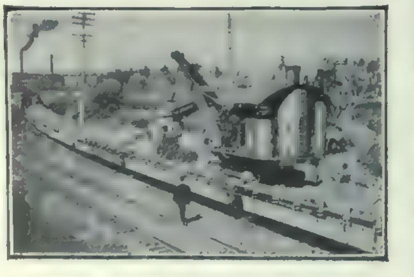
P. W. DIFTLY, Proprietor

"Our 20th Century Roller"

1303 Peach Street, - Erie, Pa.



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New York, Philadelphia, Pittsburg, Chicago, San Francisco, Montreal Can., Jacksonville, Mexico City.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

ated with a capital stock of $100,000, to carry on business as engineers, to operate hydraulic plants, hydro electric plants, reservoirs, waterworks, etc., with head office at Winnipeg. The incorporators are W. J. W. Bullock, engineer, E. J. H. Gifford, real estate agent, and H. DeA. Gill, law student, of Winnipeg.

Late News Items

Edgely, Sask.

Barn, cost $9,000, for Mrs. A. K. Larsen. General contractor, J. Inglis, 1305 Montague St., Regina. 84 x 118, electric lighting. Foundations in.

Guelph, Ont.

W. A. Mahoney, architect, has let contract for new hockey rink for O. A. College, Guelph, to Mr. C. L. Forler, of Phillipsburg. Work to be commenced at once and building rushed to completion.

Hamilton, Ont.

National Natural Gas Co. will lay 7½ miles gas mains between now and January 1st, 1915. Secretary, R. F. Miller, Bank of Hamilton Building.

Store, cost $3,000, for A. R. Campaigne, 401 Barton St. E. General contractor, J. Vogan, 280 Sanford Ave. N. Two storeys, brick construction, concrete foundation, electric lighting, felt and gravel roofing, store front and fixtures.

Addition to factory, cost $3,500, for F. W. Bird & Son, Beach Rd. General contractors, J. Poag & Son, Westinghouse Ave. One storey, frame construction, pariod roofing.

Montreal, Que.

Store house, cost $30,815, planned by Board of Commissioners. Secretary, L. N. Senecal. Plans being prepared by Mr. Barlow, Supt. Waterworks Dept., and will be submitted to Board.

Church, cost $30,000, Pius IX., for Hochelaga Methodists. Rev. Isaac Nosworthy, 814 New Birks Bldg. Plans are being prepared but tenders will probably not be called till spring. 30 x 60.

24 tenements, cost $30,000, Notre Dame des Grace (Western Ave.), for G. N. Clarmont, 97 St. James St. Architect, J. A. Ouellette, 250 Amherst St. Brick, M. Caille, c/o architect. Mason, S. Paulhus, 15 St. Lawrence. Tenders open for all other trades, to close with architect October 18th. Excavating done.

Warehouse, cost $3,825, Cabot, for Montreal Blanket Co., 1600 St. Patrick. Three storeys, 75 x 50, concrete foundation, felt and gravel roofing. Plans ready.

St. Catharines, Ont.

Welland Canal, cost $10,000,000, planned by Dom. Govt., Dept. of Railways & Canals. Secretary, L. K. Jones, Ottawa. General contractor, M. J. O'Brien & H. Doughney, Imperial Bank Bldg., Montreal and Thorold, Ont. Sub-contractors, Quinlan & Robertson, Galt Ave., Montreal, and Thorold, Ont. General contractor has section No.3. Work started.

St. John, N.B.

Walks, etc., planned by City Council. Harbor Commissioner, H. B. Schofield. Tenders to be called shortly for 13,000 ft. spruce deals No. 7, to relay sidewalk on Union St. W. between docks No. 4 and 5, and to repair platform approaching west side toll house, 100 piling, 45 x 55 ft. in length, 100 piling 55 to 65 ft. in length, also for repairs to east and west side piling.

St. Stephen, N.B.

Shoe factory planned. Mayor, Mr. Dinsmore. Inspector of Construction, David Johnston. General contractor, Thos. Toal. Foundations in.

Sarnia, Ont.

Waterworks and sewer system, cost $16,000, planned by City Council. Mayor, Dr. Bell. Ratepayers will vote on bylaw October 24th.

Tillsonburg, Ont.

W. A. Mahoney, architect, Guelph, is getting up plans for a Carnegie Free Library at Tillsonburg. Plans have been approved of by Mr. Carnegie. Tenders will be called for shortly.

Toronto, Ont.

Apartment, cost $6,000, Harrison St. Owner and general contractor, W. S. Grimshaw, 462 Avenue Rd. Two stys., 32 x 47, brick and steel construction, stone foundation, felt and gravel roofing.

Vancouver, B.C.

Warehouse, cost $7,000, 2034 11th St., planned by Alaska Bedding Co., 2064 11th St. W. Warehouse, boiler room and laundry. Plans ready.

Windsor, Ont.

Bungalow, cost $6,000, Ouellette, for F. E. Harvey, c/o Cadwell Sand and Gravel Co. Tenders received by Architects, Leybourne & Whitney, from Oct. 20th until 31st. 1½ storeys, 30 x 47, brick construction, cement foundation.

Beath Scotch Derricks

Hand or Power

THE construction of Beath Scotch Derricks embodies several points of merit not found in other makes.

All stress parts are **steel** not cast iron. Bottom Pintle Bearing is of ball and socket type and works in a bath of oil, thus ensuring an easy movement at this joint.

Beath Derricks are provided with self-oiling bearings, ensuring easy operation and reducing wear to a minimum.

We also make Jinniwink Derricks, Stiff Leg Derricks, Guy Derricks, and Steel Derricks for heavy service. Hand or Power operated.

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ENGINEERS AND MANUFACTURERS

20-30 Cooper Ave., Toronto

The A. M. Ellicott Co., 301 St. James St., Montreal, Que., sole selling agents for Province of Que.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 90
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	30
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 [illegible]	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Gravity System Distributing Concrete

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A system that improves the concrete and reduces the cost.

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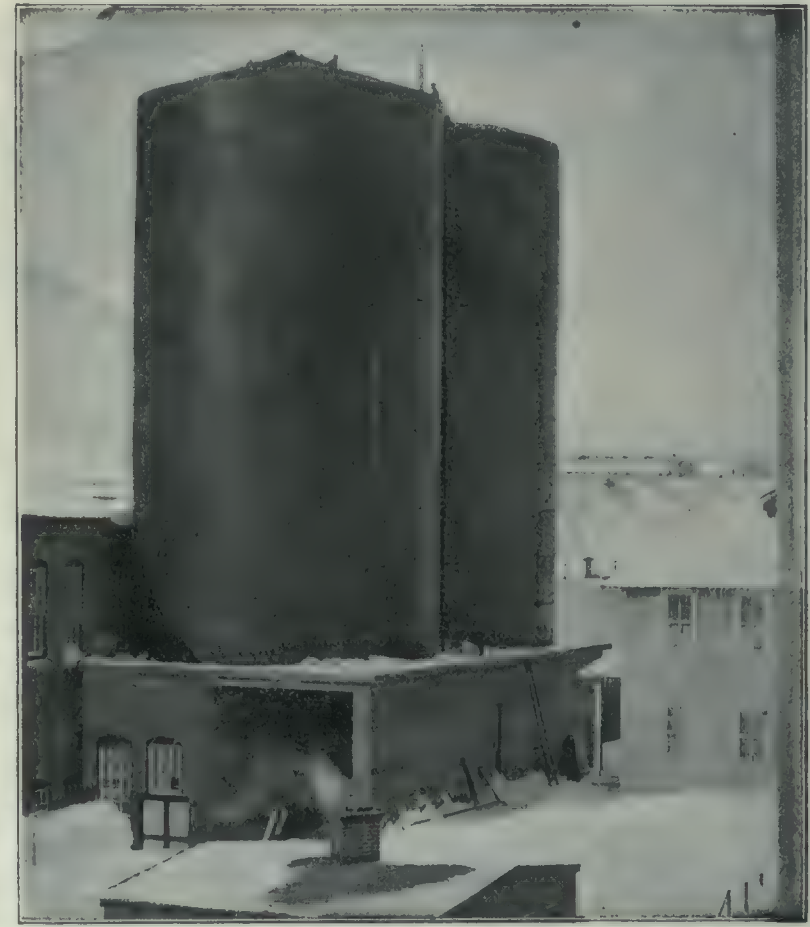

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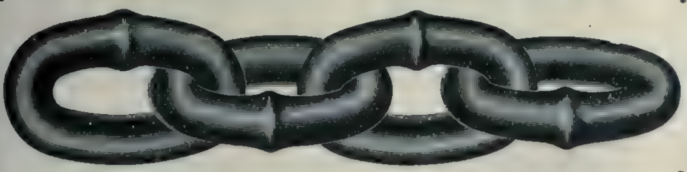

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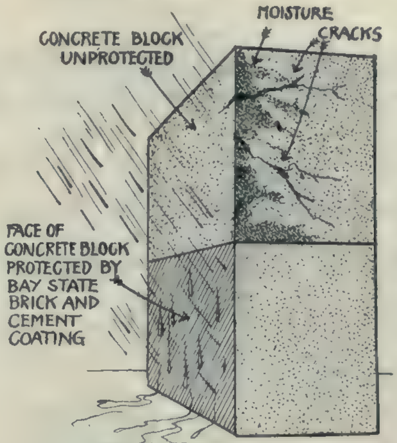
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CRACKS
CONCRETE BLOCK UNPROTECTED
FACE OF CONCRETE BLOCK PROTECTED BY BAY STATE BRICK AND CEMENT COATING

THIS cut shows the effect of water on concrete when the concrete is unprotected.

The lower block shows how impervious to moisture concrete, cement or stucco is when treated with

Bay State Brick and Cement Coating

It can be used on houses, in mills, hotels and heavy construction of every kind where the concrete or stucco is exposed to dampness.
It is also a fire retarder.

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BAY STATE

No. 110 R. I. W. DAMP RESISTING PAINT

Prevents Cement Mortar Stains on Cut Stone Work

—

Excludes Dampness

Bank of Toronto—Head Office, Toronto.—All Tennesee Marble in above building "backed" with No. 110 R.I.W. Paint.

Preserves Interior and Exterior Surfaces of Wooden Tanks

—

Protects Steel from Fumes of Acids and Alkalis

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FACTORY: 1372 Bathurst Street, Toronto

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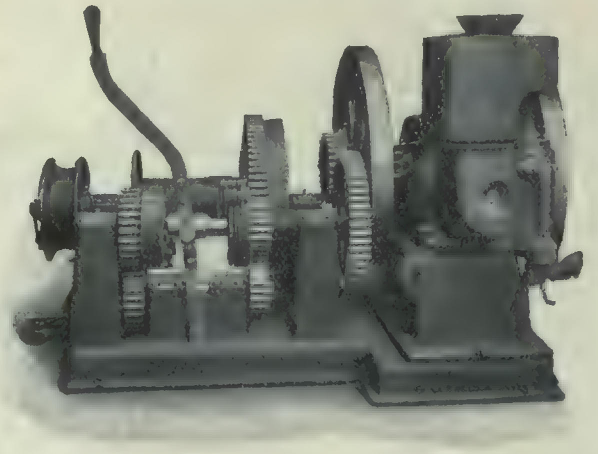
Thos. Black, Winnipeg
Can. Equipment & Supply Co., Ltd. Calgary and Edmonton

Dartnell Limited, Montreal
Canadian Agency & Supply Co., Limited, Ottawa
Gandy & Allison, St. John, N.B.
People's Building Supply Co., Fort William
Carter, Dewar, Crowe Co., Vancouver

Equipment for Contractors

Hoists, Diaphragm Pumps, Plows, Dump Wagons, Dump Carts, Dump Boxes, Heavy Teaming Gears, Gasoline Engines, Etc.



Massey-Harris Direct Connected Hoist has powerful Double Gearing; Band Brake; Adjustable Band Clutches, and in every respect will be found all that a good reliable Hoist should be. Several sizes and styles to suit different requirements.

Massey-Harris Diaphragm Suction Pump. Consists of one of the well-known Massey-Harris Gasoline Engines and a "Goulds" Pump mounted on a convenient hand truck. Both Engine and Pump are the best that can be produced. Full particulars on request.

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—Branches at—

Montreal, Moncton, Winnipeg,
Regina, Saskatoon, Swift Current, Yorkton
Calgary, Edmonton

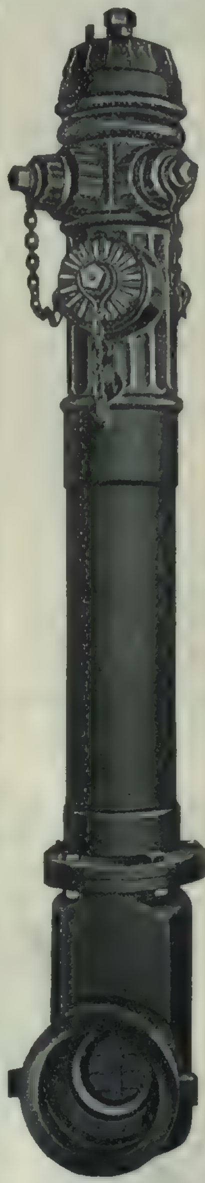
—Agencies Everywhere—

We Manufacture

The Reliable Line of

VALVES

- Brass Globe and Gate.
- Steam and Hot Water.
- Packless Radiator.
- Iron Body "Keystone" Gate, (non-rising stem or outside screw and yoke, with screwed, flanged or hub end)
- Iron Body Swing Check.



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Gate and Compression FIRE HYDRANTS

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VALVE BOXES
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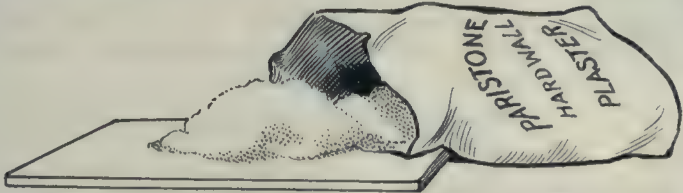

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Page 16

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An Astonishing Failure and a Timely Lesson

THE astonishing failure of the Canada Iron Corporation, as revealed by a statement recently submitted to the bondholders by the Western Canada Trust, is an impressive plea for placing our concerns on a solid financial basis and adopting a sane policy of development within the limitation of our resources. When the first news came of the Canada Iron Corporation's difficulties it was inferred that the two hundred and fifty thousand dollars which the directors sought to borrow, in priority to the existing debenture charges, represented the total amount required to restore the company's fortunes. It is astounding to learn that in order to avoid disposing of the business at a break-up price it has been found necessary to close down the blast furnaces and the mines, and to confine business to the foundries.

The insolvency of the Corporation is attributable, we are told, to losses incurred in working the mines and blast furnaces, and to the heavy capital charges incurred on account of these branches of the business. In short, one of the leading institutions of the Canadian industrial world has failed owing to bad management, poor financing and inability to provide for the expansion which must be reckoned with in a country of rapid progress like Canada.

Occurrences such as these militate against the best interests of Canadian trade. It is not so much the failure of an individual concern that matters, as the reflection upon really sound industry in quarters where it is most desirable that we should hold an unblemished reputation for a conservative and sane, if enterprising, policy in regard to things financial.

As a country we have embarked upon great undertakings in the construction and operation of which we shall be dependent upon London and other great markets for millions and millions of dollars. Mistakes, financial and otherwise, have to be paid for. The frenzied finance of the Canada Iron Corporation constitutes a particularly flagrant example of what to avoid.

It is significant to find that this failure has been the subject of somewhat extended criticism on the part of the London Financial Times, thus developing the wider aspect of the situation to which we have referred above. In urging the need for greater liquid resources, the Times deplores the number and seriousness of recent failures of companies operating in the Dominion. It concludes:

"If Canada wishes to retain the confidence of British investors it will be necessary for the leaders of industry in that country to adopt a far more conservative financial policy than has hitherto been customary and to refrain from attempting to carry on a volume of business which no English concern would dream of doing without much greater liquid resources than appear to be deemed necessary on the other side of the Atlantic. We are quite prepared to believe that the iron and steel industry in the Dominion will develop very rapidly during the next few years, and the capital employed therein will earn a good return. All this, however, is of small consolation to those who, having subscribed the necessary funds for the equipment of such undertakings, find their securities severely depreciated and a receiver in charge of their business at the first sign of adverse money conditions. Canadians are fond of telling us that they are no longer children to be held in leading strings, but that, on the contrary, they are a great nation. If they really desire to be regarded in this light they must act a great deal more circumspectly in commercial matters, and not allow their desire to do business to outrun their financial discretion."

Another Phase of the Finance Question

PASSING from the problems of finance which engage the attention of industrial concerns we are reminded of an entirely different aspect of finance in regard to municipalities. Quite recently there have been brought to light a number of cases where cities and towns have been obliged to postpone—and in some cases cancel—for lack of funds, the construction of various works that are absolutely imperative from the public health standpoint. Several towns in the province of Ontario have lately received orders from the Provincial Board of Health either to make radical changes in the sewerage systems that they have in operation or else to install entirely new systems. It is only to be expected that such changes are necessary when one considers the abnormal increase in population of late years. In many cases municipalities have entirely outgrown themselves in a decade and the sanitary provisions of a few years back have become hopelessly inadequate to taking care of the new population. Unfortunately, many of the towns which have received orders from the Provincial Board of Health, while fully realizing the seriousness of the situation and appreciating the necessity for the extension, have been unable to comply with the orders owing to the problem of securing money at a time when it is difficult to borrow it advantageously.

It would seem that in cases where, in the interests of the community, it is desirable to improve sanitary conditions, some assistance should be given by the Provincial Government, so that the orders of the

Board of Health can be enforced. It is a strange anomaly that what is deemed essential by the Provincial Board of Health—what, in fact, is decreed by the authorities, is impossible of fulfilment because of the money involved.

Such a state of affairs would not be tolerated for one moment in England. There, the responsibilities in connection with improvements of this kind are assumed by a Municipal Government Board to whom any town or city experiencing trouble due to the inadequacy of its sewerage or water systems, can apply for assistance. This Board sends one of its engineers to make an exhaustive report on what is required and if the report is favorable the necessary funds are provided at a reasonable rate of interest and the work is put in hand immediately.

When one compares the shortcomings of our own practice with the satisfaction that is derived from the procedure of the older countries, one cannot help thinking that although we are progressing rapidly we have yet many useful and important lessons to learn.

Channel Tunnel Project Materializing

ACCORDING to information given in an article published on another page, the romantic elements of the Channel Tunnel project are being sifted out, leaving a residue of solid material for engineers to reckon with. The C. N. R. tunnel through Mount Royal is one of the most spectacular pieces of engineering that we have had in a long day, but the tunnel under the English Channel would eclipse everything and provide the technical journals with descriptive matter for a decade.

From what we hear, Chief Engineer Brown, who is engaged on the Mount Royal tunnel, is greatly interested in the Anglo-French project. According to a statement credited to him, Mr. Brown has been considering the military aspects of the matter, pointing out that England's defences would not be endangered because in time of war the tunnel could be flooded at either end if need be.

Certain it is that as time goes on the engineering profession is coming to regard the tunnel project more seriously. There was a time when the authorities in the Old Country became hysterical over the annual discussion of the question. This is one of the things that have given place to "something new, to something strange." At any rate the project is growing in favor and its prospects are brightening from the engineering point of view.

A Profitable Educational Arrangement

THE educational authorities of the county of Cheshire, England, will have the support of the engineering profession in taking the initiative in the matter of instituting scholarships between colonial universities and those of the United Kingdom. We understand that the authorities of McGill University have come to an arrangement whereby the Cheshire County scholarships may be held for the whole or a portion of the term of three years at McGill. From what we can gather, the educational authorities in the old country seem to have rather exaggerated views as to the number and importance of engineering vacancies in the colonies, but Canada has such excellent prospects along the lines of general constructional activity that encouragement should be given to such a movement.

The Woman Architect

WE congratulate those who are advocating the claims of woman, says our London contemporary, The Builder. In connection with the exhibition to be held next year in the City of Cologne, it was decided—at the eleventh hour—that the building to be devoted to women's work in decorative art as applied to the house, statuary, painting, drawing, fashion designing, toys, etc., would be most fittingly housed in a building designed and carried out by women. So a competition was announced limited to women, with the result that a German was placed first, an Austrian second, and another German third. A dozen women in all competed, and the first design is described as being well proportioned and dignified, and is said to need little alteration. The judges paid a tribute to the powers of all the competitors to realize the details necessary to the housing and display of exhibition goods, and to the capacity shown for applying artistic ideas to the building and its internal decoration and arrangement. We think that the pioneers of the women's movement in architecture are in some ways fortunate when we hear of a competition in which three premiums are offered and only twelve competitors enter, and contrast it with some of our ordinary competitions. Would the conditions of such a competition permit a married man to help his wife in an inferior capacity—say, to work out her rough sketches? We ask this question in the interest of our readers. We shall hope to chronicle many other successes of the fair sex until a ladies' building journal exploits the new and—shall we add?—virgin field.

Something About Advertising

THE failure of a trial advertisement has set more business men against advertising than any other factor in publicity. This is a pity when the indefiniteness of a trial advertisement is considered. A trial advertisement represents low water mark—absolute bottom.—It is not decisive. It has no more value as evidence than a first meeting with an individual who afterwards becomes your friend. Of all the advertisements in a long campaign, the first ad is the worst, though it is written by an adept. If it is written by a novice in advertising that novice will never write a weaker one. It is like the first discord struck out of the piano by a beginner. If a student becomes disgusted with such an initial effort he will never get farther, and if a merchant abandons his advertising intentions because the first advertisement was unremunerative, he will never get farther. The first attempt of anything is valuable only as an educator. Advertising is like seed sown, it's got to have time to grow before you can reap the harvest.

If a paper, after careful examination, impresses you at all favorably, it's worth giving a fair trial. In no case should a trial ad be inserted for less than six months. If the paper is going to be a paying investment for you, it will begin to show results by that time.

There is a big difference in feeding a cow just enough to keep her alive, and feeding her enough to create a profit.

The same is true about advertising. Nine times out of ten a small advertisement inserted one or two times is simply a waste of money, while the same advertisement inserted for six or more months would have become a paying investment.

Rialroad Work in Canada not So Bad in Comparison

IN an article dealing with the construction of the Cape to Cairo Railway, a writer in Colonial Life says:—"The work has been stupendous and the difficulties immense. There has been the unfriendly attitude of the natives to contend with and overcome; encounters with lions, elephants, and other wild beasts in the northwestern parts of Rhodesia; and then, as the Congo was approached, the ravages of the white ant and other termites had to be reckoned with. On one occasion a construction train was puffing along with a heavy load of material near Gwelo, when a full-grown lion was sighted stretched right across the line and basking peacefully in he sun. In reply to the whistle of the engine the brute looked up lazily, but did not attempt to move. The efforts of the driver and stoker to drive him off the line by pelting him with billets of wood were equally futile. The train was on the point of coming to a standstill when the lion took a sudden spring at the engine. Again and again the beast sprang, falling clear of the engine every time. The driver then realized that the best thing to do was to go full steam ahead and trust to the weight of the trucks behind him to keep the train on its line and clear the lion from its path. This was done, with the result that the lion—a magnificent specimen—was cut to pieces by the engine wheels. Quite a number of natives have lost their lives by being carried off by lions while asleep in their camps. Elephants have given trouble by tearing up the roadbed and pulling down the telegraph wires and upsetting the posts."

Concreting in Cold Weather — A Timely Enjoinder

IT is none too soon to start preaching against the dangers of careless work in winter concreting. Despite the emphasis placed on the subject there has been a harvest of disasters each winter, serious always in the financial loss, and sometimes in life. Without doubt the dangers are now appreciated by a greater number of contractors and inspectors than ever before, but the increase in the number of users of cement seems to have exceeded the spread of sound knowledge of its use. The recruits and the older users who, fortunately, may have escaped disasters through luck rather than intelligent care form a large enough body to appall even the most enthusiastic campaigner.

Fortunately, there is promise of help in many quarters. The Universal Portland Cement Company has recently issued a third edition of its pamphlet, "Concreting in Cold Weather," most valuable for contractors, foremen and inspectors. Other cement companies also are preparing literature, and at least one company will use its advertising space in technical and contracting papers to preach sound doctrine on cold weather concreting. There cannot be too much co-operation. The cement companies owe it to their industry to make each salesman a missionary to warn against the dangers and teach the precautions necessary. Special efforts, more strenuous even than those of recent years, should be made to enlist the help of the jobber.

Engineers and architects have a responsibility no less serious than that of the cement companies. In fact, this journal has repeatedly taken the stand that, as technical directors of the work, they should be held criminally liable for accidents resulting from inadequate precautions against freezing. Building departments, of course, share this responsibility and should exercise the closest supervision over concrete work within their jurisdictions.

The precautions necessary, moreover, are so simple that there is no excuse for not applying them. To discourage concreting altogether in cold weather is not only unnecessary but would result in tying up to no good purpose the capital invested in construction plant and in losses owing to postponement of the use of the structures. There are construction difficulties in other lines, but they are not allowed to interfere with the execution of the work. The heating of the material and the protection of the fresh concrete from freezing are sufficient measures to permit work to proceed in all but the very coldest weather. With intelligent supervision and close attention to the heating equipment there is no reason why even in zero weather pouring should not be continued.

The use of salt, however, is open to objection in reinforced structures, and while apparently not harmful in plain concrete should not be used where steel is embedded. It has limitations, moreover, as to influence, its effectiveness being practically nil at a point 10 deg. below freezing.

Persistent efforts, beginning at once, may help in lowering materially the disaster record made last winter. Cement manufacturers and their salesmen, cement jobbers, building department officials, engineers, architects and contractors experienced in cold-weather work can all bear a part in the educational campaign. The reward will come in greater confidence in concrete as a construction material and in the saving in life and property.—Engineering Record.

In a recent issue of Progress, an enterprising New Zealand contemporary, are published some observations on damp-proof walls in which it is stated that unless the composition of a wall is impervious to moisture, there is no advantage in a thick wall as against a thin one, for if the moisture will pass through one inch, it will pass through the remaining thickness. Therefore a thin wall with a coating of thin impervious plaster will exclude damp, where a thick wall with no coating will let it pass through. With a very thick wall, however, a moderate rain storm may not continue long enough to wet it quite through, but in the case of water tanks and similar objects, thick pervious walls are no better than thin ones, except in the matter of strength. Hollow walls are sometimes adopted for dwellings, the air spaces in the walls preventing the moisture from passing through to the inside. This is regarded as a cumbrous expedient, and after due consideration, reasonably thin and porous concrete walls with an impervious coating have been successfully adopted, making walls and partitions one standard thickness, and thus gaining space in the rooms, and time in erection, which means less cost and a better job altogether.

A tall brick stack has been erected for the J. Heinz Company, of Northside, Pittsburgh. The stack is 250 ft. high and tapers from a 23-ft. base to a 10-ft. top. Sixty-four concrete piles were driven 30 ft. for a foundation. Alternate courses of the brick are headers, and heavy steel bands have been inserted in the masonry at seven stages to provide for temperature changes. A similar stack, 60 ft. away, is soon to be built.

Colloids and Their Solution in Sewage and Water

By A. C. D. Blanchard, M. Can. Soc. C. E.

FOR the purpose of the present article it may be considered that a solid is dispersed in sewage or water in one of three different phases: first, in suspension; second, in solution; third, as colloids in colloidal solution.

No attempt will be made here to deal with either the first or second division above given, excepting to employ them for the purpose of comparison or contrast with the third and least understood.

Light is thrown on the theories concerning colloidal solutions by an interesting paper read recently before the Franklin Institute.* This paper, which treats the subject more or less from the point of view of the physicist, is both liberally quoted and referred to in this adaptation of the subject to the uses of the practical engineer.

For the sake of clearness it may be well to commence with a definition of colloids and their solutions, since few readers will have an exact conception of these phrases which have been used so frequently by technical writers without further explanations.

A colloidal solution is formed by the dispersion of a solid through a liquid, but the solid is not divided into separate molecules as in a true solution. The dispersion of the solid actually exists in fairly large collections or communities of the molecules composing the solid, the number in each group being variable. The solid elements thus dispersed are known as **colloids** and the solution formed is known as a **colloidal solution.**

Comparing solids in colloidal solution with either of the other two groups we find that solids in suspension will cause a turbidity which may be removed by settling, if left undisturbed, or by filtering through a filter paper. A true solution, on the other hand will not be effected by these treatments.

A colloidal solution occupies an intermediate position; Colloids will not settle out, even if left for long periods, unless some change occurs in the organic form of the colloid itself, or unless aided by a precipitant. But if passed several times through the same filter paper the solution will gradually become clearer. Examples of ordinary colloidal solutions may be found in the absorption by water of gelatin, glue, soap, and frequently, bacterial growths.

Inorganic substances, such as gold, sulphide of arsenic, etc., may be reduced to colloidal form in solution with water or other liquids, but these are not important in connection with the aim of the present discussion.

It is well to bear in mind, however, that colloids are always of amorphous nature, since crystalline substances dissolve into molecular or even finer particles, and never exist as groups of molecules in solution, which, as already explained, is the true nature of a colloid.

From the preceding remarks it may be inferred that colloids may partially be removed from either sewage or water by the subsidence of suspended matters which carry down with them a certain proportion in solution. The use of artificial precipitation by the addition of sulphate of alumina, ferric sulphate and lime, is also introduced as a preliminary treatment. Such an expedient however, obtains only partial results, as the liquid after treatment will still retain a proportion of its colloids in solution.

The question arises at once in connection with the phenomenon of the colloidal solution: why are colloids not actuated by the usual laws of nature, and either eventually float to the surface, or sink to the bottom of the receptacle containing the liquid. Assuming that the colloid is heavier than water, it is evident, that as the particles are reduced in size there is a rapid falling off in velocity of settlement. This is easily demonstrated, and formulae have been deduced showing the diminution in velocities of settlement as particles are reduced in size. There is nothing in these formulae, however, which would indicate that the subsidence would cease altogether unless the diameter of each particle were reduced to an infinitely small dimension. This fine division of particles is obviously not reached in colloidal solutions and hence we are forced to seek another explanation of the phenomenon. The answer lies in the theory of molecular motion or **heat.** "The particles (of the colloid) are battered on all sides by a hailstorm of molecular impacts. If the particle is large the blows of the molecules of the solvent in different directions neutralize each other. But when the particle is not very much larger than the molecules themselves, a molecule striking, say, on the left, will give the particle a very perceptible push toward the right and the cause which prevents the particles in a colloidal solution from settling is in no way different from the cause which prevents the earth's atmosphere from subsiding to a snowy layer a few feet deep on the surface of the planet."†

Having thus reached an explanation of the phenomenon of the colloidal solution as it occurs in connection with the problems of water supply and sewerage, it may be well to review briefly the methods which have been employed to remove colloids in the process of purification.

In the disposal of sewage this has been attempted in many ways and with varying degrees of efficiency.

First, by Subsidence.—This removes only an extremely small proportion of colloids due entirely to the settling of suspended particles with colloids attached.

Second, by Chemical Precipitation.—A considerable proportion of the colloidal component is removed by this method, but the expense involved is hardly commensurate with the success in comparison with other schemes.

Third, by the Use of so-called Colloiders suspended in a Preliminary Treatment Tank.—The object sought is to attract the passing colloids to thin battens or slabs of wood or concrete hung vertically in the tank. Colloids have a tendency to collect and adhere to these obstacles and eventually the mass collected on a colloider attains such proportions that its weight causes it to detach itself and it sinks to the bottom, where it becomes part of the accumulation of sludge. This method, however, has been shown to be but partially efficacious, and the operation of such a tank is rendered difficult by the many parts of which it is composed.

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* "Colloids and Crystals, the Two Worlds of Matter," by Robert H. Bradbury, Philadelphia, Member of the Institute.

† Mr. Bradbury.

Fourth, by Oxidation or Biological Action.—This is accomplished either by admitting the liquid to contact beds or by spraying, or otherwise distributing the liquid upon filters. The latter method, usually applied in conjunction with preliminary subsidence, would appear to be the most economical for usual cases, and has rapidly gained in popularity during recent years.

In the purification of public water supplies the methods adopted for the removal of colloids depend largely upon the general quality of the water to be treated, since colloids do not occupy so prominent a place in the ordinary water supply as other elements of impurity, e.g., colloids in sewage. For this reason the type of filtration works adopted depends upon other constituents of water. The method usually employed having in view the removal of colloids along with other impurities are either, (a) slow sand filtration; (b) rapid sand (mechanical) filtration, either with or without treatment by a precipitant; (c) other miscellaneous types involving principles of either or both of the above.

Such colloids as are not deposited by precipitation are passed on to the surface of the filters and there retained, and either become oxidized or broken up by biological action, or are disposed of in the washing of the filter medium.

Obviously the efficient disposal of colloids, particularly in sewage, is one of the great problems which confront the sanitary engineer. It should be his first aim therefore to improve, as much as possible, the mechanical efficiency of the conduits which bring the sewage to the treatment works in a way that the comminution of solids colloidal form may be checked as far as possible, by conducting the sewage by the most direct route; by eliminating manhole drops and violent curves; by avoiding irrational velocities and poorly selected pumping equipment often met with even in large and important systems.

Springfield Sewage Disposal Plant and Its Departure from Common Practice

By Alexander Potter, Consulting Engineer, New York

THE city of Springfield, Mo., is located two hundred and forty miles southwest of St. Louis, among the foothills of the Ozark mountains, 1,400 feet above sea level. During the last decade the growth of the city has been very rapid. The population in 1900 was 23,000 and in 1910 it was 34,000. The present estimate is placed at 46,000. The area of the city is fourteen square miles.

The last two administrations have been progressive and public-spirited to a marked degree. Large sums have been spent on much-needed public improvements; so that where a decade or so ago Springfield was only a sleepy, over-grown town, it is now a hustling and up-to-date city.

The built-up part of the town is sewered and recently sewer extensions have been built into the fast growing outlying districts of the city. Up to the present time over 105 miles of public sewers have been completed.

A ridge running east and west divides the city into two distinct drainage areas, known as the northern and the southern areas. The northern area, which is the smaller of the two, takes in about two square miles and is drained by a number of small streams which discharge into the Sac river. The southern area takes in all of the thickly populated districts, including the new addition south of the city.

Necessity of Sewage Disposal

During the greater portion of the year the natural flow of all of the streams is so small that they are unable to assimilate the large quantities of sewage that are constantly discharged into them. In the spring of 1911 the nuisance from raw sewage discharged into these streams became so serious that the city authorities realized that unless immediate steps were taken to abate this nuisance the city would make itself liable for damages.

Before calling in an engineer to design the much-needed improvements to the sewerage system, the city appropriated $100,000 to construct sewage treatment plants at two sewer outlets. After appropriating this money the city proceeded to call for bids upon contractors' plans and specifications. This plan was abandoned, however, before the contract was let, and the city retained the writer to design and supervise the necessary sewage disposal plants.

Outline of Improvements

The ridge extending east and west through the city made it necessary to construct two sewage disposal plants. The most logical location for the sewage disposal plants for the northern district was near Doling Park, directly north of the city limits at the mouth of the existing sewer. In the southern district the ordinance called for the construction of a sewage disposal plant at the mouth of the main outlet sewer, To construct a sewage disposal plant at this point was not recommended. The site is low, subject to inundation, and pumping would have been necessary.

On account of the small quantity of water flowing in Wilson and Jordan creeks during the greater portion of the year, the treatment of the sewage in settling tanks alone would not give a sufficiently pure effluent to abate the nuisance. Some additional treatment, such as contact beds or intermittent filters, was therefore absolutely necessary. To obtain a head at the southern outlet sufficient to operate a filter would back up the sewage in the main outfall sewer for a distance of at least 3,500 feet. This sewer, which is an egg shaped brick sewer, 28 inches by 42 inches, was not strong enough to withstand any internal hydrostatic pressure without rebuilding. Above its mouth the outlet sewer for a distance of 3,200 feet has a fall of only 4.6 feet; at this point there is a two-foot drop and the grade increases to 4.1 feet per thousand. It was recommended that the treatment plant be built at the point where this change in grade occurs. To obtain at this point the necessary head to operate the plant only 2,000 feet of sewer would be surcharged.

For a distance of 1,436 feet, that portion of the length where the hydraulic gradient falls above the natural surface of the ground, the existing egg-shaped brick sewer was replaced with 36-inch reinforced concrete pipe of the Meriwether type, designed to resist this pressure. This reinforced concrete pipe has been found very satisfactory under the head to which it was subjected, viz.: from 3 feet to 10 feet, and the line appears to be practically watertight. The existing sewer below the sewage disposal plant was not rebuilt and is used to convey the effluent from the plant to the outlet.

Type of Plant Recommended

On account of the limited area available it was deemed advisable to use intermittent filters instead of contact beds. The ordinary type of sprinkling filter could not be used, as such a filter requires a head of at least five feet to operate the nozzles. Such a head could be obtained only by pumping. Mechanical distribution was therefore recommended. The distributor selected is operated with a head of only 12 inches.

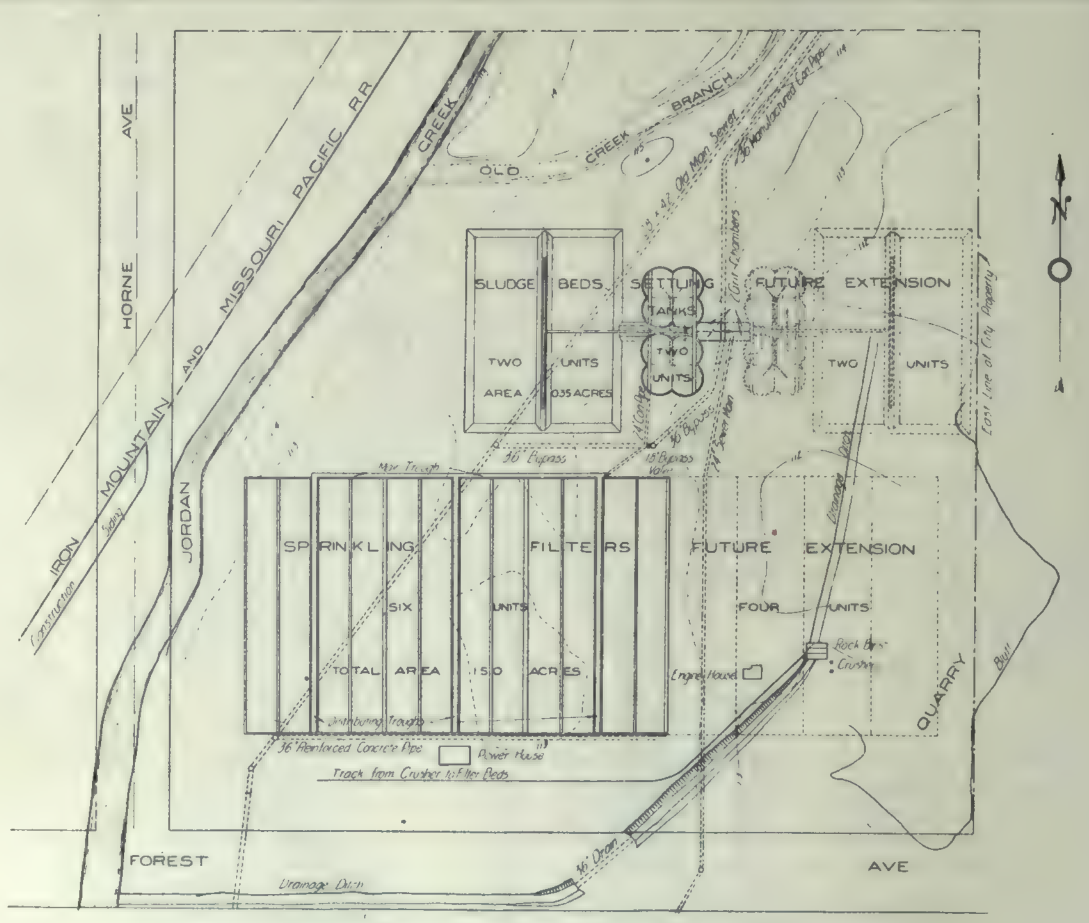
Plate 1 shows the general arrangement of the plant as built. It consists of a grit chamber built in duplicate, two settling tanks of the two storey type, a sprinkling filter divided into six units, each 53 feet 9 inches wide and 200 feet long, a sludge bed 0.35 acre in extent, and a final settling basin of 150,000 gallons capacity, located at the outlet, 3,600 feet from the remainder of the sewage disposal plant.

Grit Chamber

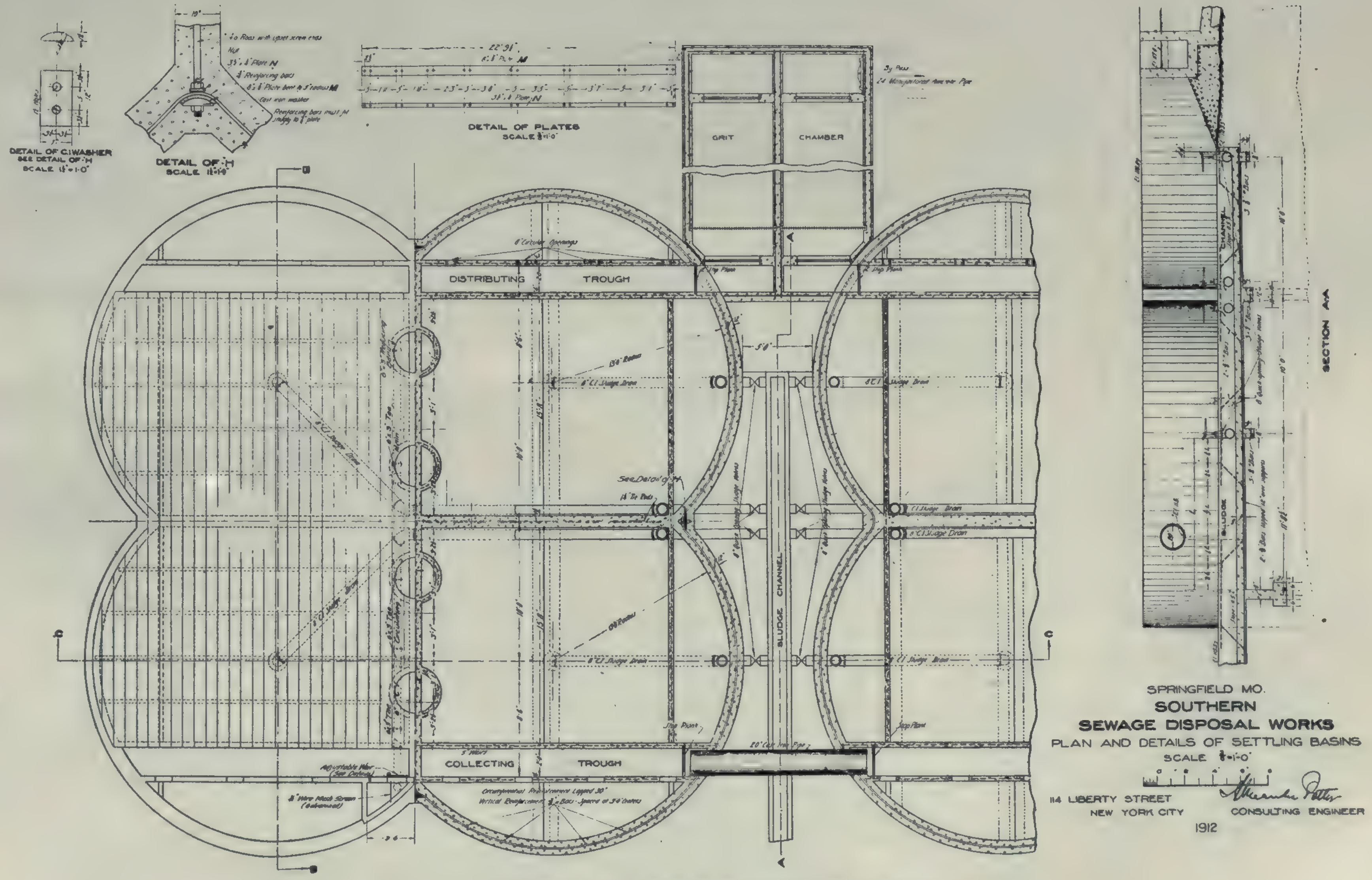
The grit chamber is constructed in duplicate. The flow in the grit chamber is retarded sufficiently so as to retain only the suspended mineral solids which would interfere with the operation of the settling tanks. Provision is made so that during times of flood the back pressure on the outfall sewer can be readily and quickly relieved, thus scouring out whatever deposits may have formed in the 36-inch reinforced concrete pipe.

Settling Tanks

Type Selected. Concrete, either plain or reinforced, is practically the only structural material available for constructing sewage settling tanks of the dimensions required for a large municipality. So far as the writer knows, the circular tank has been used in this country only in constructing the smaller units; for the larger sizes it has been customary to use rectangular construction. The rectangular form under all conditions, and especially when a large portion of the tank is above the surface of the ground, is a more expensive form to build. The Springfield sewage tanks are neither square nor truly circular. Each unit is four-leaf-clover shaped, consisting as it does of four semi-cylindrical segments 26 feet in diameter. This type of construction is peculiarly well fitted not only to resist the water pressure from within, but also the earth pressure from without when the tank is below the ground and empty. The construction features of the tank are clearly shown in Plates 2 and 3. The shell of the semi-circular segments is 12 inches thick, reinforced vertically with ¾-inch bars spaced 3 feet centers and circumferentially with ¾-inch square bars spaced so that the unit stress does not exceed 14,000 lbs. per square inch. The unbalanced tension at the



1.—Location Plan of Southern Sewage Disposal Plant.



2.—Plan and Details of Settling Basins.

point where the semi-circular segments intersect is taken up by 1¼-inch circular rods embedded in concrete struts—see Detail H of Plate 2.

The steel reinforcement in these ties is designed to resist the tensile forces at the same unit stress as the circumferential reinforcement in the shell. If this is not done, and different stresses are used for the tie rods than are used for the shell, the shell, instead of being subjected to simple tension, will be subjected to bending. The tie rods are fastened to a steel plate 8 inches wide, ⅞-inch thick, bent to a 5-inch radius. By means of double nuts the reinforcement is kept in accurate alignment which insures equal distribution of the tension among the larger number of the tie rods.

Precaution Necessary to Prevent Secondary Stress. The cylindrical segment must be free to expand in all directions. If the expansion is is any way prevented by interior construction, such as the troughs, false bottoms, beams, etc., the shell, instead of being under tension only as contemplated by the designer, will be subjected to heavy bending, often sufficient to cause the fracture of the structure. To permit of the free expansion of the shell when under internal pressure, all interior construction, except at the intersection of the ties and struts with the shell, is separated from the shell by expansion joints.

Operation of Tank. After passing through the grit chamber, the sewage enters the distributing trough, which is 2 feet wide, and holds, under normal conditions, about 2 feet of liquid. (See Plate 3.) Eight 8-inch circular openings, placed in the sides of the trough near the bottom and on the side next the outer wall, admit the sewage to the settling compartment. At the end of the trough is an additional opening, placed so as to be but half submerged, so that whatever scum may tend to collect in the distributing troughs is carried over into the settling compartments. Each settling compartment has a capacity of 111,000 gallons, which gives an average period of retention of 1.4 hours when the plant is operated at 4,000,000 gallons, its capacity. The flow in the settling compartment is parallel to the direction of the slot. To prevent eddies and other disturbances from being set up in the settling compartment which might interfere with the settling efficiency, the liquid is admitted to the settling compartment in a direction opposite to that which it must take in passing through the compartment. The clarified sewage leaves the settling compartment over eight 15-inch weirs discharging into the collecting trough.

Concrete Struts not objectionable. The presence of the concrete struts in the settling compartment does not in any way interfere with the efficiency of the tank. Where necessary, they can be capped with wedge-shaped pieces of concrete having slopes of at least 45 degrees.

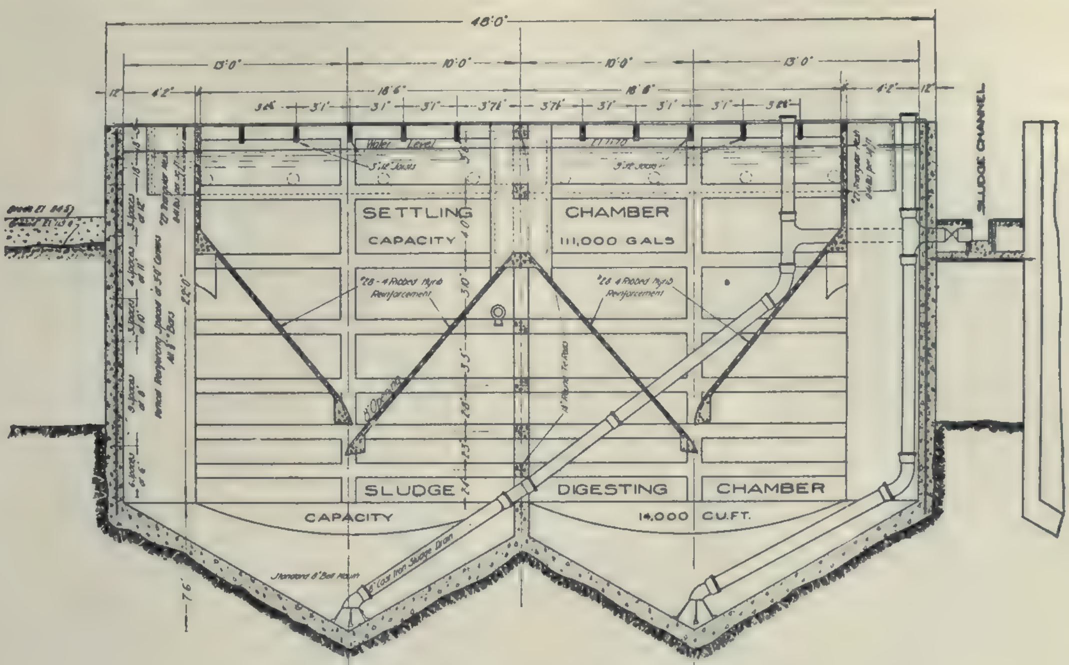
In that circular segmental area between the distributing trough and the shell of the tank, all of the floating matter is collected and forms a very heavy scum, requiring slight attention from the operator.

Vertical Circulation Used to Increase the Settling Efficiency of the Tanks. To increase the settling efficiency of tanks of the type described, the writer uses vertical circulation. The amount of sewage thus circulated is very small and does not exceed two per cent. of the total amount of the sewage treated. To accomplish the vertical circulation mentioned, a 6-in. cast iron main with four 4-inch circular openings is laid in the digesting chamber of each tank, about 6 feet above the slot. (See Plates 2 and 3). This circulating main terminates in a small chamber located in the segment between the collecting trough and the shell, which chamber has an adjustable weir to control the flow from the digesting chamber into the collecting trough. In the Springfield plant the liquid thus drawn off is mixed with the effluent from the settling compartment and the resultant mixture is treated on the sprinkling filters. In other plants that the writer has built, the liquid drawn off from the digesting chambers is returned to the distributing troughs. Circulation such as that used in Springfield is especially of value when the sewage to be treated reaches the plant in a more or less septic condition. The Springfield plant has not been in operation long enough to determine the exact value of the circulation system.

Sludge Digesting Chamber. The suspended organic and mineral matter which settles out of the sewage in the settling compartment, slides down the inclined plane through the 8-inch slots located in the bottom of the wedge-shaped settling compartments into the sludge digesting chamber. The sludge digesting chamber has a capacity of 105,000 gallons below the opening. The bottom of this compartment is formed by four cone-shaped depressions in which the decomposed sludge pipes extend down into these cone-shaped depressions, the sides of which slope at an angle of 30 degrees. The lower ends of these pipes terminate in bell-mouths supported on spiders. The sludge pipes are carried up inside of the tank to the top, giving ready access for cleaning. The sludge outlets, of which there are four for each unit, discharge under a 5-foot head into a reinforced concrete trough which conveys the sludge to the drying beds. The open channel used for conveying the sludge is preferable to the closed pipes generally used. In an open channel the sludge drawn off is at all times visible to the operator, and therefore the character of the sludge drawn off can be controlled far better than when a closed sludge conveyor is used. There is positively no odor during the operation of the sludge valves, either in the trough or upon the sludge beds.

Economy of Construction. The Springfield tanks have been found to be very economical in construction. Concrete and steel are used under ideal conditions to resist the pressures to which the tank is subjected. From the contractor's standpoint also the cost of constructing the tank is not excessive. To construct the conical bottoms of the digesting chamber a vertical pipe 2 inches in diameter was placed in the center of each cone and firmly braced. From this pipe was suspended a wooden triangle adjusted at such an elevation that the hypothenuse described the interior surface of the cone when rotated about the pipe. The concrete was mixed rather dry and placed in 4-inch layers and tamped as much as it would stand, the last layer being carefully brought to a true line by the swinging template. A ½-inch coating of 1 to 2 mortar was applied to the interior of the cones to give them a smooth surface.

To construct the outside shell of the settling tank the constructor used wooden forms made in 5-foot sections 2 feet high. A complete set of inside and outside forms was built extending entirely around one tank, and a complete ring 2 feet high was poured at one time. The following day the sectional forms were raised 2 feet and wired in place at the new point. No trouble was found in shifting the forms and holding the walls plumb and true to line. The false bottoms of the settling compartments were built of No. 28—4-rib hyrib plastered with mortar to a thickness of 2½



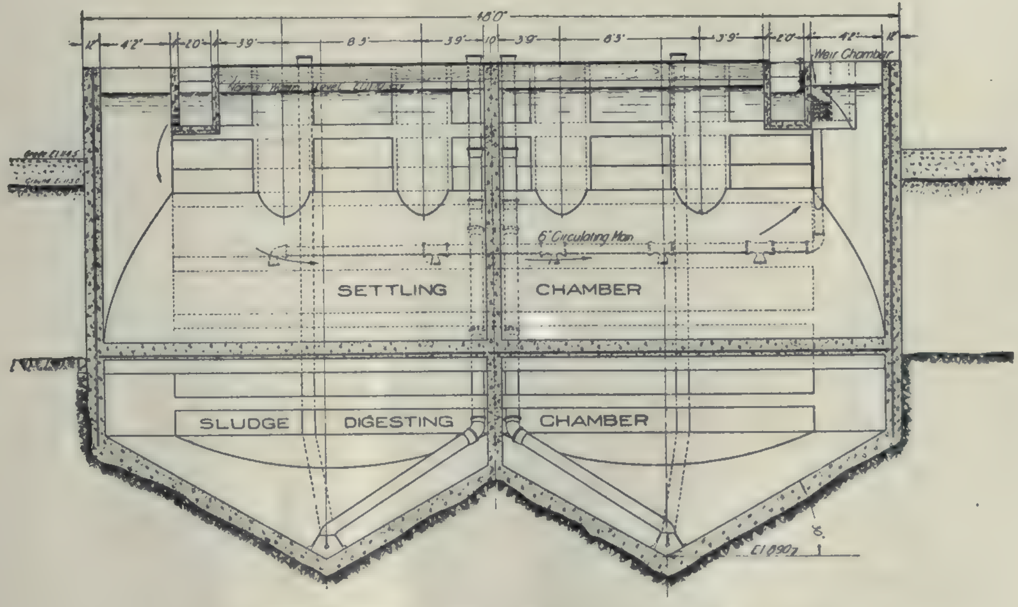
3A.—Detail Section of Main Settling Tank Section on CC.

inches. The circular ventilators also were built of hyrib and plastered with cement mortar, no other forms than templates being used.

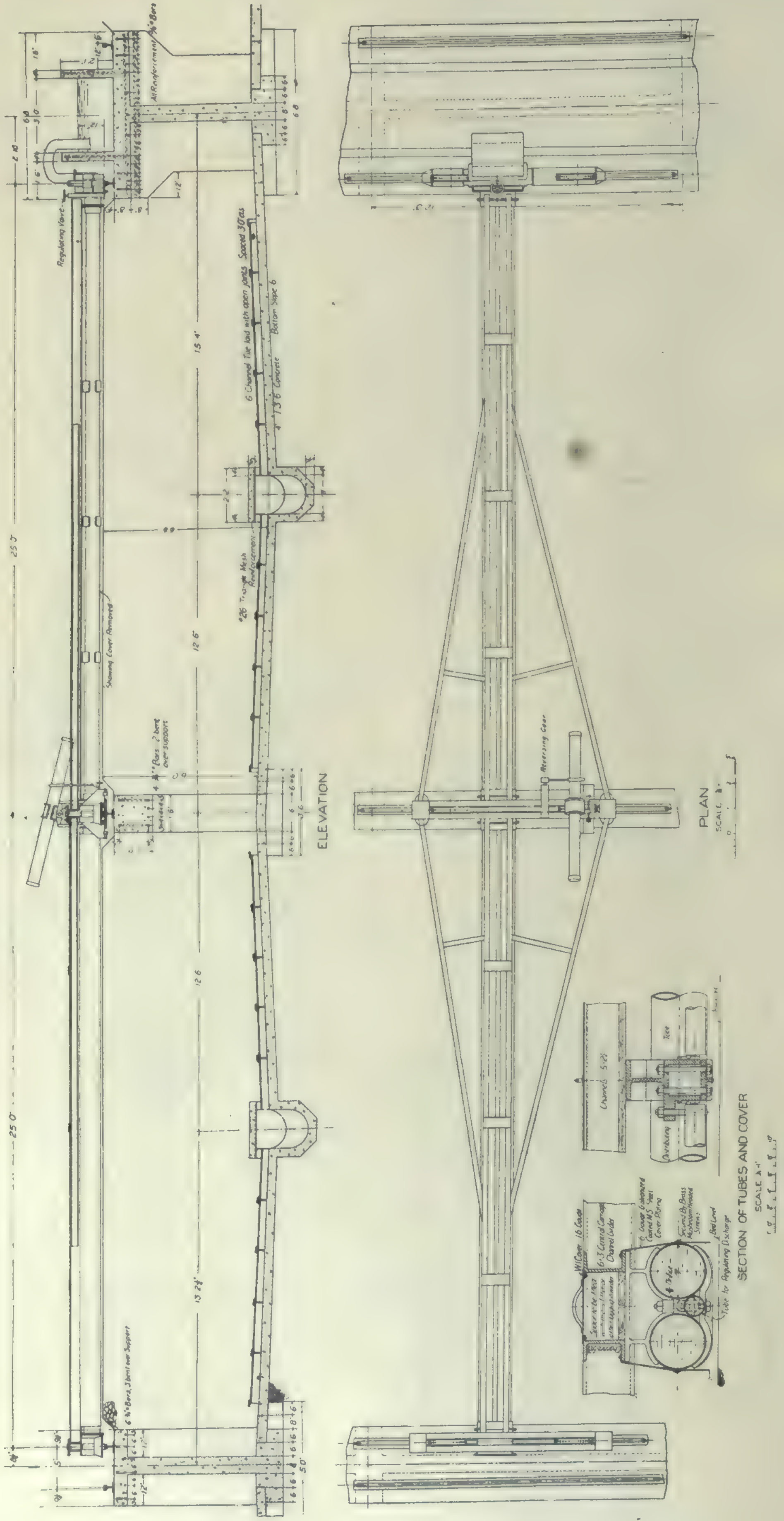
Intermittent Filters

To reduce the loss of head to a minimum power driven mechanical distributors are used to distribute the sewage on the filters. These distributors were manufactured by the Ham Baker Company of London, England. They are designed to distribute the sewage upon the beds with a loss of head, not to exceed 12 inches when the liquid is applied at the maximum rate of 720 gallons per square yard per day. Plate 4 shows the construction of one of these distributors. Each distributor is supported on three rails, spaced 25 feet on centers. The length of the travel is 200 feet.

The effluent from the settling tanks is conveyed by a 24-inch reinforced concrete pipe to a main distributing trough located at the north end of the filters. The lateral distributing troughs which supply the traveling distributors are fed by 3-foot weirs from the main distributor. The object of these weirs is to insure a uniform distribution of the liquid to the distributors. Plate 4 also shows the construction of the sprinkling filters. The depth of the filtering material ranges from 6 feet, 6 inches in the center to 6 feet at the sides. The



3B.—Detail Section of Main Settling Tank Section on BB.



4.—Section of Filter Unit Showing Travelling Distributor.

underdrains were not built as shown on the drawing. Instead of using 6-inch channel tile, the contractor was given permission to construct 6-inch semi-circular channels in the concrete floor and cover them with vitrified tile slabs. The main collectors are semi-circular in shape, 18 inches in diameter and of variable depth, the distance between them being about 25 feet. The rails on which the distributors travel are supported by concrete girders carried by piers spaced 12 feet, 5¼-inch centers. The area covered by each distributor is enclosed by an 8-inch concrete wall. The winter temperature of Springfield is sometimes so low that it may be questionable as to whether the traveling distributors can be successfully operated in extreme weather. Should the traveling distributors go out of commission or any of them break down, it is possible to utilize the filters or any unit thereof as a contact bed to be operated by hand, suitable gates being provided for this purpose.

Operation of Distributors. Extending down the center of the filters between two of the traveling distributors is a 3-foot rectangular conduit in which the normal depth of sewage is 16 inches. A cast iron siphon, 24 inches long and 8 inches in width, conveys the liquid from this trough to the distributor. This siphon is provided with a gunmetal air cock and brass air exhaust pump for starting the flow. The siphon discharges into the feed tubes, of which there are two. These feed tubes are made of wrought iron 3/16-inch thick and have an external diameter of 7⅜ inches. The feed tubes are supported at each end and at the center by a cast iron carriage braced together by rolled steel beams so as to form a rigid structure. In each feed tube just above the center are located ⅝ x 4-inch orifices, spaced about 15 inches lengthwise. The even distribution on to the beds is accomplished by a distributing tube 2½ inches in diameter, located between the feed tubes. This distributing tube is built in sections and can be raised or lowered as required to control the flow of sewage upon the beds. The feed tubes are protected with galvanized sheet iron covers provided with hinged access doors. The protection extends to within one inch of the surface of the bed in order to conserve the heat in the sewage as much as possible, especially during the cold weather. It also acts as a preventative of flies. A space is provided between the two channels supporting the feed tubes, which during the cold weather is to be filled with moss, leaves or other insulating material.

Each pair of distributors is operated by an endless wire cable. All three sets of cables are driven by one six horse-power Otta gasoline engine, which gives the distributors a speed of 38 feet per minute. The change in direction of the distributors is accomplished by means of the reversing lever shown on Plate 4.

The distributors have realized every expectation. Less than two horse-power is required to drive all six distributors. The writer believes that the distribution of the liquid over the bed is more uniform than can be obtained by the methods now in use in this country. The more uniformly the liquid is distributed upon a filter, the greater the quantity of sewage that can be applied to the filter to obtain the same degree of purification; or, with a given quantity of sewage, the more uniform the distribution, the greater the purification.

First Used in Springfield.—To the knowledge of the writer this is the first time that power-driven travelling distributors have been used in this country. The range of temperature at Springfield makes this installation an important one as indicating possible limitations of service in extreme winter weather without covering the filters.

Final Treatment of Filter Effluent

The existing sewer conveys the filter effluent to the final settling basin located near the mouth of the existing sewer. This final settling basin is 150 feet long and 50 feet wide and has a capacity of 150,000 gallons. A reinforced concrete channel admits the sewage to the basin at the upper end and at the lower end a similar channel conveys the settled liquid through a short length of the existing sewer to the outlet into Wilson creek. It has not been deemed necessary to sterilize the effluent.

Sludge Disposal

The sludge which is drawn off from the main settling tanks is conveyed by a concrete trough laid to a grade of 5-16 of 1 per cent. to the sludge beds. The sludge bed, which takes in an area of .35 of an acre, is divided by wooden partitions into twelve units, each unit being 25 feet wide and 50 feet long. Each sludge bed is underdrained with graded gravel 18 inches deep at the center and 12 inches deep at the sides. Down the center of each unit extends a 6-inch vitrified underdrain laid with open joints. The surface of the gravel is covered with a thin course of mortar sand to prevent the sludge from working its way into the gravel. The bed is given a slope of 1 inch in 10 feet away from the sludge inlet to assist in the distribution of the sludge over the entire bed.

Disposal Plant for Northern District

The sewage disposal plant for the northern district is located near Doling Park. It has a capacity of 500,000 gallons in 24 hours and, with the exception of the distribution of the sewage over the filter, is in all respects similar to the plant just described. Instead of mechanical distribution, nozzles are used to distribute the sewage over the beds.

Both plants were efficiently constructed by J. C. & E. T. Likes, contractors, of Des Moines, Iowa, the south plant under very adverse conditions. The south plant was constructed for the sum of $76,063, and the north plant for the sum of $14,795, thus keeping well within the appropriation of $100,000.

The writer's principal assistant, Mr. A. H. Beyer, was in charge of the development of the details. Mr. H. C. Atwater was resident engineer during the entire construction of the plants.

English Road-Testing Machine

A road-testing machine has recently been installed in the National Physical Laboratory at Teddington, England, according to "Good Roads." A circular track 104 ft. long furnished the base for the various types of roads. A horizontal frame, consisting of spokes connecting to eight wheels resting upon the test road surface, completes the apparatus. Each wheel is 3 ft. in diameter and may be fitted with tires of every type known to traffic. The weight carried by a wheel can be varied, as can the speed and the inclination of the wheel to the surface. Other devices for approximating the conditions imposed by climate or weather are provided, and sprinkling of the road surface forms a part of the test. Although but few tests have so far been completed, several definite facts seem to be indicated. Col. R. E. Crompton, consulting engineer of the road board, states that apparently road repairs are necessitated not by surface wear directly but by the displacement of the stones in the body of the road.

The Control of Sidewalk Construction and Maintenance*

By A. Prescott Folwell

IN the early part of this year a member of the society requested the Clearing House to obtain information concerning the methods followed by up-to-date cities in order to avoid the objectionable features of the inspection of sidewalk work by city engineers, and to secure compliance on the part of property owners with the city ordinance requiring them to construct and maintain sidewalks and curbs of standard types. The city engineer making the inquiry said, "The enforcement of the sidewalk ordinance is imposed upon the city engineer and entails an enormous amount of petty detail and annoyance."

Responses were received from forty-five city engineers giving replies to this inquiry. It seems to the author probable that a number of members of the society would be interested in learning what information was obtained by the Clearing House in connection with this subject. Accordingly he has endeavored to give in as brief a form as possible the general tenor of most of the replies.

The methods employed by the several cities may be classified under three heads: First, those in which the city does the entire work, in most cases charging all or part of the cost against the property owner. Second, those in which the matter is left entirely to the property owner, either without any inspection or with only nominal supervision. Third, those in which the contractor is placed under bond. Fourth, those in which the property owner is required to construct sidewalks when ordered, make his own contract for the construction, which construction the city engineer or a similar official is supposed to carefully oversee, and is to a certain extent responsible for.

1. Work Performed by City

Richmond, Indiana, writes: "All work of this kind is done by the city; that is, the city lets the work by contract and exercises careful supervision over it, assessing the cost to the property owner. Only in exceptional cases, where the property owner possesses a long frontage, such as a block, and petitions the city for the privilege of constructing the work by private contract, is such permit granted him, on condition that the work be done according to the standard city specifications and under the inspection of the engineering department."

Asheville, N.C., "lets contracts for this kind of work and employs an inspector, and the property owners pay for same."

In Valdosta, Ga., "all sidewalks are paid for by the city, the work being done under the supervision of the city engineer. Two-thirds of the total cost of this work is assessed against the abutting property." The same is true of Albany, Ga.

In Columbia, S.C., "all sidewalk work is done by contractors employed by the city or by the city's own force, and the work carried on directly under the supervision of this office. We have a competent paving inspector who not only inspects all the sidewalk work being done, but the street paving and other concrete work as well."

In Aberdeen, Washington, and in fact in all the cities of that state, a property owner has no more to do with building his own sidewalks than he has to do with paving the streets. They are both part of the municipal work and are let by contract.

CANADIAN PRACTICE

In Lethbridge, Alta., "all sidewalks are built under local improvement, the city bearing fifty per cent. of the cost, and the frontages affected, the balance. In view of this, the city lets a contract for all the sidewalks petitioned for and recommended in the early spring, and all the work is done by one contractor working on the designs of the city engineer and under his supervision. The contract thus becomes of sufficient importance to demand the inspection of the city engineer's department, and I would say that we have had no annoyance on account of details of construction."

In Winnipeg, Man., "all sidewalks are laid by the city, or by contractors under city supervision. It is not understood how any other system could be worked to advantage."

In Hamilton, Ont., "the city lays all the sidewalks and curbs, there being no contract work whatever."

In Victoria, B.C., "no private parties are allowed to do any work on the public streets, all sidewalk work being carried out by the department by day labor, and if any special crossings or entrances from the curb line to the property line are required, the department does the work and charges the property owner with the cost."

One city engineer in New York State writes that in his city he believes there are a few more objectionable and disagreeable features than ordinary in connection with the sidewalk work. "I think they would all be eliminated, however, if we might conduct our sidewalk construction in the same manner as we lay a pavement or build a sewer, that is, make a plan and specification and let the contract for a complete job from one end to the other."

A New Jersey engineer also has experienced these difficulties and writes: "I have maintained for several years past that the repairs to sidewalks and curbs should come under the same status as repairs to the roadway and that the cost of such work should be included in the budget for road maintenance. This would make it possible for city engineers to make the necessary repairs at such times and places as in his judgment they are required, without regard to the petitions of the property owners to same. The maintenance cost of work of this kind is a very small fraction of road maintenance and I believe rightfully should be included. In the construction of sidewalks and curbs, I believe they should be given the same consideration as road construction, and should be laid by the municipal authorities and should be assessed against the abutting property. This, of course, applies only where the assessment plan is in operation."

2. No Supervision

Pawtucket, Rhode Island, has no city ordinances covering the subject of sidewalk construction and appreciates the disadvantage of this. It cannot compel a property owner to repair his sidewalk nor charge him with the expense of repairs made by the city. The city furnishes and sets all street curbs, charging the cost of the stone, but not the setting, to the abutting owner. If the owner sees fit to construct a concrete curb in front of his property before the city orders the street curbed, there is no restriction and no inspection of the work.

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*Paper presented before The American Society of Municipal Improvements.

In Norristown, Pa., sidewalks are constructed by the property owner, the only ordinance requirement being that they shall not be of wood or slabs of stone (except flagging) and have a slope of not less than ½ inch to the foot above the top of the curbstone; also, all concrete work done on the public highways shall be constructed according to specifications prepared by the city engineer. The engineer is not supposed to make personal inspection of sidewalks. The entire responsibility for maintenance of sidewalks, including suits for damages for accidents, are left entirely to the property owner.

In Birmingham, Ala., the city engineer furnishes grades and lines for sidewalks on condition that they be built according to city specifications, "but the carrying out of the specifications is a matter of the integrity of the contractor or the watchfulness of the owner, the engineering department being in no way responsible for the quality of the work." Such sidewalks as the city constructs are done by contract under city inspectors.

In Forth Worth, Texas, and probably in other Texas cities, the homestead law does not permit the city to require an owner to construct a walk in front of his premises if this property be all he owns and he resides on the same. All improvements of sidewalk and curb are paid for by the owner and with one or two exceptions the work has been done by private contract in 50 or 100-foot sections, making inspection difficult and costly and the setting of grades and lines particularly so. "I have for a long time been trying to have sidewalks and curbs put down a block at a time, but as yet have, except in a few instances been unable to do so."

In Quebec, "sidewalks are maintained by proprietors and the city reimburses one half of the cost. If they do not keep sidewalks in good order, police constables report them direct to the recorder's courts."

3. Bonding Contractors

In Ames, Iowa, the city council early in the spring lets a contract for all sidewalk work which it may wish to do during the year. Property owners are notified to build sidewalks, and if they refuse to do so, the work is done by the contractor with whom that year's contract has been made. This work is done under city specifications, and no inspection of the job is made, but the contractor is required to put up a bond and then "is left to his honor to do the work according to contract and the specifications. This may appear to be a very loose way, but it has proven so successful in this town that most sidewalks are put in by the city contractor." The engineering department merely gives lines and grade, for this and other street work.

In Decatur, Ill., all contractors are required to give a bond and a three-years' guarantee. If the property owner does the work himself, he is required to give a bond to the city. The engineer only fixes the grade and stakes out the work.

In Kalamazoo, Mich., sidewalk work is done by licensed contractors and are under bond to the city. The inspection is put up to each property owner and he can employ any licensed builder, the engineering department giving grades only to licensed builders.

In Pine Bluff, Ark., when a certain territory requires sidewalks a blank is filled out by the city engineer, signed by the clerk and mayor and served on the property owner by the chief of police. "In regard to handling inspection, I found it a very troublesome and unsatisfactory proceeding but about two years ago I had an ordinance passed placing all sidewalk and concrete contractors under a bond of maintenance to the city in the sum of $1,000 for each and every job of work. Just an ordinary bond for $1,000 with a clause 'to apply to each and every individual contract' had been held legally binding. I also had an ordinance passed requiring a contractor to take out a permit for each job and for this permit a fee of one-half cent per square foot is charged, which amount is ample to pay the salaries of all the necessary inspectors without using any men from the office or regular engineering force." Should the engineer consider the contractor's price too low to give a reasonable profit on good work, an extra inspector is placed on the job. If the contractor is found to be deliberately and consistently doing poor work he is cautioned, and if again found guilty of such conduct he is refused any further permits for sidewalk work.

In Grand Forks, N.D., there is no inspection other than inspection of the work after completion. "The contractors make application at the office for line and grade for each and every piece of walk to be laid. A card index form is used giving lot, block, addition, street, name of owner, name of contractor, date of application, date of survey and completion of work (to be inserted afterwards when same is made), also signature of surveyor. This card serves as an order to the field crew who signs same when the survey is completed. When the work is finally checked, the date of completion and measurement is put down.

"To insure good work we require the contractors to put up a two-year guarantee bond in a sufficient amount to cover a liberal percentage of their work. If in the opinion of the engineer the work is defective at the end of two years it will have to be replaced, not repaired. After two years' trial will say that the system works well, and we get much better results than under the old inspector system."

4. Inspection

In Binghamton, N.Y., two inspectors are employed to look after sidewalk work, but during the rush season it is impossible for them to cover the work and some poor work is done. "My opinion is that the inspection of sidewalks is a farce unless you have enough inspectors so that an inspector can stay with one gang of walk layers the entire season, which would be an expensive method. We now have a proposition which the Department of Public Works is considering putting in force, and that is to put the walks under a two-years' guarantee, label each walk with the date and put the contractor under bond."

In East Orange, N.J., owners are given thirty days in which to repair sidewalks, and on failure to do so the city makes repairs and charges the cost in the next tax bill. The execution of this is in the hands of the city engineer. One street inspector makes occasional rounds and reports walks needing repairs, the city engineer communicates this to council and he is directed by council to have the repairs made. Notices are sent to the property owners and thirty days thereafter a second inspection is made by the inspector, and those not then found in good condition are repaired by the city gang.

In Wilkes-Barre, Pa., sidewalk work is looked after by the commissioner of highways.

In Wilmington, N.C., the city engineer is required to sign a certificate that the lines and grades and specifications have been followed in the construction of the sidewalk in front of his property. If this signature is refused by the city engineer, the owner can refuse payment to the contractor, and the city can rebuild the walk if or whenever it desires and charge the cost to the owner.

In Charleston, S.C., the city pays half the cost of the sidewalks. The city engineer appoints an inspector, whose time is figured in, in calculating the cost of the work.

In Lima, Ohio, sidewalks are constructed under the supervision of the city engineer, under whose direction is an inspector of sidewalks and sewers who is required to see that all sidewalks are constructed according to specifications. As he has supervision over all sewer tamping, is special inspector on the few jobs of sewer construction, looks after the few jobs of sidewalk inspection that the city is doing itself and also inspects construction work being done by private parties, it is self-evident that sufficient inspection of sidewalks could not be given even though he had one assistant. In his latest annual report, the city engineer recommends that a city inspector be appointed for each sidewalk job.

In Indianapolis, Ind., there is "no trouble from this source as, whether work is done under private or public contract, it is done under the supervision and specifications of the city engineer."

The city engineer of Moline, Ill., has nothing but consolation to offer the member making the sidewalk inquiry. "I think all city engineers in the small cities of Illinois are up against about the same condition."

The only reply from Iowa states that "enforcement of the sidewalk ordinance is council's business in Iowa and hence is not attended to."

In Grand Rapids, Michigan, there is an employee under the department of public work known as "sidewalk and pole inspector" "who relieves the engineering department of a considerable amount of work, and a fairly good enforcement of the sidewalk ordinance is secured without undue expense."

At Atchison, Kansas, the enforcement of the sidewalk ordinances is the duty of the street commissioner and, although performed very satisfactorily, is found by him to be a very disagreeable and annoying task.

In Manhattan, Kansas, the engineer is supposed to make a perfect inspection of all sidewalks, but when there is a great deal of work this is found to be impracticable. When enough work is being done to justify an inspector, one is kept going from one job to another, but when sidewalk work is slack, an occasional job is done without any inspection, except such as the property owner may do at the request of the engineer. The engineer tries to have the citizens generally know how many sacks of cement should be used for every 50-foot stretch of sidewalk. As a general thing, the work done has been very satisfactory.

In Holland, Michigan, the city engineer must certify by endorsing the property owner's permit, that the material used and the manner of work done are approved by him and the work has been completed in accordance with his line and grade.

In Fort Smith, Ark., an inspector is employed under the direction of the engineering department to look after sidewalk construction.

In Kansas City, Mo., the city engineer is responsible for the proper construction of all sidewalk work (only concrete sidewalks are permitted) whether this be done by private parties or by public contract. Repairs to construction work are under the supervision of the superintendent of street repairs. All is at expense of abutting property owners.

In San Angelo, Texas, each property owner must take out a permit before constructing a sidewalk, for which the city charges a fee of $2.50 for each 25-foot business lot or each 50-foot residence lot, with a 50 cent charge for each additional lot. Upon presentation of this permit to the city engineer he is required to give the necessary grades and alignment and furnish an inspector to see that all requirements regarding specifications and grades are complied with. Any property owner not complying with this regulation is liable to have to rebuild his curb or sidewalk if it has not been properly constructed.

The Austin, Texas, engineering department has under its direction a special sidewalk inspector whose business it is to see that the work is in compliance with the city specifications and conforms to the engineers lines and grades.

In Santa Barbara, Cal., permits for sidewalk, curb, and gutter work must be taken out by property owners, and inspectors are employed whose sole duty it is to look after this work, which must be done to their satisfaction or it is ordered out.

In comment upon these replies, the author would call especial attention to the arguments in favor of the method first described—that of treating sidewalk work in the same way as roadway work; and this method of treatment should, in his opinion, apply to the designing and general control as well as to the mere construction. By this he means that the material to be used and the time of construction should be determined by the department of highway or city engineer, and that the work should be put in an entire block at a time and not piecemeal.

It seems to us inevitable that most of the highway construction which is performed in small sections scattered over the town cannot receive as effective supervision by the city engineer as could a few contracts each covering an entire block or more. There certainly would seem to be little question that construction in 25 or 50-foot sections must be quite a little more expensive and in many respects less satisfactory than if the entire block were constructed at one time. In addition to this, even where the work is well done, the patchy appearance of a street where old and new sidewalks alternate, and indeed where brick, flag and concrete may all be found on one block and in various stages of repair, is far from pleasing to the eye and is unpleasant for the pedestrian.

The sidewalk is as fully a part of the public highway as is the roadway, so far as its use is concerned. It is as free to the general public and is (or should be) no more used for private purposes by the abutting owner, and we can therefore see no reason why the two should receive different treatment.

As a matter of fact, in too many cases little attention is paid to the sidewalk. Volumes are written about roadway pavements, but only an occasional page about sidewalk paving; but yet to one person who uses the roadway there are probably ten who use the sidewalk. The additional property rights or quasi-ownership which in some cities are held by the abutting owner over the sidewalk need not interfere with the municipal control any more than they interfere with roadway paving in those states or cities where such ownership is constructed as extending to the center of the highway.

And the logic of the argument would include also maintenance, including street cleaning. In German cities the street cleaning gang cleans the sidewalks as well as the roadway, in many cities flushing them down with hose during the night at the same time that the roadway is similarly treated. In large cities a considerable proportion of the dirt on the sidewalks is blown there from the roadway, and the remainder is carried or thrown there by the public at large which uses the sidewalk (except for store sweepings or other dirt thrown from the abutting premises in violation of the city ordinances). It would therefore seem to be as much the city's business to remove this dirt from the sidewalks as to clean the roadways. An additional argument in favor of this is the fact that the dirt from the sidewalk is very apt to be blown or swept on to the roadway shortly after the latter has been cleaned, thus to some extent undoing the work of the street cleaning gang; which would not have occurred had the entire street from property line to property line been cleaned at one operation.

Considering, however, merely the point of view of the cost of sidewalk construction, there would seem to be little reason to dispute the following statements: First, an improperly constructed sidewalk will be more expensive in the long run in that it must be renewed more frequently than one properly constructed. Second, inspection adequate to securing proper construction is very expensive when the work is done in small jobs of 25 or 50 feet. Third, construction in such small jobs is more expensive to the contractor and consequently to the property owner or city. Fourth, not only would it appear reasonable, but it has been demonstrated by experience, that the lowest prices can be obtained for sidewalk work by letting the contract for the work of an entire season to one or two contractors, with the understanding that no stretch of work of less than a block will be ordered.

Lessons from the International Road Congress

By Col. William D. Sohier, Chairman Massachusetts Highway Commission

THE most important lesson that France teaches us, it seems to me, is that we should secure proper locations for our highways and sufficient width for all future use. Main French highways are 60 feet in width.

The macadam on the national routes is 24 ft. in width; on the departmental roads, 18 ft.; and on most of the other roads, about 15 ft. There is a grass shoulder on each side, about 15 ft. in width.

Most important is that they are spending more than $45,000,000 a year for maintenance on 371,000 miles of road. This is about $125 a mile a year; and we must remember that all of their roads have been built for years and are practically to-day all waterbound macadam roads, where they have not already put in some more permanent form of construction. Their Minister of Public Works is now recommending that $50,000,000 additional be provided to be used during the next ten or twelve years for some bituminous binder on 6,000 miles of the national roads, where it is greatly needed. France has undoubtedly the best road system in the world so far as location, layout, foundation, drainage, etc., are concerned; but where there is much motor vehicle travel—and that is near the cities—their macadam roads are going to pieces just as fast, I think, as our waterbound macadam roads have been since the advent of the motor vehicles. Wherever the motor traffic is heavy I found the macadam roads extremely rough and going into potholes as they are here; but it is only fair to say that this observation would not cover many miles of road in all out of their 371,000 miles, because, especially near Paris, they are already using tar or some bituminous binder, either in construction or as a surface coat.

One noticeable thing in both England and France was that except near the cities one did not meet even 10 per cent. of the number of motor vehicles that one usually encounters here, at any rate in the Eastern States. This accounts for the good condition in which their waterbound macadam roads have remained.

In France, as we all know, they have a patrol system. You still see the piles of stone on the roadside ready to be broken up and put on the road; but in the entire 1,000 miles which I went over, on perhaps only four places—less than ¼ mile each—did I see any dry stone put on the road to fill the holes, and in those instances it was being scattered over the road by the motor vehicles as it is in this country.

They have found it necessary there to use some binder in their patches, and in both France and England I found that they were using tar on their main roads, painting the bottom and painting the stone, and covering with sand, or filling in with stone that was already coated. It was evident to me that in neither France nor England can they maintain waterbound macadam roads where they have more than fifty automobiles a day and still keep them in reasonably good condition without the use of some bituminous material.

Drainage Ditches

Every road that I saw in France had a ditch on each side to carry the drainage. This ditch was usually placed beyond the 15-ft. grass shoulder, and had waterways connecting it.

On almost all of the main roads where there was a grade of 3 per cent. or more they had a shoulder on the side of the macadam and a paved gutter about 4 ft. in width. This was made of larger blocks of stone than ordinary paving stone.

One very noticeable thing, and one that we could well copy, was that the gutter was laid out on almost the same crown as the road, so one could travel on it without any inconvenience.

The crown of the roads there was flatter than ours, not more than ½ in. to the foot, often less. I saw many places in the villages and in the parks near Paris where the gutters were across the road. These gutters were constructed so wide and so shallow that at any reasonable rate of speed (say 15 miles an hour) an automobile could go over them without having anyone inconvenienced, even in the back seat.

In England they have a different road system than that of France. The county boards and county engineers have charge of the main roads outside of villages, though the Government is now helping to improve main roads, and has a competent board of engineers to advise on the kind of improvement to be made.

The central Government has about $5,000,000 a year with which it is helping its counties to make improvements. This, by the way, is secured from a tax of 6 cents a gallon on gasoline, and from the motor vehicle fees, which are extremely large; for instance, in England a 40-h.p. Packard would be taxed about $110 a year.

I should judge that England had on its main roads much more motor traffic than there is in France; although even in England, as far as I went, there was much less motor traffic out in the country than there is in this country, though there is a tremendous motor travel near the cities, particularly in London.

What is particularly noticeable in connection with the English traffic is the tremendous number of traction engines and trailers which one meets everywhere hauling from 8 to 10 tons on iron tires. I understand from their engineers that this kind of traffic will rapidly cut through and destroy any macadam road which is less than 5 in. in depth. So far as I could learn, they are now building most of their heavily travelled main roads of at least 9 in. of macadam, the top 3 in. of which is made of bituminous macadam or a tarred slag.

In and around London they have a very large number of motor buses, which travel on rubber and often go 10 to 25 miles out in the country, with a five-minute service. They are practically like our 6-ton trucks.

The road surfaces there are remarkably good, and they have now about 40,000 miles of road where the surface has been coated with tar. On the whole, I should say that their road surfaces on main roads were much better than those in France, because they have used so much more tar and bituminous macadam. In England and in France they are covering all their tarred surfaces with sand, gravel, or pea stone and dust.

On the other hand, the English layouts are inconceivably bad. Their roads, even on the main lines of travel, are extremely narrow, and the corners very blind. Often there is not room to pass the traction engine that one so frequently meets. I measured several roads where the distance between banks on the road was only 9 to 11 feet.

The surfaces, however, were almost uniformly good, except near the cities, where the motor travel was heavy; and here again the waterbound macadam road was full of holes and rapidly going to pieces when it had not been treated with tar. It is only fair to say, however, that most of them were treated with tar. Right near Hyde Park in London I saw as rough a piece of macadam road as one could find anywhere in this country near any of our cities.

As in France, the whole width of road surface was made suitable for travel from shoulder to shoulder. The drainage was poor. Many times it looked as if the road was going to carry the water from the surrounding country, and would be something more like a drainage canal than a road in a heavy downpour. They have, however, realized the importance of the drainage problem and are rapidly making great improvements.

Maintenance

We can learn a great deal from the English in the matter of maintenance. With a total of more than 150,000 miles of road in England and Wales, they classify as main roads 27,800 miles. The average cost of maintenance of these 27,800 miles of road is $475 per mile per year. About 95,000 miles of road in England are maintained by the local authorities; they are called rural roads. Even on these roads the average amount spent for maintenance per mile per year is $115. Remember that their labor costs much less than in this country.

On 2,173 miles of road maintained by the London authorities (not including the London County Council) the average cost of maintainence is $1,675 per mile per year, or that was the cost some years ago; I am informed it has substantially increased. No wonder they can keep good surfaces.

The engineer in the County of Lancaster, Mr. Schofield, told me that he had more than 600 miles of road to maintain, and that this year he had an average of $1,500 a mile for maintenance. Of course "maintenance" means not only ordinary maintenance, but includes resurfacing and even reconstruction. Mr. Schofield told me that many of his roads had an average of from 50 to 75 traction engines, hauling trailers, going over the road every day. He said they had absolutely destroyed the 6-in. waterbound macadam road and that he was reconstructing his roads with what we would call a Telford base and 9 in. of macadam, with the top 3 in. made of bituminous macadam. To build a road of this character in Massachusetts would cost from $20,000 to $25,000 per mile for a road 18 ft. in width.

In the towns in his county that I went through he was building granite block pavement grouted with cement laid on a 6-in. concrete base.

Resurfacing

In England and France I saw many places where resurfacing was going on. They were uniformly resurfacing with what they called a granite, either Belgian or Welch—what we should really call a trap. What impressed me particularly was that if they resurfaced at all they used what we call a No. 1 stone, at least a 2½ or 3-in. stone, and only about 10 per cent. of the finer stone. This was true wherever they were resurfacing. In France where I saw them resurfacing they were generally using stone alone, but in England they were putting on slag, coated with tar, of this large size, or a 3-in. stone coated with tar. Their method was to lay this stone "one stone deep," roll it slightly, and then roll in ten per cent. of No. 2 and some chips coated with tar. I saw several of these roads, which carried very heavy traffic, that were in very good condition indeed, although three or four years old.

In Liverpool I saw one tar-macadam road built by the "Brodie Method," which is to grout the top 3-in. No. 1 stone when it is rolled with a mixture of equal volume of tar and sand. The sand is heated to the temperature of the tar, the mixture kept agitated and poured evenly into the stone until it flushes to the surface, and then 10 per cent. of No. 2, or finer stone, is rolled in. This road was eleven years old, and still in very good order, whereas a waterbound macadam road, just beyond, carrying the same traffic, had been resurfaced three times in the eleven years and to-day is rougher than the tar macadam.

I was informed that they never close the road in England or France for resurfacing. Personally, I must have gone over at least one hundred places where the roads were being resurfaced, and invariably, whether it was waterbound macadam, tarred macadam or tarred slag, they were repairing one-half of the road only, and left one-half, over which one could pass in reasonable comfort. At four or five places where I inquired I found that they did very short stretches at a time, and at night finished up with a square end. At no place in either England or France could I discern any line in the middle of the road where the joining came.

Character of English Tars

There is still another observation I would like to record, and that is that the tars in England seemed very much more lasting, more elastic and more sticky than ours. I saw only 1 mile of road in all where the tar surface seemed to be picking up—in other words, where the stone showed below it; and in that instance it would undoubtedly be patched at once and before a pothole came. With that one exception, their tar surfaces were practically perfect. There were no potholes, and when one dug into the tar it always seemed alive, sticky and soft.

On only a very few miles of road was there any of that mosaic effect that we had been told about. The engineers told me that that effect came the first year when they had used only, say 1/6 gal. of tar per square yard, and where it had worn off on the tops of the stone; but when they received a second application, with sand covering, it made a blanket coat similar to one we have in this country.

In Massachusetts we find we can maintain our oil and tar surfaces most economically by having a team and three men constantly patching from 6 to 8, or even 10 miles of road. If this work is well done we never have any holes.

Another important consideration was that in both England and France all roadwork is in charge of competent, trained engineers, who not only have technical training but many years of practical experience. They stay in office as long as they are competent and efficient; it is not a matter of politics. They have entire charge of roadbuilding and road repairs, and employ efficient foremen and workmen. These facts largely account for the results obtained.

Another most valuable lesson that our cities could learn from the practice in most of the cities abroad is to leave street surfaces alone after they are built. When this is impossible and the street has to be dug up, the street department relays the pavement or surface and collects the expense of putting the surface into good condition again and maintaining it for a reasonable period of time. Water pipes, local sewers, gas, electric conduits, etc., should be so located that they can be connected with the buildings without disturbing an expensive street pavement. It is no unusual sight in my State to see a street dug up two or three times in one year, and it is hardly ever properly repaired. In consequence, paved streets that would have remained in good condition twenty to forty years have to be reconstructed in five or ten years at enormous cost. In the meantime they are in wretched condition. The time has come, in my opinion, when no one should be allowed to dig up our roads and streets anywhere, no matter how influential the corporation or indivdual may be, without having to pay to the department in charge of the road enough money to put the street back to its former condition.

Owing to the slight sinking of a corner of the McGill Union, Montreal, the Foundation Company were hurriedly called in, and have underpinned the corner. The foundation of this particular portion of the building is supported on piles.

Brick Road Construction*

By James M. McCleary, Road Engineer, Cuyahoga County, Ohio

THE chief purpose of rolling the sub-base is accomplished when the weak or spouty places in the soil are revealed, so that the engineer can treat them as he sees fit. For this purpose a roller weighing from 8 to 10 tons answers every requirement. Preceding the final preparation of the subbase the curbs must be placed. In case of most of our rural work curbs are placed flush with the surface of the completed pavement.

With curb set and base prepared the next step is the placing of the concrete base, which with our roads has been 4 in. in depth. In specifying the proportions a mixture of 1:3:5 with a permissible variation according to the size of the aggregates which will most nearly fill the voids meets every necessity.

In laying the brick, first see that the lugs are turned one way. Next make certain that the joints are broken so that one-third or more of the brick of one course overlaps the brick of the next course. Third, be sure that every fourth course is driven up to a straight line. Finally, for the sake of appearance, keep the line of the brick at right angles with the curb.

Care should be taken to see that all soft brick or brick that are burned too hard are removed. Those so heavily kiln-marked that they will cause unevenness in the pavement should be turned. Caution should be exercised in this, for many a kiln marked brick is thrown out which if allowed to remain would have been of more value to the pavement than others that are retained.

Use of Roller

After the brick are thus placed in the street their slight unevenness should be ironed out by the use of a roller not exceeding 5 tons in weight. If a horse roller is used at all, it should have a diameter of at least 5 ft. Rolling should begin on one side and pursue a course parallel to the curb. This should continue until the center of the pavement has been reached, when the roller should be moved to the opposite curb and rolling repeated.

For grouting joints use a grout filler composed of equal parts of sand and cement. The grout should be mixed in a watertight box with a "lower corner," using not more than 1 cu. ft. of sand and one bag of cement, mixing the mass until it assumes a uniform color. Add water and stir the mixture until it assumes the consistency of thin cream. The mixture should then be applied to the pavement by means of scoop shovels and thoroughly swept into the joints. After sufficient time for setting has elapsed a second coat, slightly thicker, should be applied, and later a third coat, which will assure filled joints. The last coat should be worked either with a specially prepared broom or a rubber squeegee and swept across the joints at an angle of 45 deg.

After the initial set has taken place the pavement should be covered with ½ in. or more of sand and this kept saturated with water for at least five days. The pavement should not be opened to traffic for at least ten days.

To counteract expansion and contraction we have relied mainly on the ability of our structure to prevent moisture from getting underneath the roadway and upon an endeavor to have our cement filler at the greatest possible strength. These provisions, together with a rigid curb, enable us to hold in compression the expansion occurring in our narrow roadways. A few cracks in the pavement have appeared, but have not ravelled out so as to injure the traffic worth of the road, and have not been thought of sufficient importance to require repairs.

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* Road Congress paper abstracted by The Engineering Record.

The facts that our roads are in shape for maximum service twelve months in the year, that they originate no dust, and that washing by rain suffices to keep them clean have so impressed the taxpayers that, although we have built nearly 400 miles of such road, thirty-three farmers' petitions are now on file in our office asking for thirty-three separate extensions.

Harbour Projections and their Effect Upon the Travel of Sand and Shingle

AMONG the readers of papers at the meeting of the British Association at Birmingham was Mr. Ernest R. Matthews, borough engineer of Bridlington, who dealt with the subject of harbour projections and their effect upon the travel of sand and shingle.

Mr. Matthews pointed out that any seaward projection on the coast, whether it were in the form of a groyne extending merely to low water of ordinary tides or low water of ordinary spring tides, a breakwater, a harbour arm projecting 1,000 ft. or more, or a promontory such as Flamborough Head or Spurn, extending seaward some miles, had the effect of arresting, more or less, according to the magnitude of the projection, the travel of the sand and shingle on such coast. In the case of harbour projections run out at right angles to the coast line, this obstruction, especially on a sandy coast, impounded the travelling material on one side of the harbour, and often caused alarming erosion on the other. He gave excellent examples of this in the case of Yarmouth, Shoreham, Lowestoft and Madras harbours, at each of which millions of tons of sand (except in the case of Shoreham, where it is shingle), representing acres in area, were being held up by the harbour piers. The sea front at Yarmouth might be said to have extended seaward during the past half century an average of 300 ft., due almost entirely to the construction of the harbour; while at Madras 650,000,000 cu. ft. of sand had accreted on the south side of the harbour within a distance of 3 miles of the harbour, and 450,000,000 cu. ft. of land has been eroded on the north side within a similar distance, and the authorities there were now contemplating an extension of the harbour seaward at an estimated cost of about £3,000,000. It was considered necessary to do this in order to reduce the extent of the silting up of the harbour. The author referred to the Newhaven, Bridlington and Whitby harbours, and that at Hastings, which is only partially constructed, and described their effect upon the coast. He also described the effect upon the coast of headlands which ran out at approximately right angles with the coast, and those which formed an obtuse angle with the coast.

The question would naturally be asked: What was the remedy or partial remedy for this trapping of the travelling sand and corresponding erosion on the leeward side of a harbour? Previously the only method of escaping from the impounded material seemed to have been in periodically extending the arm of the harbour further seaward as proposed at Madras. This meant a tremendous cost, and the results were often not satisfactory, for as the pier advanced the shore also advanced. It had been suggested that instead of doing this openings should be left through the shore ends of the harbour arms for the sand to pass through, but this suggestion was not practicable, for immediately the travelling material passed through the openings the wave behind it did not possess sufficient force to move the material through, especially where the width of the harbour was considerable.

Mr. Matthews suggested that, in order to modify this trapping of the sand, the ground plan of a harbour, instead of showing the piers running out at right angles to the coast, or approximately so, as was the usual custom, should, on the side facing the direction of the travelling material, project from the coast at an angle of 45 deg., and the additional area thereby enclosed by the harbour piers could be utilised, among other purposes, for that of wharfage. The travelling material would pass around the harbour projection if the plan of the harbour were on those lines, and would supply the coast on the lee side of the harbour with a natural protection of sand and shingle.

The reader of the paper illustrated the various points referred to by numerous diagrams, photographs and lantern slides, and stated that, in arriving at his conclusions he had carried out numerous experiments—he described in the paper—in which he was assisted by the deputy mayor of Bridlington, Mr. Councillor S. Charlesworth. He made the suggestion that where it could be proved that erosion had occurred, and was still taking place, owing to the projection of harbour piers, or the lengthening of such piers, or the construction of a spur breakwater from such piers, the harbour authorities should be called upon to contribute towards the cost of the protection of such a coast as far as the affected area was concerned. He also suggested that in the granting of powers by Parliament for the construction of new harbours it should be made compulsory that contributions should be made towards the cost of the prevention of erosion where it was proved that protection works were necessary in consequence of such harbour projections.

Two-Course Concrete Pavement Work

In a communication on top course work on concrete floors in the Engineering Record, Charles H. Johnson, Supt. Public Works Dept., Guantanmo, Cuba, writes in part as follows:

"From personal observation of several hundred jobs I think that most, if not all, of the cases of the top coat separating from the base are caused by putting in the base too dry, allowing the base to set before applying the top, getting sand or other foreign matter on the base before applying the top, thus ruining the bond between the two layers, and finally making a sand joint in the base and not cutting the top through.

"The writer laid about 3,500 lin. ft. of concrete road from 8 to 12 ft. wide with 1:3:6 base and 1:2 sand top, and had absolutely no trouble with it. This was laid in sections 30 ft. long, with a 1-in. cypress expansion strip every 30 ft. Six months after laying there was no sign whatever of any separation between base and top.

"On this job the base was laid very wet and put into place with a shovel, no tamping whatever being done. The top was often laid not more than fifteen minutes after the base was placed, and was also very wet. It was floated with a wooden float as soon as possible and then covered with 1 or 2 inches of sand, which was left on for at least a week, and frequently wet."

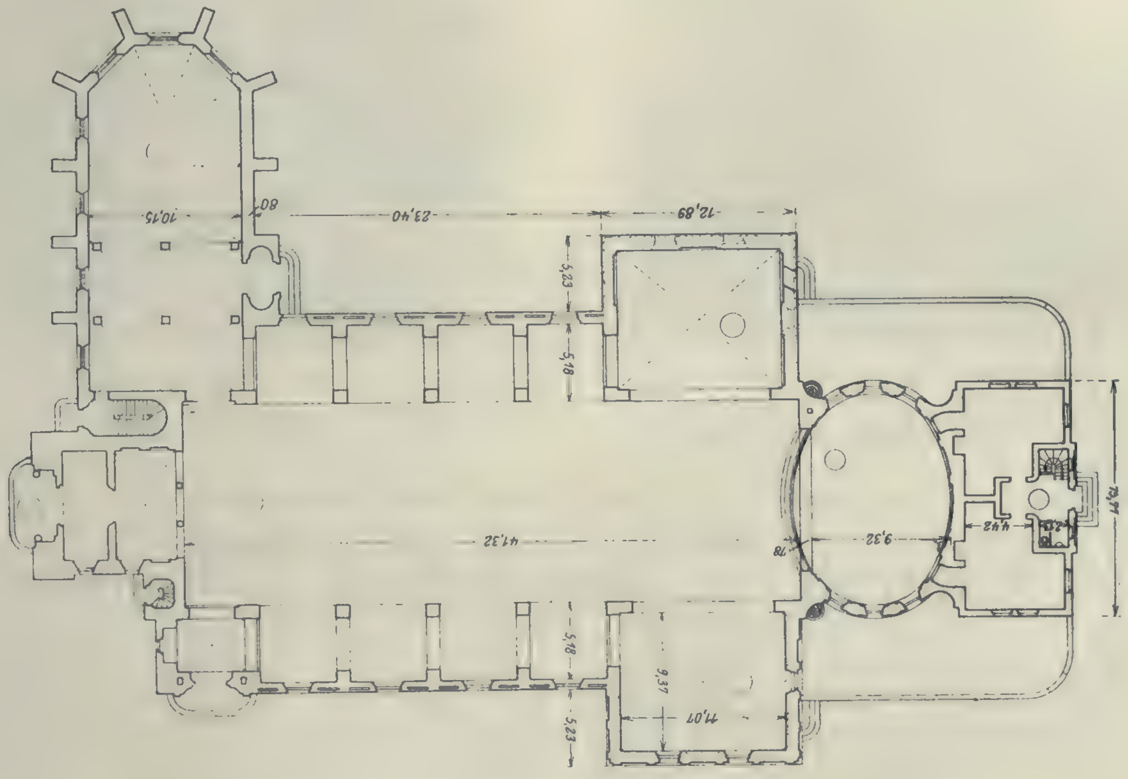

Fig. 1.—Plan.

Plan and Longitudinal Section
of
St. Magdalen Church, Strassburg

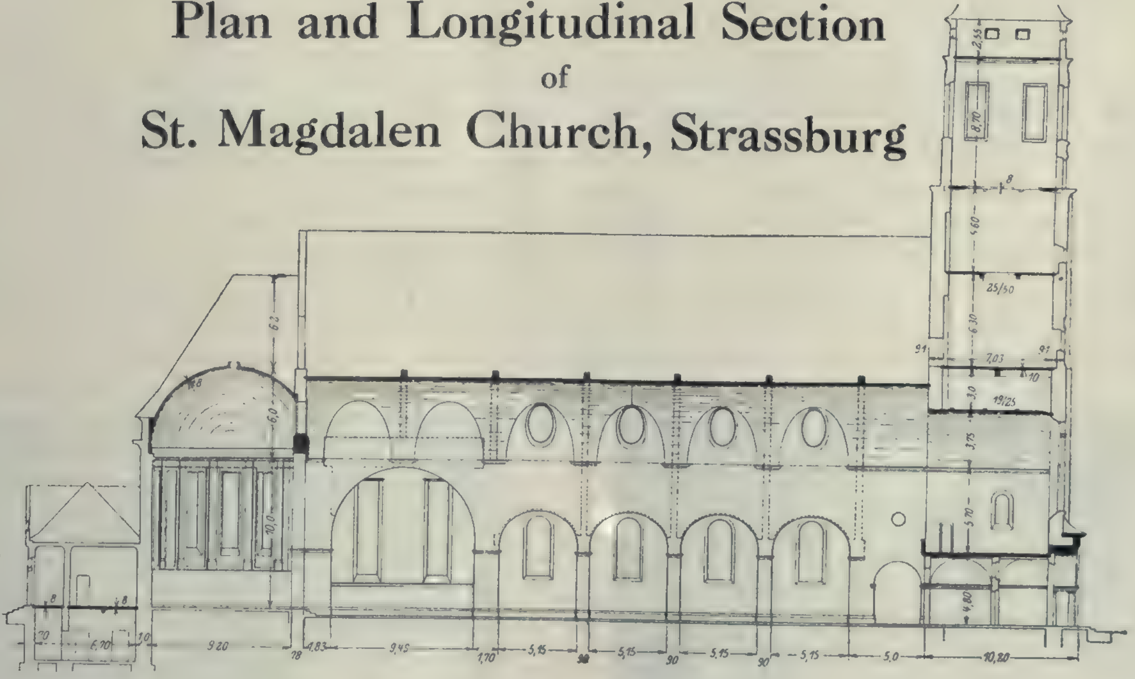

Fig. 2.—Longitudinal section.

A CHURCH IN REINFORCED CONCRETE

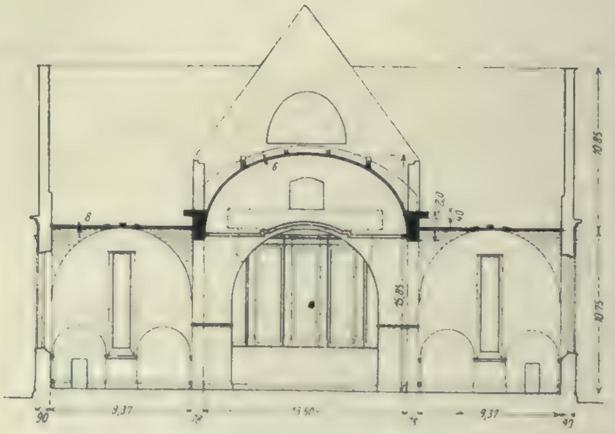

Fig. 3.—Section through cross nave.

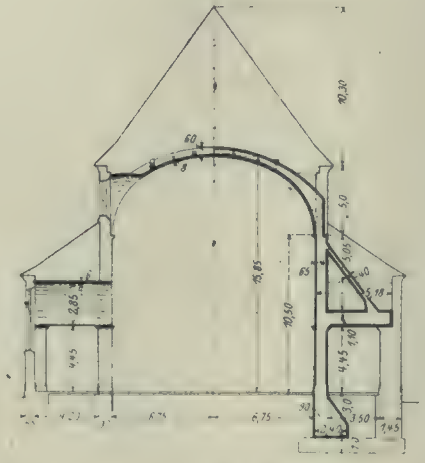

Fig. 4.—Cross section.

A Church in Reinforced Concrete

By V. J. Elmont, B.Sc., A.M.Can.Soc.C.E., Montreal

THE employment of reinforced concrete in church building has increased rapidly during the last ten or fifteen years. Though there is still only one church—so far as I am aware—built entirely in that material, namely the Cathedral of St. John and St. Mary, Manila, Philippine Islands, there are numerous churches in which some part of the structure is built in reinforced concrete.

Not infrequently when a church, in which wood has been used extensively, burns down, the new church, erected in the same place, is made fireproof by adopting reinforced concrete as the material for the vaults, domes, floors, stairs, roof trusses, etc. This is the case with the St. Magdalen Church, in Strassburg, which was destroyed by fire some years ago. The new structure has been completed recently. It has a main nave (Fig. 1) 44 ft. 4 in. wide and 135 ft. 4 in. long and a cross nave 36 ft. 4 in. wide. The choir is elliptic in plan, the axes of the ellipse being 50 ft. 9 in. and 36 ft. 1 in.

All the floors and vaults are in reinforced concrete. The main nave is covered by a barrel vault, running through from tower to choir (Figs. 2, 5 and 6). The 2½-in. thick slab of the vault is supported by four longitudinal beams (Figs. 3 and 5), which again rest on five arch girders, spaced 19 ft. 10 in. center to center. The load due to the roof and the wooden roof trusses is also carried over to these girders.

In the cross-section on Fig. 4 there is shown, diagrammatically, the design of the arch girders. These are built in one with a triangular frame, one each side, supported by two rows of columns, the inner one being of reinforced concrete and the outer of brick. The foundation for the reinforced concrete columns is also built of that material, the dimensions being figured out to keep the pressure on the soil within the allowable limit for the most dangerous combination of horizontal and vertical forces.

The depth of the arch girders at the crown is 2 ft. and at the springing lines 2 ft. 2 in., the width being 16 in. The reinforcing bars at the crown are five plain round bars ¾ in. diameter by 2⅞ in. diameter, both

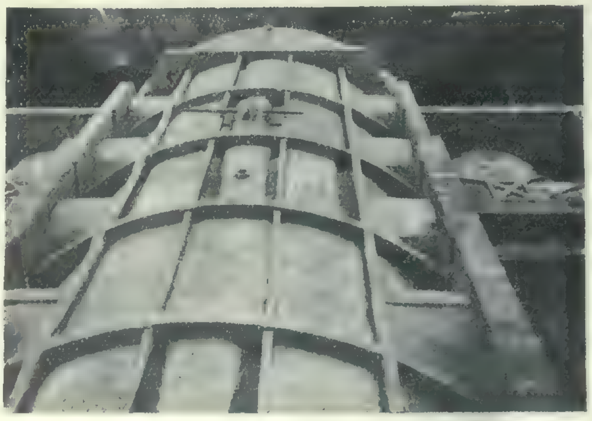

Fig. 5.—Vault over main nave.

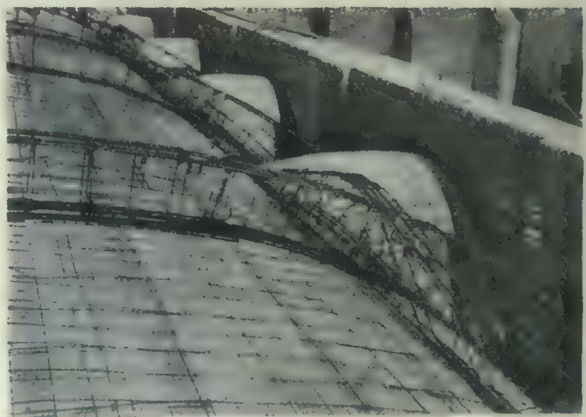

Fig. 6.—Reinforcement of mainvault.

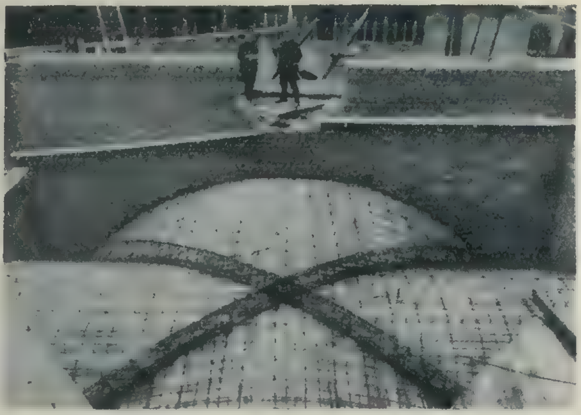

Fig. 7.—Reinforcement of vault over cross nave.

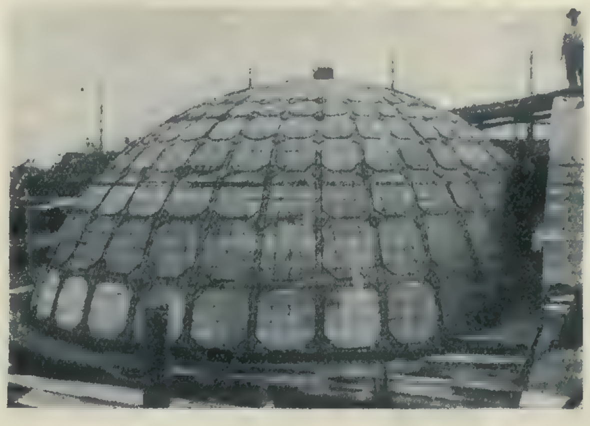

Fig. 8.—Dome over choir.

at the intrados and extrados, at the springing lines eight ¾-in. diam. bars at both sides. Between the second and third arch girder the vault has an expansion joint. The longitudinal beams are therefore designed as cantilevers in this bay.

The two portions of the cross nave are covered with vaults, each having an area of 36 ft. 4 in. by 30 ft. 7 in. The diagonal ribs (Fig. 7), have a width of 10 in. and are 2 ft. 8 in. deep at the crown and 1 ft. 10 in. at the springing lines. The reinforcement is four ½-in. diam. bars in both sides.

The slab forming the dome over the choir (Figs. 2 and 3) is 3-in. deep at the horizontal and vertical ribs, but only 2½ between them. The horizontal ¼-in. diam. bars have a spacing of 10 in. to 12 in. at the crown and of 2 ft. 8 in. to 3 ft. 4 in. at the springing lines. The area of the vertical bars is also diminished toward the crown. A ring of three bars ⅝ in. diam. is arranged at the springing line and half way up is a similar ring of two ½-in. diam. bars.

The barrel vaults over the side naves have a span of 16 ft. 10 in. by 3 in. thickness.

Proposed New Machinery Hall for the Canadian National Exhibition

By W. Almon Hare, B. A. Sc.*

THE consensus of opinion among machinery men and others vitally interested in the welfare of the Canadian National Exhibition is that there should be an entirely new Machinery Hall, and on a new location in the grounds, for the proper display of machinery of different kinds, so as to bring before the public a more correct understanding of the importance of the many and varied industries established for its production in Canada. With this in view the following is an outline of some of the ideas which have occurred to the writer, and which may accelerate the movement toward the establishment of better facilities.

The present location, owing to the recent lowering of the Grand Trunk tracks to the north, has made it impossible to switch a car into the building. Obviously it will be an important feature in the new location that this facility is well provided for. The material to be exhibited is all of a heavy nature, and can be economically handled in only one way; that is, by bringing the railway cars into the building and by having proper crane facilities to lift the machinery and to place it in any part of the Hall.

The accompanying proposal represents a design that, in the writer's opinion, would not be any too large, considering the number of firms who would avail themselves of the opportunity to exhibit, if the proper facilities were provided. The design is for a steel building 600 ft. long by 125 ft. wide. It should be constructed in two bays each 600 ft. by 62½ ft., thus providing opportunity for the erection of a 10-ton and 15-ton motor electric travelling crane, each with a nominal span of 60 feet and running the entire length of the Hall. If the railway tracks are brought into the building on a line at right angles to the length, the cranes will pass directly over the cars, and will thus give all necessary facilities for the rapid and economical loading and unloading of heavy machinery. If the commissioners cannot see their way clear to erect the whole building as illustrated, the ground should be secured and held in view of an extension by adding length only, so as not to call for the erection of a third crane.

As a great number of exhibitors have apparatus that requires either steam or compressed air for operation, it is suggested that a conduit 5 or 6 feet wide be laid all around the inside walls below the floor line, with two cross connections from side to side. In this conduit would be placed the high-pressure and exhaust line for steam and water service; gas pipe; low-tension a.c. and 250-volt d.c. wires, together with the compressed air pipe line. A drainage system would also be required. These pipes and wires would be provided with tapping stations every 75 ft. or so, with branch connections to each booth. Doubtless the compressed air would be provided without charge by the exhibitors of steam or electrically driven air compressors. While the steam and electrical current would be provided by the C. N. E. power station, which should be erected adjoining Machinery Hall.

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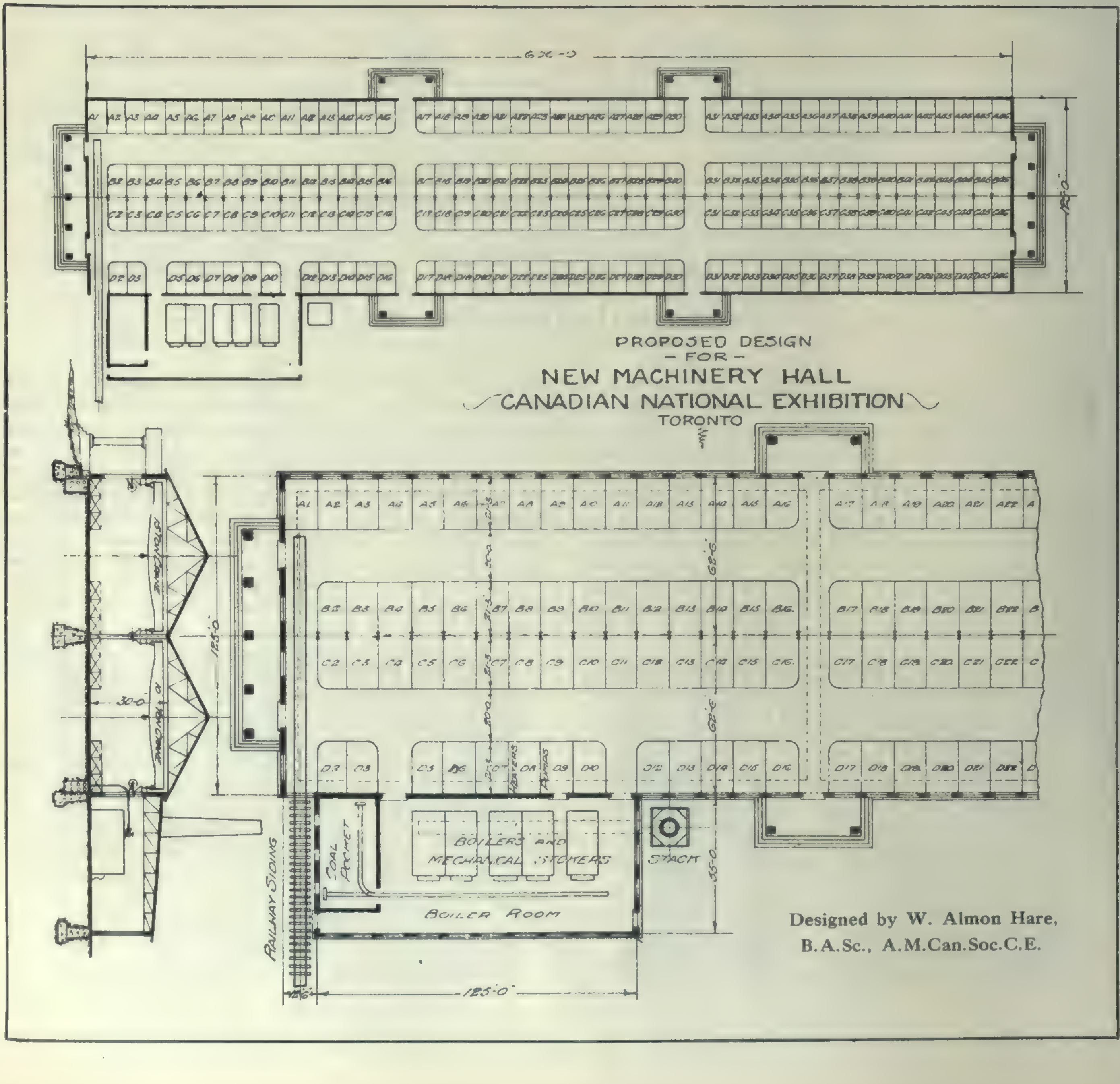
* President, The Hare Engineering Company, Toronto.

This power station should be designed to carry the entire Machinery Hall load. This would obviously require quite a modern steam boiler plant with stack and mechanical stokers. It could not be done without considerable expenditure, but it will be impossible to get exhibitors of steam apparatus unless they are given facilities to operate their equipment.

For the operation of the equipment that does not call for steam, electricity or gas, lines of shafting should be provided on both side-wall columns as well as on the centre columns. This shafting should be operated by motors mounted on brackets, out of the way, and geared to the shafting by chain-drives, so as to secure close centres. This shafting should have frictionless bearings, and would be available for all small apparatus to be operated only by belt.

Doubtless this is an undertaking which should be in the hands of a consulting engineer, who has made a specialty of factory construction. After the general layout has been decided, it would be in order to have an architect beautify the exterior to conform to the general scheme of the other buildings, provided no alterations were permitted with the details inside the building. It is important that no secondary consideration, such as questions of cost, exterior appearance, etc., should be allowed to interfere with the carrying out of the scheme in the best possible way. The idea is to provide that which is absolutely necessary to properly represent this tremendous branch of industry. The general public has no idea as to the importance of the part that machinery plays in our national development, and if facilities are provided along lines similar to those suggested above there will be no parties more surprised at the resulting exhibition in the new Machinery Hall than the directors themselves.

In conclusion, the writer feels that attention should be drawn to the possible future of Toronto as a general machinery market in Canada, and the influence of the new Machinery Hall on bringing this to pass. The completion of the Welland and Sault Ste. Marie canals and the enlargement of the St. Lawrence canal, with the new harbor facilities in Toronto, will cause this



Designed by W. Almon Hare, B.A.Sc., A.M.Can.Soc.C.E.

city to be the great distributing point for material of this kind in Canada, to a much greater degree than ever before.

Ontario is the best market for machinery of all kinds at the present time, and Toronto is the natural centre of supply, but with these added shipping facilities Toronto houses will be better able to ship to all destinations, and this will assist materially in the development of the city. The size and importance of the exhibits that will come to the new Hall, once the facilities are provided and fully advertised, will make this city a buying centre for the whole country. American and European firms who wish to establish themselves in Canada will make large displays, while Canadian producers will not be found behind their competitors.

The facilities above outlined will be found of great assistance in bringing to the city conventions of American and Canadian associations of all mechanical trades, and this will assist in extending the influence of the new Machinery Hall beyond that of the term of the Canadian National Exhibition itself.

Reinforced Concrete in Factory Construction

By Alexis Saurbrey, M. Am.Soc.C.E.*

THERE are no special difficulties in the problems encountered by the engineer in the construction of factory buildings. The essential requirements are: 1, adequate strength; 2, fireproof construction; 3, plenty of light; 4, sanitary conditions; 5, reasonable cost.

From the point of view of the engineer, all of these are of equal importance. The owner, perhaps, is somewhat prejudiced in giving too much weight to the last item on the list, the cost—but it can usually be shown that the other four are of as great financial importance as the first cost, and sometimes greater.

1. Adequate Strength.—This question is of a purely engineering nature and needs only to be touched upon briefly in this place. The floor loads in most factories are usually small from the engineer's point of view, and the machinery light, and there is no trouble whatever in avoiding vibrations and noises. Of course, it will be necessary to make the floors of the stock rooms and shipping rooms stronger than the manufacturing spaces, but it is safe to say that the average factory will ever carry such weights on the floors as will, for instance, machine shops, foundries, or grain elevators, of which many have been built of reinforced concrete throughout this country.

2. Fireproof Construction.—It is true that no known building material (except asbestos) will survive a hot fire of long duration. Nevertheless, concrete has a far better endurance than any other commercially feasible material, be it bricks, hollow tile, or plaster, and the proof of this statement is found in numerous experiments conducted by the U. S. Government, and various Boards of Underwriters, if indeed actual service tests were not sufficient to dispel all doubt upon the subject. For instance, the Bayonne (N. J.) plant of the Pacific Coast Borax Company, built in 1898, went through an exceptionally hot fire in 1902. Yet, the damage to the reinforced concrete floors and walls was repaired for less than one thousand dollars, and this damage largely occurred through the fall of various heavy tanks, etc., supported temporarily on wooden trestles, which were destroyed in the fire.

Many owners take advantage of this fact and carry no insurance on the building itself. The contents, of course, should be insured, for even if the building itself is fireproof, a fire once started will consume all combustible materials within reach, if not put out. But according to Mr. L. H. Kunhardt, vice-president, Boston Manufacturers' Mutual Fire Insurance Company, the insurance rate on both building and contents is reduced.

3. Plenty of Light.

4. Sanitary Conditions.—A reinforced concrete building is in itself a sanitary building. It has no pockets for dirt, it might be daily or weekly flushed with water without any injury; there is no wood to decay or rot, no possibility for vermin.

The Foster Armstrong Company, one of the clients of the company with which the writer is connected, have informed us that their buildings require much less fuel for heating than anticipated—and they have, all told, more than a dozen large buildings of reinforced concrete, used for the manufacture of high-grade pianos.

The diffused daylight, admitted through the large windows, and reflected by the light-colored ceilings, makes the buildings of this kind cheerful even in winter, which again results in increased output per man. Light is the great moving power behind the human machine, and can be had for nothing if we only give it admission. Light drives away the germs and makes the workmen healthy and efficient, and light is the best safeguard against accidents. A reinforced concrete building can be designed so as to give a maximum of light on all sides.

5. Reasonable Cost.—The owner will here consider two items: The first investment of which he must pay the same interest yearly, and the upkeep, which is nothing for the first year or years, and then in most types of buildings, after a certain interval, it will grow fast each year, or, if not taken care of properly, it will cause the building to deteriorate rapidly. The only wear in a reinforced concrete building is in the cement surface of the floor, and where this is properly laid, to begin with, it will give perfect satisfaction for years. The Ransome people have been constructing wearing surfaces of cement for thirty-seven years, and have never been called upton to replace any worn-out cement finished floors.

Compare this record with the known facts in other types of construction: rusting of iron, replacing of worn-out wooden floors, gradual sagging and failure of overstressed joints and girders; ravages of dry rot and the hundred and odd other kinds of rot, and, finally the tremendous annual fire loss.

If then, the maintenance of a reinforced concrete building is nil compared with that of other types, the first cost is also very favorable. A first class reinforced concrete building is cheaper than any other type of FIREPROOF building by about 15 per cent. up. It has been known to compete successfully with a first class mill constructed building but where lumber is cheap, and other conditions are in favor of brick and timber work, the reinforced concrete building may sometimes cost ten to fifteen per cent. more than the combustible, or non-fireproof building. Here again, recent innovations have materially lowered the cost of the standard reinforced concrete building. Thus, the recent additions to the United Shoe Machinery Company's buildings were built under the Ransome Unit System at a materially lower cost per square foot than the older buildings of similar appearance but erected according to the usual methods.

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* Chief Engineer, Sansome Engineering Company, New York.

While the true cost of any given building can be determined only by careful estimates, based upon loyal conditions as to cost of labor and materials, loads to be carried, and character of the available soil upon which the foundations must be placed, we may perhaps say that a reinforced concrete building complete but exclusive of machinery, will cost approximately 6 to 8 cents per cubic foot, with a probable reduction of about one cent per cubic foot in case improved methods are used.

It takes men of a peculiar kind to build well and economically. Owners have sometimes been disappointed with their buildings of whatever type selected, and as this is usually the owner's own fault, if we go deep enough, it might perhaps be well to speak briefly of the best methods of getting a good factory. The owner must have 1, good plans; 2 good work.

It is the duty of the engineer to procure these two. It is the duty of the owner to meet his obligations promptly. Even if both owner and contractor do their best to pull together, disputes of an entirely innocent nature may arise, in which case the engineer has the additional duty of acting as judge between owner and contractor.

Under this arrangement both owner and contractor are usually bound by the engineer's decision without recourse. In other cases, where mutual confidence exists between owner and contractor, the architect or engineer is dispensed with, and the contractor does all the planning.

1. **Good Plans.**—However skillful the engineer may be, on questions relating to the best way of putting the building together, the proper man to plan a factory layout is the one who has to use it, that is, the manager of the plant. In some special lines of manufacture, the makers of the machinery are better posted on the best arrangement, in other lines special mill engineers are the best men. But in any case the best man to design the reinforced concrete work is a reinforced concrete expert and no mill engineer, or manufacturers' manager should attempt to do what the structural specialist can do better and cheaper. Many essential features of reinforced concrete buildings are subject to patent royalties, of which only the specialist is aware. When the plans have been thus prepared by the specialist, and work started, no further changes should be made. While changes during the erection can be made in a reinforced concrete building better than in any other, changes are nevertheless the great bugbear of building construction and will break up the best organization.

2. **Good Work.**—One essential pecularity of reinforced concrete is that it is manufactured right where it is to be used, while steel, timber, brick, etc., are brought to the building more or less ready for assembling, except possibly for a few finishing touches. Special ability is therefore required on a concrete job, and only firms of old and established standing should be entrusted with the work. In that case, there would naturally be that mutual confidence to which reference has been made above so that the owner would not hesitate at giving the contract out of the so-called cost plus profit basis. In that case, the contractor is certain of a reasonable profit on his work, while the owner pays only for what he actually gets in materials or service, plus the stipulated profit. In this way, contracting is placed on a sound and equitable basis, and the gambling feature is eliminated.

Where, on the other hand, bids are asked for promiscuously, and the contract awarded to the low bidder, the work is almost certain to go to a man who is bidding low, not on account of his excellent methods of handling this kind of work, but on account of his lack of ability and knowledge. Quite often such contracts end in litigation and troubles of all kinds. It rests with the owners in general whether or not the work is to be creditable, and whatever form of contract is entered into, it is essential that the work be given to people who really know their business.

It is true that inspection of the building will do much to eliminate bad work, and the owner would therefore do well in having a competent, tactful engineer to represent his interest on all work of importance. There are many engineers who make a business of such inspection, and their employment will in most cases result in satisfaction to both owner and contractor if the man is of the right kind.

Mr. R. F. Uniacke on Transcontinental Construction

Mr. R. F. Uniacke, bridge engineer of the Grand Trunk Pacific, at a meeting of the Canadian Railway Club, described some of the difficulties of the construction work, particularly of bridges, on the eastern section of the Transcontinental, from Winnipeg to Moncton. There are 220 bridges—aggregating 11 miles—on this section, the cost being about 6 million dollars. Concrete was largely employed in constructing the piers and abutments, and said Mr. Uniacke, this material might well be called the spirit of the Transcontinental. Without concrete, he added, the work of building the line, depending on stone masons, could not have been done in 25 years. Typical bridges were shown on a screen and their characteristics described, while instances were given of initial failures owing to unsuitable sub-soil and other causes. Work went on summer and winter, sometimes with the temperature 30 deg. below zero. The rails were now joined from Moncton to Winnipeg, with the exception of the crossing of the St. Lawrence at Quebec, which awaited the completion of the bridge.

In the meantime a car ferry was being built in England by Cammell, Laird & Company. There were difficulties to be overcome in ferrying trains across the St. Lawrence, owing to the flow of ice, and the rise and fall of the tide. The result was that water froze on the side of the docks, the ice being sometimes eight and nine feet thick. Mr. Cowie, the Montreal harbour engineer, was consulted, and he designed a ferry with a tidal deck, and with an "apron" at each end, which joined the rails of the boat with those of the docks, without the ferry having to touch the dock. The cost is £115,000, and the ferry will be in operation in May next.

Mr. Uniacke spoke of the difficulties of getting supplies to the scene of operations, and stated that dogs played an important part in taking up the goods to the various parts of the country.

The Channel Tunnel—A Project of International Interest

THE project of a tunnel under the English Channel, connecting England and France, has been engaging considerable attention of late. The scheme is no longer regarded as hare-brained, or mythical, as is evidenced by the careful reply which the British Prime Minister gave to a deputation representing all sections of the House of Commons which waited upon him recently to urge the great benefits that the tunnel would confer upon commerce between England and the continent. The Prime Minister, the Rt. Hon. Mr. Asquith, explained the policy of the government in rejecting previous proposals—a policy founded largely upon military considerations—but expressed willingness to hear further arguments in favor of the project, and promised careful consideration by the Imperial Defence Committee, whose decision is awaited with interest.

The construction of this tunnel would provide one of the most interesting engineering works of a century. It may not generally be known that more than four thousand yards of tunnelling have been done at a cost of $1,250,000; that thousands of soundings have been taken from shore to shore, and that all the elements are at hand to enable work to be resumed promptly and carried to a successful issue.

The total cost of the whole undertaking, including the purchase of land and rights on the English and French coasts, is estimated at $80,000,000, which would be contributed equally by English and French companies.

Our remarks are introductory to an extract given below, from an interesting paper read last month at the First Annual Congress of the Franco-British Travel Union in London by Sir Francis Fox:

In 1876 and 1877 the French geologists, Messrs. Potier and Lapparent, took 7,600 samples of the bottom of the Channel, 3,267 of which they were able to utilise. The grey chalk through which the tunnels would be bored, if the scheme were sanctioned by his Majesty's Government, was 87 ft. thick at Dover and 70 ft. thick at Sangatte. It was excellent material in which to work, possessing the peculiar property of gradually "puddling" itself, and becoming impervious. Containing no flints, it was, as far as could be ascertained, free from fissures and slides; but should a fissure be encountered, it could be easily and satisfactorily dealt with by means of the system of high-pressure grouting which had been introduced within the last five or six years. In the Mersey Tunnel, his own firm, Sir Douglas Fox and Partners, had met fissures with which they had thus dealt successfully.

A drainage heading would be driven from each side of the Channel, rising towards the centre, and connected at Dover and Sangatte with shafts for pumping and widening. The main tunnels would consist of two single-track circular tunnels, each of 18 ft. net internal diameter, and thus large enough to accommodate the rolling stock of the British and French main lines, except only their locomotives, for which would be substituted electrical locomotives of ample power to deal with the heaviest trains running upon the main lines. At frequent intervals these tunnels would be connected by cross passages with air tight doors, rendering it easy to introduce currents of air, and to exchange workmen from one tunnel to the other. Including the junctions with the main lines of railway in England and France, the total length of each tunnel would be 31 miles, the actual length under water being 24 miles. The tunnels would be placed 36 ft. apart, and lined throughout by cast iron segments, of ample strength to resist any possible pressure, and grouted on the outside so as to secure a covering of cement which would not only prevent leakage into the tunnels, but also preserve the plates from corrosion.

Assuming that 17 yards per day could be excavated for six days per week, the annual progress would be about three miles at each face, so that the driving of the drainage heading would occupy four years. Three shifts of men would have to be employed, and the changing would take place below and on the spot, no stoppage of work being allowed. This was the system adopted in the case of the Simplon Tunnel, where the drills never stopped while the shifts were changing. An emergency door would always be kept in position near the "face" of the heading, not so much for actual use, but rather to induce confidence in the minds of the men at work. The drainage heading would be commenced and driven ahead at as high a speed as was found to be practicable, it being a matter for the directors to decide whether this should be completed before proceeding with the main tunnels, or whether they should be carried forward at the same time. It would be necessary to keep an efficient supply of air throughout the entire length of the heading for the men employed. This could be best effected by bratticing off the upper portion of the heading, thus forming a conduit of the required size for the volume of air, which would be blown in by high-speed fans. Such would be the primary ventilation, and permanent ventilation of the main tunnels would be established by blowing air in the direction in which each train was travelling. The traffic being electrically operated, the volume of air required was very largely reduced. To keep the tunnels pure and fresh, it would be necessary to supply 45,000 cubic feet per minute on each line of way, traveling at a velocity of 6 ft. per second, which was equivalent to a very light breeze. The power required to induce this current of air, much assisted as it would be by the trains, would not be large, and the entire problem was simple as compared with that in many collieries through which not only were far greater volumes of air blown in order to deal with great "blowers" of explosive gas, but the length of passages through which the air had to be driven or exhausted was considerably greater, and impended by bends which woud not exist in this case.

The prevention of fire in the trains was also one to which much attention had been devoted. In the case of specially built rolling stock for the London and Paris and other expresses, no inflammable material should be used, and as the motors of the electric locomotive would be "armoured" against fire in case of short circuiting no danger would arise as regards the electrical working even from the employment of ordinary rolling stock. Assuming, however, that in spite of precautions any stoppage should occur in the tunnels, the passengers would readily pass along the tunnels in the rear of the train, where ample space would be available, as a footpath, clear of the electrical conductors. The passengers would thus be free from smoke, in consequence of the direction of the current of air always blowing from the rear of the train towards the front. In consequence of the large diameter of the tunnels, the electric conductors could be so placed as not to obstruct the permanent way or interfere with repairs.

The tunnels would be lighted throughout by electricity. A separate and special circuit would be provided, so that in the event of the main traction current failing, the lights in the tunnels would not be extinguished. Carriage lighting would be independent, each vehicle carrying its own store of light. Sanitary and hygienic regulations similar to those so successfully adopted at the Simplon Tunnel would be enforced during the progress of the works. The French engineers had satisfied themselves as to the best position for the sorting sidings and station at Sangatte, and as to the site for the deposit of their moiety of the excavation from the shafts, heading, and tunnels.

Consulting Engineers

Isham Randolph, Chicago

Among the consulting engineers from the other side of the border who have distinguished themselves in connection with Canadian undertakings, a prominent place must be given to Mr. Isham Randolph, of Chicago. Mr. Randolph has an international reputation, and an extended connection in Canada, but he is best known in the East. It was he who was consulting engineer for the City of Toronto during the track elevation contest, which, after being won by the city, was appealed by the railroads to the Privy Council who sustained the City. He was retained by the City of Toronto on the water supply problem, and has been particularly active in that field.

Mr. Randolph was born at Newmarket, Clark County, Virginia, in 1848. His education, both general and technical, was acquired in the school of experience. He entered the profession of engineering in 1868 as an axeman on the Winchester & Strausburg Railroad, a part of the Baltimore and Ohio system. After the location, he continued on that work as rodman until its completion. In 1870 he was leveller on the surveys for the Washington and Ohio Railroad. In 1871 he was transit man on the survey for the extension of the Lehigh Valley Railroad from Jugtown Mountain to Perth Amboy, N.J.

Mr. Isham Randolph.

In March, 1872, he re-entered the service of the Baltimore and Ohio Railroad as transit man in the extension of that line to Chicago. In this capacity he located the line from Syracuse, Indiana, to Chicago. Later, as resident engineer he built twenty-seven miles of this line and the roundhouse and shops at South Chicago. In 1876 he entered the service of the Sciota Valley Road as assistant engineer, and later became roadmaster of that line. In 1880 he went to Chicago as Chief Engineer of the Chicago and Western Indiana Belt Railway of Chicago. There he had extensive experience in the building of railroad terminals, freight houses, round-houses, etc.

In 1885 he opened an office for general engineering work in Chicago. In 1886 he was employed by the Illinois Central Railroad in the location and building of the Chicago, Madison & Northern Railroad and the Freeport and Dodgeville line as Chief Engineer. In 1888 he resumed the general practice of engineering in the city of Chicago and was employed as engineer on various projects and later as consulting engineer for the Union Stock Yards & Transit Company and the Baltimore & Ohio Railroad Company.

On July 7, 1893, he was elected Chief Engineer of the Sanitary District of Chicago and served in this capacity for fourteen years, during the entire period of construction of the Chicago Sanitary & Ship Canal, a project costing some sixty millions of dollars. He retired as Chief Engineer in 1907, and has since served the Sanitary District as Consulting Engineer.

He was appointed by President Roosevelt on the Board of Consulting Engineers for the Panama Canal, and was one of the five members of the Board whose minority report was accepted by the President and Secretary of War, approved by the Panama Commission and adopted by Congress.

In 1908 President Roosevelt invited him to be one of six engineers whom he wished to have accompany President-Elect Taft to Panama to consider "whether or not there is any reason to change the plans upon which we are working." This Board of Engineers submitted its report to the President on Tuesday, February 16, 1909, unanimously upholding the plans for the lock canal across the Isthmus.

He recently served the City of Milwaukee as Consulting Engineer on its harbor project and prepared comprehensive plans for harbor improvement there.

He was Chairman of the Internal Improvement Commission of Illinois, which Commission was charged with the duty of planning the Deep Waterway from Lockport to Utica, for which the State voted an issue of twenty million dollars in bonds. He is a member of the Illinois State Conservation Commission. He was a member of the Harbor Commission of the City of Chicago, and is consulting engineer for important engineering projects in Toronto, Buffalo, Baltimore, Maryland, and other cities.

He is a past-president of the Western Society of Engineers and a member of the American Society of Engineers; also a member of the American Institute of Consulting Engineers. In 1910, the University of Illinois conferred upon him the degree of Doctor of Engineering. He is a member of the Rivers and Lakes Commission of Illinois.

In February of this year the Franklin Institute of the State of Pennsylvania conferred upon him the Elliott Cresson Medal, the highest award in the gift of the Institute in recognition of "Distinguished Achievement in the Field of Civil Engineering."

Regina Engineering Society

The second annual banquet of the Regina Engineering Society was held at the Metropole Hotel, Regina, on the evening of October 2nd. Mr. H. S. Carpenter, Chairman and President, presided.

Mr. L. A. Thornton, formerly City Engineer and now City Commissioner, proposed the toast paid to the Dominion of Canada, to which response was made by His Honor, Lt.-Governor Brown. "The City of Regina" was proposed by Mr. W. Parsons, who paid a tribute to the enterprise that the city had showed in carrying out her municipal programme in the face of financial stress. Reply was made by His Worship Mayor Martin, while Mr. J. F. Bole, M.L.A., also responded, expressing himself in favor of the formation of a provincial engineering society for Saskatchewan.

The toast to "Kindred Societies" was proposed by Mr. R. N. Blackburn and responded to by Mr. F. C. Clemesha, of the Architects' Association, and Mr. M. B. Weeks of the Surveyors' Association. Mr. Blackburn outlined briefly the history of the three professions, from mediaeval times up to the present. Mr. Clemesha called the attention of the engineers to the fact that the Architects' Association was already provincial in its scope, and said that he hoped the time was not far distant when they would be able to effect a wider organization. Mr. Weeks conveyed greetings from the Surveyors' Asscoiation, which, he also said, was a provincial organization.

The toast to the "Guests of the Evening" was proposed by Mr. O. W. Smith and responded to by Mr. H. G. Smith, President of the Board of Trade, a body which has recognized the importance of engineering and allied societies by the organization of the Engineers and Architects' Committee.

Personal Mention

Mr. W. S. Harvey has been appointed City Engineer of Lethbridge, Alta., vice Mr. A. C. D. Blanchard, resigned.

Mr. W. G. Chace has been appointed Chief Engineer of the whole project in connection with the Greater Winnipeg Water Supply.

Mr. G. F. Porter, Engineer of Construction for the St. Lawrence Bridge Company, Montreal, has been elected to membership of the American Society of Civil Engineers.

Mr. T. W. Roby, designing engineer with Henry Goldmark, consulting engineer of New York City and Kingston, Ont., has been elected an Associate Member of the American Society of Civil Engineers.

Mr. S. E. Rockwell, Resident Engineer for the Puget Sound Bridge & Dredging Company, Victoria, B.C., and Seattle, Wash., has been elected an Associate Member of the American Society of Civil Engineers.

Mr. J. E. Pennybacker, who was recently appointed in an advisory capacity to the Ontario Highway Commission, was in Toronto last week conferring with the provisional authorities in regard to plans for future development.

Mr. C. B. Brown, Jr., Chief Engineer of the Intercolonial Railway, Moncton, N.B., and Mr. W. E. Smith, engineer with the Calgary Asphalt Paving Company, Limited, Calgary, Alta., have been elected full members of the American Society of Civil Engineers.

Mr. G. Janin, chief city engineer of Montreal, has just returned from a visit to Europe. He has gathered a large amount of data bearing on European civic administration, engineering problems, and road work. His report has been submitted to the controllers.

Mr. C. F. Krumbiegel, resident Canadian engineer of the Deutsche Machinenfabrik A. G., Duisburg, Germany, is on a visit to the home office. On his return he will be permanently located in the office of Messrs. Gerald Lomer, Montreal, Canadian representatives of the German company.

Mr. Tanaka Kozo, engineer of the Japanese Railway Board, and Mr. Nakamura Kenichi will undertake investigations of railway management and engineering abroad for the Japanese Government, the former in Belgium and England, and the latter in Canada, the United States, Germany and Switzerland.

Mr. Walter J. Francis, the well known consulting engineer of Montreal, addressed the engineering students of the University of Toronto last week on the occasion of the annual open meeting of the Engineering Society. The subject of Mr. Francis' address was "Engineering as a Profession," from which we hope to give some extracts in a later issue.

Messrs. Douglas-Milligan, Limited, building and mechanical specialists, Montreal, announce the opening of a new Toronto office in the Tyrrell Building, 95-97 King street east, under the management of Mr. W. M. Campbell (mechanical lines), and Mr. C. A. Fox (building lines).

Mainly Constructional

The News in Brief—From Coast to Coast

The contract for the Quebec dry dock has been awarded to Mr. M. P. Davis for $2,721,156.

Building permits in London, Ont., up to the middle of October, 1913, exceed the total for the whole of last year by over $430,000.

It is expected that the new $200,000 court house at Vernon, B.C., will be roofed within the next month or so, steady progress being made with the work.

Contracts will be let some time in November for the new $200,000 commercial high school which is to be erected in Toronto. Excavation will commence this fall.

The Dominion Board of Railway Commissioners have ordered that the clearing of the site for the new Union Station at Toronto be commenced within the next week.

The Burrard Peninsula, B.C., Joint Sewerage Commission have accepted a loan of $500,000 from a firm of London bankers to carry out their necessary sewage disposal works.

The Provincial Board of Health of Ontario have made suggestions to the city of Peterborough which practically means that a new sewage disposal plant will have to be installed there.

Up to date $9,800,000 has been paid by the Government to the Canadian Northern Railway under the fifteen million dollar subsidy agreement of last session, for the company's transcontinental line.

"The Qu'Appelle," at Regina, is also under way, and the entire space to be occupied by this hotel has been excavated and the foundation is now being put in so that the steel work can be commenced this fall.

Efforts are being made to induce the eastern section of the Canadian National Association of Builders' Exchange to hold their convention in Montreal at the end of January, at the time the Montreal Builders' Exchange hold their annual dinner.

The city council of Regina has drafted a programme of paving work to cost $650,782.46, to be done next year. It has also approved of a by-law providing for the issue of $119,427.24 of debentures to be used in concrete sidewalk construction throughout the city.

"The Fort Garry," Winnipeg's new hotel, built by the Grand Trunk, is nearing completion, and it is expected that it will be opened on or about December 1st next. The power plant of the hotel has been started and the work of furnishing is being carried on night and day.

The time for receiving tenders for the second section of the new Welland Ship Canal closed on the 15th inst. The Government intends to lose no time in letting the contract. This will allow of the construction work proceeding simultaneously on sections one, two and three of the canal, one and three being already under contract.

"The Macdonald," at Edmonton, one of the chain of Grand Trunk hotels, is progressing favorably, the steel work on this building being up to the roof, while the stone work is up seven floors, and it is anticipated by the contractors that the building will be roofed in this fall. It is not expected, however, that the hotel will be open until the fall of 1914.

About three hundred men are engaged on the five shops being constructed at Longueuil, P.Q., for the Armstrong Whitworth Company. Various railroad sidings, including that of the Quebec, Montreal and Southern Railway are being brought into the works. There is already sunk a six hundred feet artisian well for drinking water and a chimney of over 150 feet in height is in course of erection.

Railway construction work now going forward in the immediate vicinity of Kamloops, B.C., is estimated as amounting to at least $6,000,000, the present extensions of the Canadian Northern figuring as the most important item in this programme. Recently compiled figures indicate that there are now more miles of railway under construction in British Columbia than the mileage in actual operation.

The Montreal Electrical Service Commission expect to have the wires placed in the underground conduits on St. Catherine Street by May 1st next. The commissioners have therefore suggested that the City Council should pass a bylaw requiring that all buildings erected and to be erected, on this and other streets should be wired to suit the underground distribution. All customers for electric light or power must change their interior wirings to the satisfaction of the Canadian Fire Underwriters' Association.

By June next the Canadian Northern will run through trains between Toronto and Edmonton, and, by August, trains will commence running from Montreal through to the Pacific Coast via Edmonton, over the Canadian Northern Railway. This announcement was made recently by Sir Donald Mann. Sir Donald said the line between Sudbury and Port Arthur would be finished by December, and the two ends of the steel on the main line between Edmonton and the Pacific Coast, would be connected about the middle of next summer.

At the suggestion of the Pedlar People, Limited, the Montreal Builders' Exchange have decided to take up the question of the insolvency law, with a view to securing amendments. A committee consisting of Messrs. Gilday, McKergow, Locker, Potter and Werry have been appointed to study the subject, and join with the other bodies interested in obtaining an improvement in the law. Messrs. Brunet, Pauze, Allan, Stinson and Werry have been appointed on a committee to look into the lien law and report to the exchange with a view to securing amendments to the existing law.

The Canadian Northern have had about 25,000 men engaged upon construction this year, and, according to Sir William Mackenzie, the company have spent four million dollars since the beginning of the 1913 season. By the end of the season the company will have added between one thousand and eleven hundred miles to the trackage in the Dominion. They will have completed by then the laying of track on the line between Port Arthur and Sudbury, which will connect the western and eastern systems and give the country another Transcontinental line between East and West. By the end of the year there will remain but a fifty-mile gap to be finished between Edmonton and the Pacific Coast.

Mr. C. E. Watkins, a well-known Victoria architect, recently completed plans for an apartment block to cost about $45,000. The building is to be of brick veneer and concrete construction, with frame interior and three storeys in height, containing 24 suites of two and three rooms each. Disappearing beds will be used, gas stoves will be placed in each suite, and there will be a well-equipped laundry in the basement for general use. Messrs. Fulton Bros. have been awarded the contract for this building. Mr. Watkins has also completed plans for the new Quadra street school. This building will have brick walls and fireproof staircases, and will contain eight classrooms, and a large assembly hall measuring about 50 feet square.

In order to get into close touch with the highway needs of all sections of older Ontario, the Provincial Highways Commission will this winter hold sessions at various points, at which county and municipal representatives will be asked to attend with a statement of their views. The representatives will be encouraged to state their opinions as to the kind of roads desired in each locality, the sources from which revenue can be derived, the value of statute labor, the classification of roads and the governing body in which control of each class should be placed, and the particular roads that are best adapted for development as main market roads. They will also be asked to state their views as to the width of tires and the control of automobile, traction engine, motor truck and other traffic.

Mr. C. C. Whittier has been made Treasurer and General Manager of Robert W. Hunt & Company, Limited, with headquarters at 905 McGill Building, Montreal. Mr. Whittier has been residing in Winnipeg in charge of the company's business in that district, but has removed to Montreal. Mr. T. C. Irving, Jr., has been re-elected Vice-President of the company and will remain in charge of the business in Toronto and surrounding district. Mr. B. N. Dickman, the well-known mining engineer, has become associated with Robert W. Hunt & Company, in the United States, and with Robert W. Hunt & Company, Limited, in Canada. His headquarters will be 2200 Insurance Exchange, Chicago. He is now engaged upon the examination of gypsum and coal properties in Western Canada.

The plans for the interior storage elevator, which the Dominion Government will erect in Moose Jaw, have now been decided on. The elevator will consist of 84 concrete tanks with 66 inter-space tanks. The space occupied by these tanks will be 44 by 88 feet. The buildings are to be of fireproof construction, concrete and brick with reinforced steel. The plant will include receiving, cleaning and shipping plants with workhouse, track sheds, storage house and drier plant, all to be completed and ready for operation by December 1st, 1914. On each side of the workhouse there will be railway tracks, on the receiving side three tracks, and on the shipping side two tracks. The workhouse will be 76 by 158 feet, and will be 169 feet in height, with 16-foot foundation underground. The equipment will consist of 50 circular bins, 36 interspace bins, and 26 outer space bins, with storage capacity of 500,000 bushels. The storage elevators will contain 150 bins with a capacity of three million bushels.

Electric Welded Chain

The McKinnon Chain Company, of St. Catharines, Ont., have added to their equipment new machinery for the manufacture of heavier sizes of electric welded chain. These sizes are ⅝-in. and ¾-in. chain, which are made on automatic machines and welded by a special process under patents controlled exclusively by this company. Sizes of electric welded chain up to ½-in. inclusive have been furnished during the last five years.

The features of McKinnon electric welded chain are the location of the weld at the side of the link at the point of least wear, and a swell at the weld resulting from the strengthening of the only possible weak point by the addition of 25 per cent. more material. This increase at the weld actually makes the weld the strongest instead of the weakest point of the link, and repeated tests have proved that over 95 per cent. of this chain will pull stiff before it breaks and that the break will occur at some point other than the weld.

McKinnon electric welded chain is all made from the highest grade of steel and every pound is actually proof-tested before leaving the factory. McKinnon electric welded chain is the only welded chain made in Canada. By reason of this, as well as the automatic process of manufacture, the company claim to sell at prices much lower than those that obtain on the imported product.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Calgary, Alta.

Resolution passed by council authorizing Waterworks Dept. to install meters throughout city. Tenders will not likely be called for until first of year. Commissioner, A. G. Graves. Waterworks Engineer, A. W. Ellson Fawkes.

Delhi, Ont.

Waterworks system, cost $32,000, for Town Council. Clerk, Roger Crysler. Specifications not yet prepared.

Edmonton, Alta.

The City Council plan extension of city watermains along 122nd Ave. to 127th St. north to 129th Ave. to railway terminus financed by J. D. McArthur. Clerk, C. E. Cox. Engineer, A. J. Latornell.

Hamilton, Ont.

Storm sewer system, cost $650,000, for City Council. Mayor, Jno. Allan. Engineer, A. F. Macallum. The Works Committee has recommended the Board of Control to submit by-law to ratepayers next January to raise the above amount.

Montreal, Que.

Sewers planned by Board of Commissioners. Sec., L. N. Senecal. Council has voted the following amounts for sewers on Old Orchard Ave., $7,700; Desmarteaux St., $3,300; Toulouse St., $12,000.

Council has voted the sum of $90,000 for the laying of watermains in a number of streets. Board of Commissioners. Sec., L. N. Senecal.

Ottawa, Ont.

Water supply system, cost $8,000.000, for City Council. Mayor, J. A. Ellis. Engineer, Sir Alex. Binnie, London, Eng. Report has been made, gravity supply from Thirty-one Mile Lake with reservoir at Chelsea, 2 suspension bridges will be built, also 1 tunnel. 50 miles of 54 in. steel pipe will be required.

Water meters for City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Sub-committee appointed to look into the advisability of metering all large premises. Committee, Ald. Brethour, Ald. Fisher, and City Engineer.

Preston, Ont.

The Board of Health recommended sewers on the following streets, Montrose, Hedley, Laurel and Lowther, petition for sewer on Church St. was granted. Clerk, H. C. Edgar.

Pavements on Guelph and King Sts. planned by Town Council. Clerk, H. C. Edgar. Engineer, Frank Barber, 57 Adelaide St. E., Toronto. Tenders received by engineer until October 27. Bitulithic, asphaltis concrete and rocmac. Plans are also ready for sewer on Montrose.

Swift Current, Sask.

Sewers and water main planned by Town Council. Sec.-treas., G. D. Arnott. Engineer, Geo. D. Mackie. Tenders are to be called shortly for the excavation and laying of 600 ft. of 18-in. sewer tile 600 ft. of 15-in. sewer tile, 1,000 ft. of 12-in. sewer tile, 1,000 ft. of 8-in. and 10-in. water main.

St. Thomas, Ont.

Sewers, New and Oliver Sts., for City Council. Mayor, E. N. Price. Plans being prepared.

Reinforced concrete pavement, Alma St., planned by City Council, 32 ft. wide, from Talbot to Redan St., and 26 ft. from there to city limits. To be put in shape this fall and paving started in spring. Mayor, E. N. Price.

Toronto, Ont.

Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Nov. 4th. Plans, etc., at office of Works Dept. Division No. 2, West Toronto, Contract No. 3. Outlet from Keele St. and Uttreley Park to Quebec and Annette via Uttley Park, Hillsview ave., Medland Cres., Humberside avenue and Quebec avenue.

Commissioner of Works, R. C. Harris, City Hall, has recommended brick block pavement, cost $13,892, St. Clair Avenue, from McRoberts Ave. to G. T. R., 18-ft. pavement on each side of track allowed.

Sewers for Board of Control. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris, City Hall. Moore Park Drainage System recommended by Commissioner as local improvement. Western Section, $464,895; Eastern Section, $88,300.

Roadway for Ward Cartage Co., 1154 Dundas St. Tenders received by Owner or Mr. LePage, 102 Tyndall Ave. Concrete roadway, 350 ft. x 16 ft. wide.

Waterworks, pumps, etc., cost $500,00, for Board of Control. Chairman, Mayor H. C. Hocken. Mechanical and Electrical Engineer, Mr. Jas. Milne, Dept. of Works, City Hall. Tenders received until noon Nov. 25th for one or more 7½ and 20 million Imp. gal. pumping engines, 3 water tube boilers with piping. Coal handling apparatus at the High Level Pumping Station. Specifications, etc., at office of Engineer.

Winnipeg, Man.

Water system, cost $13,500.000. Shoal Lake, for Board of Control. Sec. M. Peterson. Engineer, J. G. Glassco, 54 King St. Tenders to be called early in January, 1914, for a dyke and channel for the diversion of the Falcon River into Snowshoe Bay, 85 miles concrete aqueduct, 10 miles pipe line (probably 1916 work), 900 lin. ft. tunnel under Red River, 85 miles of construction railway, telephone lines, clearing and ditching. Full particulars, etc., from Secretary.

Tenders received by Board of Control until Oct. 24th, for 50 4 in. gate valves. Specifications at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Hamilton, Ont.

Pavements, cost $50,033, for City Council. City Engineer, A. F. Macallum. Work being done by City. Asphalt, macadam and wood block pavements, cement curbs and walks.

Montreal, Que.

Sewers, cost $59,930; for Board of Commrs. Sec., L. N. Senecal. General contractor, G. H. Moineau. For construction of sewers on various streets of Monkland Property. On McGregor Street, Edward III. Blvd., Turenne and Louis Veuillot Sts., awarded to Palermo, Gentile & Co., 20 Imperial Ave, $14,907. Sewers on Lacordaire, Lajoie and Montsabre, north wards, to S. Ricci & Co., 1753 Ave. Chateaubriand, $18,968. Sewers on Adam, Ontario, St. Catherine, Latontaine and Geo. V. Ave., to H. Bertrand, 2727 St. Hubert St., $14,182.50.

Ottawa, Ont.

Pavement, Lakeside Ave., for City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, Ottawa Constr. Co., Central Chmbrs., Elgin St.

Otterville, Ont.

Standpipe, cost $10,000, planned by Town Council. General contractor, Orn. Oatman. Reinforced concrete storage standpipe.

Port Hope, Ont.

The Town of Port Hope have awarded the contract for sewers on Smith, Alexander, Choate, Martha, Margaret, Hope and William Streets to W. G. Gibson, of Port Hope. Lump sum $5,202. Other tenders submitted were G. A. Outram, $5,300, and H. B. McConnell, Oshawa, $8,400.

St. John, N.B.

Walks, etc., planned. Commissioner, H. B. Schofield. 200 ft. ferry piling awarded to Jas. S. Gregory, Portland Point, $1,500. Driving piles, east side, Robt. Roberts & Sons, 52 Cunard Street. Driving piles, west side, S. Herbert Mayes, 235 Winslow, W.E.

Toronto, Ont.

Concrete curbs, Avondale, Beaumont, Bellair, Dufferin, Elm, Nanton, Symington and Wolseley. Mayor, H. C. Hocken. Work to be done by Commissioner of Works, R. C. Harris, by day labor.

Concrete sidewalks. Board of Control. Mayor, H. C. Hocken. Balfour ave., Wm. Ransom, Dineen Bldg. Belsize Drive, A. J. Penberthy, 292 Booth Ave. Brownlow Ave., Bracondale, National Contracting Co., 9 Garnock Ave. Wilfred, Glen, Wm. Bushell, 168 Dundas St. Bradd, Clifton, Carey Rd., Ramsay Contracting Co., 39 Indian Rd. Cres. Geary, Cuthbert, Herbert Mitchell, 464 Brock Ave. Osler, Thorne Cres., Duchess St., A. Gardner & Co., Yonge St. Arcade. McFarland, Somerset, Pleasant Avenue, R. J. Moyes, 592 Gerrard St. E. Rosemount, Britnell Contracting Co., Dupont St. Spadina Rd., Queen City Concrete Paving Co., 176 Broadview Avenue. Waverley Rd., Riverdale Concrete Paving Co., 256 Jones Ave.

Sewer, cost $97,380, planned by Board of Control. Mayor, H. C. Hocken. Contract awarded to Moran Construction Co., Ottawa, Ont., withdrawn and awarded to Fussell, McReynolds & Co., Dundas St., Toronto. Midway Sewer System Outlet.

Asphalt pavement, cost $59,558, planned by Board of Control. Mayor, H. C. Hocken. General contractor, Commissioner of Works, R. C. Harris. Beaumont, Bellair, Browning, Carlaw, Cumberland, Dunn, Elliott, Grange, Wolseley. Bitulithic pavement on Mavety St., $2,505. Concrete pavement on Lane N. of First ave., $1,138. Work day labor.

Wingham, Ont.
Water mains, Edward and Victoria Sts. planned by Town Council. Clerk, J. F. Groves. General contractor, Wm. Guest, at 34c per foot.

Winnipeg, Man.
Sewers planned by Board of Control in Martin Ave. from Kelvin to Brazier St., awarded to Dom. Construction Co., 290 Selkirk Ave., $125.90. Sewers on East side Euclid Ave., from Austin to Lusted, awarded to J. Le Cour, 264 Edmonton St., $114. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Railroads, Bridges and Wharves

Bosanquet Twp., Ont.
Repairs to drain for Twp. Council. Tenders received by Engineer, R. Tedbell, Con. 10, Bosanquet Twp., Thedford P. O., until Oct. 25th for repairs to Sullivan Drain.

Fort Fraser, B.C.
Grand Trunk Pacific Railway has approved of proposed site for station at Fort Fraser, mileage 372.8 from Prince Rupert E. in Sec. 26-15-5, Coast District.

Ottawa, Ont.
Temporary bridge, cost $10,000 to $15,000, Bank St., for City Council and County of Carleton. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders to be called shortly.

Province of Ontario
Canadian Northern Ontario Railway has been authorized to construct bridge over White's Creek, mileage 64.9 from Toronto.

Peterboro, Ont.
Dam for Dom. Govt. Dept. of Railways and Canals. Tenders received by Sec., L. K. Jones, Ottawa, until 12 o'clock noon, Oct. 31st., for Nassau Dam, Trent Canal. Plans, etc., at office of Chief Engineer of Dept., Ottawa, and Superintending Engineer, Trent Canal, Peterboro.

Rainy River, Ont.
Pile protection work planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders received until Nov. 17th. Plans at office of Dept., F. Y. Harcourt, Port Arthur, J. G. Sing, Toronto, Postmaster, Fort Francis. 800 lineal feet round pile and sheet pile protection work anchored and braced.

Washago, Ont.
Dams and removal of rocks, Severn River, for Dom. Govt, Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Nov. 10th. Plans, etc., at office of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, J. H. Armstrong, Dist. Engineer, Midland, Ont., Postmaster, Washago, and at Dept., Ottawa.

CONTRACTS AWARDED

Annapolis Royal, N.S.
Five ice piers, cost $34,700, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Engineers & Contractors, Limited. Managing Director, E. M. Archibald, Middleton. Work to be finished in spring.

Ft. William, Ont.
Addition to car barns, cost $40,000, Walsh, for City Council. Architect, City Engineer. General contractor, P. J. Donahue, Cameron Block, S. May St.

Hamilton, Ont.
Freight shed, cost $5,000, Main and Catharine Sts., for Dom. Power and Transmission Co. Supt., Geo. E. Waller. General contractor, Geo. E. Mills, 614 King St. E. Brick and steel construction, concrete foundation, felt and gravel and galvanized iron roofing.

Ingersoll, Ont.
Freight shed, cost $15,000, for C. P. R. General contractors, John Hayman & Sons, Ltd., St. George Apts., London. One storey, 145 x 55, red brick construction, concrete foundation.

Montreal, Que.
Extension of arch now at Glen Yards to accommodate 4 tracks, cost $50,000, Westmount, for Can. Pacific Railway, Montreal. General contractors, Jno. S. Metcalf Co., 54 St. Francois Xavier St.

North Sydney, N.S.
Store and office, cost $15,000, for McCallum & McMillan. Architect, B. A. Huntsman, Sydney. General contractor and mason, F. C. Redding. Carpenter, M. McMillan. Tenders for plumbing received by owners until Oct. 31st. Two storeys, 60 x 53, concrete foundation, reinforced concrete and brick facing construction, felt and gravel roofing.

Sussex, N.B.
Station for Dom. Govt., Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, British American Construction Co., Ltd., Prince William St., St. John, N.B.

Station planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Chief Engineer, Mr. MacKenzie, Moncton, N.B. General contractors, British American Constr. Co., Ltd., Prince William St., St. John, N.B. Company's Engineer, Jno. Baughan.

Sydney Mines, N.S.
Coal washing plant, cost $35,000, Nova Scotia Steel & Coal Co., H. O. General manager, T. J. Brown, Sydney Mines, New Glasgow. General manager, H.O., Thos. Cantley, New Glasgow. Purchasing agent, W. G. Stanfield, Trenton, N.S. General contractors, owners will do all work. Concrete foundation, reinforced concrete bins, new machinery required.

Victoria Harbor, Ont.
Wharf planned by Dom. Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa. General contractors, McFarlane-Pratt-Hanly, Ltd., 43 Scott St., Toronto.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
City Hall, cost $150,000, Queen and Dalhousie streets, planned by City Council. Clerk, H. F. Leonard. The buildings and grounds committee asked architect, L. H. Taylor, Hope Chambers, to prepare plans. By-law may be submitted to ratepayers in January.

Sunday school, cost $7,000, St. Paul Ave., planned for Baptist Church. Pastor, Rev, Thos. E. Richards, 110 Chestnut Ave. Architect, L. D. Barber, Temple Bldg. Tenders will not be called before December.

Burnaby, B.C.
School, cost $75,000, Vancouver Heights, for School Board. Sec., A. J. Barham. Eight rooms, fireproof and concrete construction. Will allow for double extension. Plans in progress.

Clinton, Ont.
Skating rink, cost $10,000, for Robert Trench, Teeswater, Ont. Steel and frame construction, electric lighting, concrete floors. Plans in progress.

Duck Lake, Sask.
Town Hall, cost $11,000, planned by Town Council. Mayor, Paul Ashby. Sec.-Treas., J. A. Perrit. By-law to authorize the raising of sufficient funds to complete the Town Hall was passed by burgesses.

Exeter, Ont.
Post office, cost $30,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. White brick and cut stone construction. Plans ready.

Forest, Ont.
Post office, cost $25,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans in progress.

Gananoque, Ont.
Interior fittings, post office, King St. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Oct. 23rd. Plans and specifications at office of W. N. Rogers, Clerk of Works, Public Bldg., Gananoque, T. A. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at Dept., Ottawa.

Gaspe Basin, Que.
Public building for Dom. Govt. Dept. of Public Works. Tenders close with Sec., R. C. Desrochers, Ottawa, Oct. 27th. Three storeys and tower, 58 ft. 10 in. by 35 ft. 10 in., stone foundation, brick construction.

Halifax, N.S.
Tenders addressed to Alex. Johnston, Deputy Minister of Marine and Fisheries, Ottawa, will be received until Dec. 15th for the construction of a wooden lighthouse and dwelling and boathouse combined, at Beaver Harbor, Halifax County. Plans, specifications, etc., at this Dept., Ottawa and Halifax, and Post Of-

fices, Beaver Harbor, Sherbrooke, Isaac's Harbor and West River Street Harbor.

Lindsay, Ont.
Addition and alterations to post office planned by Dom. Govt., Dept. Marine & Fisheries. Secretary, R. C. Desrochers, Ottawa. Tenders received by secretary until November 5th. Plans, etc., with Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto; Post Office, Lindsay, and at Department, Ottawa.

Montreal, Que.
Fire and police station, cost $85,000, Bois de Boulogne. Board of Commissioners. Secretary, L. N. Senecal. Architect, C. A. Reeves, 58 St. James Street. Tenders received from Picard & Balin, $90,000, A. Pion, $110,000, A. Gratton, $106,879.

Hospital, Inspector and St. Antoine, planned by Montreal Dispensary. Dr. A. Vipond, St. Antoine and Inspector. New building is contemplated as present one is too small.

Club House for Grand Trunk Boating Club, W. Jennings, Verdun. Plans in progress.

Old Peoples' Home, cost $250,000, St. Laurent, contemplated for Grey Nuns, Guy and Dorchester Sts., Montreal. Architect, A. Piche, Victoria Bldg., Victoria Sq., Montreal. Plans to be drawn up this winter and tenders called in spring. Three storeys, 300 x 80, concrete foundation, reinforced concrete construction, Spanish tile roofing.

Church, Decarie Blvd., contemplated for St. Luke's Congregation, care W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg. Plans will be ready to call for tenders about Nov. 1st.

School, Maisonneuve (4th Ave.), contemplated by Board of School Commrs. Site purchased and plans will be prepared.

Nanaimo, B.C.
Addition to post office, cost $25,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders will be called shortly for addition of two storeys.

Chlorination buildings, cost $7,000, Lemieux Island, planned by City Council. Mayor, J. A. Ellis. City Engineer, Archibald Currie. Asst. Waterworks Engineer, A. N. Beer expects to have plans prepared and tenders called in about two weeks.

Orillia, Ont.
Addition and alterations to public building. Tenders received by Dom. Govt., Dept. of Public Works, R. C. Desrochers, secretary, Ottawa, until Nov. 5. Plans, etc., at office of Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, Postmaster, Orillia, and at Department, Ottawa.

Regina, Sask.
Drill hall planned by Dom. Govt., Department of Public Works. Secretary, R. C. Desrochers, Ottawa. 272 x 150. Tenders will be called shortly.

Stonewall, Man.

Public building planned by Dom. Government, Dept. of Public Works. Tenders received by Secretary, R. C. Desrochers, Ottawa.

Roberval, Que.
Interior fittings, post office, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Time extended for receiving tenders till November 3rd. Plans, etc., at office of A. Parent, Clerk of Works, Public Bldg., Roberval; Chas. Chapais, Dist. Engineer, Post Office Building, Que., and at Dept., Ottawa.

Toronto, Ont.
Addition to church for St. Hilda's Church Congregation, Fairbank. Tenders open for removal of building and alterations. Plans, etc., with Rev. H. R. Young, 100 Oakwood Ave.

Vancouver, B.C.
Public building planned by Dom. Government, Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders will be called shortly.

William Head, B.C.
Detention building planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, Wm. Henderson, Victoria. Tenders received by Secretary until Nov. 17 for first class detention building.

Winnipeg, Man.
Church, cost $75,000, planned for Maryland St. Methodists. Architect, Jn. Semmens, 905 McArthur Bldg. This project will start in Spring, 1914. Two storeys, 80 x 90.

CONTRACTS AWARDED

Bowmanville, Ont.
Alterations to club house, King street, for Goodyear Tire & Rubber Co. General contractors, H. Gay & Son, Oshawa. Heating and plumbing, R. G. Sturgeon & Co., 202 Charlotte St., Peterboro.

Charlottetown, P.E.I.
Alterations to post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, W. W. Harper, 239 Fitzroy St., $3,000. Concrete work, Jno. Power, Cumberland St. Concrete floors, elevators, dumb waiters.

Cobalt, Ont.
Church, cost $10,000, for R. C. Congregation (Cure Arsenault). Architect, Eugene Payette, 103 St. Francois Xavier St., Montreal. Owner doing all work by day labor.

Edmonton, Alta.
Church, cost $70,000, 23rd, for Robertson Presbyterian Church. Pastor, D. G. McQueen, 408 4th St. General contractor, R. Grant, 1626 Jasper Ave. W. Mason, Jack Meatin, 20th St. Painting not let. Plumbing and heating, McKnight & Frost, 9th St. Work done by day labor under supervision of General Contractor. One storey, 96 x 135, red brick and stone construction.

Ft. William, Ont.
Addition to orphanage, cost $25,000, Franklyn, for Roman Catholic Denomination. Architect, H. R. Halton, Port Arthur. General contractor, C Mathieu, Ft. William. Mason, Street Bros., Ft. William. Heating and plumbing, Superior Heating & Plumbing Co., Ft. William.

Fredericton, N.B.
Normal School Annex, cost $45,000, planned by Prov. Govt., Dept. of Public Works. Commissioner, Hon. Jno. Morrissey. General contractor, J. Fred Ryan, Regent St. Walls partly up.

Post office for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Falconer & McDonald, 59 Granville St., Halifax, N.S. Steel, Mr. O'Neil, Pictou, N.S.

Glace Bay, N.S.
Hospital, cost $60,000, planned by Gen. Hospital Board. Chairman Building Committee, N. McKenzie. Architect, Geo. Beckwith, Sydney, N.S. General contractors, Chappell Bros. & Co., Sydney. Three storeys. Walls up.

Kentville, N.S.
Skating rink, cost $11,000, for The Kentville Arena Co. Pres., T. P. Calkin. General contractor, Arthur B. Ward. Ice surface, 70 x 170, building, 190 x 90 x 52 ft. high, will contain ball room, dressing rooms, etc. To be completed in November.

St. John, N.B.
Sunday school building, for Germain St. United Baptist Church. Pastor, F. S. Porter, Queen St. General contractor, R. A. Corbett, Douglas Ave. Heating and plumbing, Jas. McPartland, 25 Nelson Street.

Sudbury, Ont.
Rink for Sudbury Curling Club, Ltd. Sec., L. Lambe. Architect, W. W. Workman, 8 Johnson Block. General contractors, LaBerge Lumber Co., Ltd.

Truro, N.S.
Church, cost $60,000, for First Presbyterian and St. Pauls United Congregations. Sec. of Bldg. Com., H. A. Dickie, Royal Bank Bldg. Architects, Curry & Sparling, 105 Bond St., Toronto, Ont. General contractors, Wilson's Ltd., Truro. To be completed by Nov. 1st, 1914. Grey stone and pressed brick construction.

Toronto, Ont.
Church, cost $60,000, Glen Road, for Northern Congregational Church. Pastor, Rev. F. J. Day, 19 Edgar ave. Arch., John Gemmell, 23 Jordan St. Masonry, Elgie & Page, 18 Toronto St. Brick and stone construction, stone foundation.

Market building, cost $18,916, St. Patricks, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Teagle & Son, 55 Boswell avenue. Excavating, E. Corner, 698 Manning ave.

Winnipeg, Man.
Drill hall, cost $519,929, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Architect, owners. General contractors, Carter-Halls-Aldinger, Union Bank Bldg. Excavating started.

Theatre, Market St., for Paterson & Cass, Canada Bldg. Architect, G. W. Northwood, Northern Crown Bank Bldg. General contractors, J. McDermott & Co., Canada Bldg.

Woodstock, N.B.
Library and Agricultural College, cost $70,000, for Estate of L. P. Fisher, (Alison Connell, Woodstock, N.S.) Architect, G. E. Fairweather, 13 Germain St., St. John. General contractor, J. Fred Ryan, Fredericton. Library walls up one storey, plastering and trimming college.

Business Buildings and Industrial Plants

Bridgewater, N.S.
Creamery for LaHave Creamery Co., Ltd. Tenders received by J. W. Hebb,

Hebbs' Cross, until Oct. 25th, for foundation and building separately or together, concrete foundation, wood construction.

Calgary, Alta.

Warehouse, cost $14,500, planned for Gray, Campbell, Ltd. Work to be done by day labor under supervision of J. J. O'Gara.

Chatham, Ont.

Remodelling mill of Canada Flour Mills Co., planned. Architects, Adam & Adam. Frame building to be replaced by steel and brick work.

Ft. William, Ont.

Orpen Conduit Co., 165 King St. W., Toronto, intend erecting a plant here. Additional information shortly.

Hamilton, Ont.

Factory, Park St. S., for J. & H. Davis, 2 Park St. S. Three storeys, 40 x 92. Plans being prepared.

Midland, Ont.

Malleable iron works planned for Edward Jno. Vanderboom. By-law carried by ratepayers granting loan of $60,000 to Owner. Concrete construction and foundation, waterproofing.

Montreal, Que.

Two stores and flats, cost $9,000, Sherbrooke ave., for Alb. Messier, 15 King Edward ave. Architect, Jos. Dubreuil, Sherbrooke ave. Two storeys, 36 x 44, concrete foundation, felt and gravel roofing. Plans ready.

Artificial ice plant contemplated, Westmount (Hillside), for The Centerfreeze Sanitary Ice Co., Ltd., 601 Merchants Bank Bldg., Montreal. Architect to be appointed after December 1st.

Bank, St. Lawrence and Mt. Royal, for Bank of Montreal, 40 St. James St. Architects, Barott, Blackader & Webster, New Birks Bldg. Work will not start till spring. Two storeys, 40 x 70.

Factory, cost $9,000, for Fyon & Fyon, 288 Garnier St. Architects, Benoit & Girard, 215 St. Catherine W. Work will not be started till spring. Two storeys.

Store and flats, cost $7,500, Smith and Gallery, for Jos. Ward, 115 Youville Sq. Architect, Jos. Sawyer, 407 Guy street. Architect will call tenders for General Contractor at once. Three storeys, 42 x 25, stone and concrete foundation, stone and brick construction.

Metals, Ltd. (Mr. Glass), 30 St. James St., contemplate the erection of a factory.

New Westminster, B.C.

Addition to hotel, cost $8,000, planned by an English Estate. Representative, J. Hutchison. Architects, Gardiner & Mercer, O. West Trust Block. Brick construction, Paris specification, roofing, electric lighting, plumbing. To be completed by January 1st, 1914.

St. Marys, Ont.

Addition to factory. Architects and Owners, C. Richardson & Co. (Dairy Machinery Mfrs.). Four storeys, 40 x 70, white brick construction. Plans ready.

Thorold, Ont.

Store, cost $5,000, contemplated for J. A. Sneath, Albert St. Architect to be selected. Two storeys, white brick construction, stone and concrete foundation.

Villeray, Que.

Store and flats, cost $8,000, planned for Mr. Auger, St. Hubert St., Villeray. Architect, Z. Trudel, 238 St. Andre St., Montreal. Plans will be ready to call for tenders in about two weeks. Concrete foundation, comp. paper roofing, brick construction.

Vancouver, B.C.

Addition to warehouse, cost $10,000, 1198 Helmcken St., for Gray Bros., 402 Pender St. Plans ready.

Winnipeg, Man.

Storage warehouse contemplated for Big Four Transfer Co., 341 Bannatyne ave. President, Jas. Lightfoot. Architect not selected. Building will probably go on next year.

CONTRACTS AWARDED

Brandon, Man.

Warehouse, cost $8,925, 1st St. N., for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. One storey, 30 x 62, brick construction, concrete foundation.

Bridgeburg, Ont.

Factory, cost $20,000, Lewis, for Mentholatum Co., Bridgeburg. General contractors, Turner Constr. Co., Buffalo, N. Y. Plumbing and electrical, Flanders Mfg. Co., Bridgeburg. Three storeys, 60 x 70, brick and reinforced concrete construction.

Calgary, Alta.

Remodelling bank, stores and offices, cost $20,000, 8th ave., for Royal Bank of Canada, Montreal, P.Q. Architect, Kenneth Rea, Montreal, P.Q. General contractors, Purvis & Henderson, Vancouver. This work is the remodelling of the old Hudson Bay Stores. Two storeys, 100 x 130.

Warehouse for Alaska Bedding Co. General contractors, Carter-Halls-Aldinger Co., 7th and 1st St. W. Plumbing and heating, Wm. Head Co.

Garage, cost $6,000. General contractors and Owners, Calgary Brewing Co. One storey, 42 x 92, reinforced concrete construction.

Edmonton, Alta.

Stores and apartments, cost $20,000, Stoney Plain Rd. Architect and Owner, G. P. Dobson, 119 Jasper Ave. W. General contractor, N. B. Eby, 304 Nelson Ave. Two storeys, 40 x 80, mill brick construction, concrete foundation.

Offices, cost $7,500, Jasper Ave., for E. L. Ferris, 43-5 Jasper Ave. E. Architect and general contractor, J. R. Ferris, 43-5 Jasper Ave. E. Two storeys, concrete block and brick construction.

Two stores and apartments, cost $5,000, 24th, for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Plumbing and heating, Modern Heating & Plumbing Co., 45 Morris St. Elec., Burnham Frith Elec. Co., Rice St. Two storeys, 32 x 52, brick veneer construction.

Stores, cost $4,000, 4th Ave. N., for Jno. Fering, 463 2nd Ave. S. W. Architect and general contractor, Owner. One storey, 38 x 66, frame construction.

Store and rooms, cost $7,000, Alberta, for Dr. Campbell, 550 14th St. General contractor, E. D. Williams, 1214 26th St. Two storeys, 30 x 60, frame construction, concrete foundation. Excavating done.

Store and residence, cost $5,000, Alberta. Architect and general contractor, W. Clure. 650 Sinclair. Two storeys, 36 x 36, frame and brick veneer construction, concrete foundation. Excavating started.

Ft. William, Ont.

Nail plant, cost $110,000, Montreal St., for Steel Co. of Canada, Montreal, Que. Architects and general contractors, Prack & Perrine, 38 James St. S., Hamilton.

Business block, cost $20,000, Simpson, for T. W. Bowlker, c/o G. R. Duncan. Architect and general contractor, Henry Russell. Two storeys, 50 x 80.

Hamilton, Ont.

Factory, cost $18,000, Bay and Vine streets, for Duncan Lithographing Company, McNab St. S. General contractor, W. H. Yeates, Jr., 18 Leeming St. Two storeys, brick and steel construction, concrete foundation.

Warehouse, cost $40,000, City Dock, for Harbor Commissioners. Chairman, Geo. J. Guy. General contractor, W. H. Yeates, Jr., 18 Leaming St. Steel, Hamilton Bridge Works, Stuart St. Building to be completed March 1st, 1914. Steel construction.

Addition to garage, cost $5,000, Bay St. N. General contractors and Owners, Auto Garage Co., 80 Bay St. N. One storey addition, 90 x 60, brick construction.

Warehouse, cost $8,000, King St. W., for Gore Realty Co., Federal Life Bldg. General contractor, Geo. E. Mills, 614 King St. E. Three storeys, brick construction, stone and concrete foundation.

Alterations and addition to warehouse, cost $6,000, McNab St. N., for Walter Woods & Co., McNab St. N. General contractor, Geo. E. Mills, 614 King St. E. Two storeys addition, brick construction.

Lindsay, Ont.

Addition to machine shop and garage, William St., for R. F. Thomas, Lindsay Machine Works. General contractor and carpenter, Jos. Grozelle. Mason, James Baldwin. Painting, Geo. McFadden. Electrical, Owner. One storey addition, brick construction.

McAdam Jct., N.B.

Machine shop, cost $45,000, for C. P. R. Engineer, Geo. Wetmore, King St., St. John, N.B. General contractor, Henry Post, Woodstock, N.B. Painting day labor.

Montreal, Que.

Store and flats, cost $6,500, 2122 Main, for Gelinas Freres, 1958 Main. Architect and general contractor, J. D. Blais, 50 St. Zotique. General contractor doing work by day labor. Three storeys, 25 x 74, concrete foundation.

Garage, cost $5,000, 709 Sherbrooke N., for Marcil Trust Co., 180 St. James. Architect, Mr. Harris, c/o Owner. General contractor, Wm. Irving, Guy Block. Heating and plumbing, Alex. J. Mearns, 109 Fairmount. Elec., J. C. Duff, 35 Metcalf St. Concrete foundation, solid brick construction.

Garage, cost $8,000, Westmount (Mt. Crescent Heights), for N. P. Bryant, 84 St. Francois Xavier. Architect, R. E. Bostrom, McGill Bldg., McGill St., Montreal. General contractor, C. Blakely, Argyle Ave., Westmount. Two stys., 25 x 40.

Factory, cost $9,000, Canal Bank, for Canada Sugar Refining Co., St. Patrick

St. General contractors, The Jas. Shearer Co., Ltd., 225 St. Patrick St. Roofing, Hickey & Aubut, 93 Dominion. One storey, 56 x 100, brick construction. Foundations in.

Nanaimo, B.C.
Warehouse, Prideaux St., for The Nanaimo Pressed Brick & Terra Cotta Co. General contractors, McRae Bros. 40 x 60.

New Westminster, B.C.
Hotel, cost $20,000, Liverpool Arms, for T. Ovans. Architects, Gardiner & Mercer, O. West Trust Block. Four storeys, Paris specification, brick and concrete construction. Plans ready.

Hotel for Swanson & Hausen, Occidental Hotel, 718 Columbia St. Architects, Gardiner & Mercer, O. West Trust Block. General contractors, Miller & Jewhurst. Plumbing and heating, H. Archibald. Four storeys, reinforced concrete construction, concrete foundation, Barretts Specif. roofing, electric lighting, hot water, heating, plumbing (Durham System).

Ottawa, Ont.
Stores and offices, cost $150,000, Rideau, for Blackburn Bros., Creighton St. Architect, W. E. Noffke, Central Chambers. Carpenter, Smith Bros., 310 Flora. Steel work up, brick facing up to 4th storey.

Regina, Sask.
Printing office, Halifax, for Saskatchewan Courier, 104 Northern Bank Bldg. Manager, F. Brewgmann. General contractors, Parsons Construction & Engineering Co., Ltd., 1712 Scarth Street.

St. Marys, Ont.
Addition to factory for C. Richardson & Co. Architect, C. E. Richardson, Jr., care owner. Mason, John Barry. Carpentry and heating, owner. Four stys., 70 x 40.

St. John, N.B.
Bank building for Bank of British North America. Architect, G. E. Fairweather, 84 Germain. General contractors, B. Mooney & Sons, 112 Queen.

Stratford, Ont.
Addition to factory, cost $25,000, Erie, for Can. General Electric Co., King and Simcoe Sts., Toronto. Local manager, W. Preston. Architect, J. S. Russel, 21 Downie St. General contractor, J. L. Youngs, Stratford. Three storeys, 50 x 161.

Toronto, Ont.
Stable and garage, cost $5,000, Aylmer Ave., for Britnell Contracting Co., Ltd., 209 Davenport Rd. Architect, N. G. Beggs, 12 Cosgrave Bldg. General contractors, Owners. Two storeys, 44 x 80, brick construction and foundation.

Winnipeg, Man.
Hotel, Smith, for Olympia Cafe Co., 277 Portage Ave. Architects, Jas. Chisholm & Sons, Enderton Bldg. General contractors, Carter-Halls-Aldinger, Union Bank Bldg.

Addition to stables, cost $50,000, Burnell St., for Canada Bread Co., Portage and Burnell. Architect, c/o Owners. General contractors, Gray & Davidson, Wall and Portage.

Addition to hotel for Canadian Pacific Rly. Co. General contractors, Westinghouse Church Kerr Co. Terra cotta, Dom. Fireproofing Co., Ltd., 503 Confed. Life Bldg. All other work done by General Contractor.

Stables, cost $45,000, Alexander Ave., for Dominion Express Co. Architects, Woodman & Carey, Lindsay Bldg. General contractors, Carter-Halls-Aldinger, Union Bank Bldg.

Residences

Hamilton, Ont.
Residence, cost $10,000, Mountainview Survey (Mountain Top), for Cooke & Goulding, Federal Life Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. 2½ storeys, 30 x 38, brick construction. Plans ready.

Montreal, Que.
Residence, cost $5,000, Northcliffe, for J. Choquette, 460 St. Herbert. Two storeys, 24 x 38, concrete foundation, felt and gravel roofing. Permit issued.

Residence, cost $20,000, Outremont (Querbes) for M. Dagenais, 1055 Laurier Ave. W. Architect, L. R. Montbriand, 230 St. Andre. Tenders to be called shortly for sub-contracts. Three stys., 50 x 72, brick construction.

Ten flats, cost $5,500, St. Germain, for E. Ladouceur, 2735 St. Hubert. Three storeys, 50 x 40, concrete foundation, felt and gravel roofing. Permit issued.

Six flats, cost $9,000, St. Jerome, for P. Labelle, 45 Marquette. Two storeys, 40 x 50, concrete foundation, felt and gravel roofing. Plans ready.

Eight flats, cost $7,000, De La Roche, for R. S. Charlebois, 1234 St. Hubert. Three storeys, 50 x 35, concrete foundation. Plans ready.

Six flats, cost $5,000, Paris, for Alf. Libeau, 30 Soulanges. Three storeys, 30 x 45, concrete foundation. Plans ready.

Eight flats, cost $9,000, Chambly, for L. O. Jalbert, 77 Chambly. Three stys., 26 x 26, concrete foundation. Plans ready.

Nine flats, cost $5,000, Aylwin, for J. V. Gagnon, 1851 Notre Dame W. Three storeys, 45 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Montreal West, Que.
Cottage, cost $8,000, for A. Brunet, Montreal. Architects, Benoit & Girard, St. Catherine and Bluery Sts., Montreal. Plans are to be finished this winter and work start in spring. Three storeys, concrete foundation, brick veneer construction.

New Westminster, B.C.
Apartments, cost $80,000, for J. H. Hanky, Vernon, B.C. Plans in progress.

Ottawa, Ont.
Residence, cost $4,800, Hopewell, for W. E. Hawkins, 41 Hopewell. Double brick veneer construction, stone foundation. Plans in progress.

Residence, cost $5,000, 3rd ave., for J. W. Nelson, 130 3rd ave. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $10,000, Monkland, for E. I. Shuttleworth, 24 Euclid St. Architect, A. L. Weeks, Can. Life Bldg., Sparks St. Solid brick and stucco construction, stone foundation. Plans ready.

Residence, cost $7,000, Goulborne, for Jas. S. Wilson, 256 Kent St. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $4,800, Turner, for W. O. O'Byrnes, 577 Arlington. Two stys., double brick veneer construction. Plans being prepared.

Ottawa South, Ont.
Residences, cost about $5,000 each, for Oakland Land Co., c/o J. Spratt, Bank St. Several residences to be built. Brick veneer construction, stone foundation. Plans in progress.

Toronto, Ont.
One detached residence, cost $5,000, Melgund Rd., for Geo. E. Dunning, 691 Ontario St. Architects, Chadwick & Beckett, 18 Toronto St. 2½ storeys, 24 x 33, hollow tile and brick construction, brick foundation. Plans drawn.

One pair residences, cost $8,500, Roxborough, for Ellis & Connery, 209 Manning Chambers. Two storeys, 40 x 48, brick construction, brick foundation. Plans drawn.

Six pair residences, cost $24,000, Boston Ave., for J. A. Gallagher, Langley and Broadview. Two storeys, 33 x 42, brick construction. Plans in progress.

One detached residence, cost $5,000, Fernwood, for R. H. King, 1109 College St. Two storeys, 26 x 44, brick construction and foundation. Plans drawn.

CONTRACTS AWARDED

Brandon, Man.
Five cottages, cost $20,000, 1st N., for Prov. Govt. Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. Plumbing and heating, Mitchell and McGregor, Brandon. One storey, 28 x 42, frame construction, concrete foundation.

Calgary, Alta.
Residence, cost $9,000, Mt. Royal. Owner and builder, H. J. Rowan, 825 14th ave. west. Two storeys, 30 x 39, frame construction. Foundations in.

Residence, cost $12,000. General contractor and Owner, R. H. Rowan, 825 14th Ave. W. 2½-storeys, 30 x 39, brick veneer and stucco construction. Garage in rear, 11 x 28.

Apartment house, cost $20,000, for O. G. Anderson, 1215 12th Ave. W. Architect, Burroughs & Richards, 11 Crown Block. General contractor, Supt., A. P. Hindleman. Two storeys, 100 x 40, brick veneer construction.

Residence, cost $6,000, for J. J. O'Gara, MacLean Block. General contractor, W. Cunningham. Two storeys, 26 x 39, frame construction.

Edmonton, Alta.
Residence, cost $5,000, 21st. Architect and Owner, M. McInnes, 528 McKay Ave. General contractor, R. Gilles, 636 21st. 1½ storeys, 30 x 33, frame construction.

Residence, cost $7,000, 26th, for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Plumbing and heating, Modern Heating & Plumbing Co., 45 Morris St. Elec., Burnham Frith Elec. Co., Rice St. Two storeys, 30 x 32, brick and frame construction.

Residences, cost $5,000 each, 26th for C. R. Horne, 886 24th St. Architect and general contractor, Owner. Two stys.,

(Continued on page 74)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Milverton, Ont.," will be received until 4 p.m., on **Monday, November 3, 1913**, for the construction of a Public Building at Milverton, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the office of J. S. Russell, Esq., Architect, Stratford, Ont., at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Milverton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45635. 42-43

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m. on **Wednesday, November 5, 1913**, for the construction of a Public Building at Lakefield, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. -49240. 43-44

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Orillia, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Orillia, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C.DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47491. 43-44

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 4th, 1913**, for the construction of the following sewer:

Division No. 2, West Toronto, Contract No. 3.

Outlet from Keele St. and Uttley Park to Quebec and Annette via Uttley Park, Hillsview Ave., Medland Crescent, Humberside Ave. and Quebec Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender, the names of two sureties (approved by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 15, 1913. 43

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Friday Noon, October 31st, 1913.

for the several trades required in the

Enlargement of Ryerson School.

Fresh Air Class Room on Roof of Hester How School.

Heating, Plumbing and Electric Wiring at Parkdale, Shirely and Kimberley Schools.

Plastering at Kimberley School and Black Loam at Sundry Schools.

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.

W. C. WILKINSON,
43 Secretary-Treasurer,

Department of Railways and Canals, Canada

Trent Canal

Notice to Contractors

Nassau Dam

Sealed tenders, addressed to the undersigned and marked "Tender for Nassau Dam, Trent Canal," will be received at this office until 12 o'clock noon on **Friday, October 31st, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of Superintending Engineer, Trent Canal, Peterborough, Ont.

An accepted bank cheque for the sum of $10,000.00 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order.
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,

Ottawa, 13th October, 1913.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—49189. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Pile Protection Work, at Rainy River, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913**, for the construction of a Pile Protection Work, at Rainy River, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; and on application to the Postmaster at Fort Frances, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works.
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48052. 43-44

FOR SALE OR RENT

One ten-ton Ruston-Proctor Steam Roller, good as new.

RIGBY & ANDRUS,
43 St. Catharines, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913**, for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47820. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Lindsay, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Lindsay, Ont., and at this department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47381. 43-44

To Contractors

Sealed tenders, endorsed "Tender for Plumbing," addressed to the undersigned, will be received at this Department up to noon on **Tuesday, the 28th day of October**, for the heating and poultry building at the Ontario Agricultural College, Guelph. Plans and specifications can be seen at this Department, and at the above Institution. An accepted bank cheque, payable to the Honourable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender, and the bona fide signatures and addresses of two sureties, or the name of a Guarantee Company approved by this Department, willing to provide bonds for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,
H. F. McNAUGHTEN,
Secretary Public Works Department.
Department of Public Works, Ontario.
Toronto, 17th October, 1913.

Newspapers publishing this advertisement without authority will not be paid for it. 43

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Positions Vacant

WANTED -Capable Machinery Salesman only experienced applicants considered. Position offers good opportunity for advancement. Advise experience, present occupation and salary expected.

T. FLEMING,
340 Sparks Street,
43 Ottawa, Ont.

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 71)

24 x 35, brick construction, concrete foundation. Owner is building 2 other residences, value $5,000. Will be finished about Dec. 15th.

Hamilton, Ont.

Apartment house, cost $25,000, Charlton Ave. and Bay St., for L. Donaldson, 229 Bay St. S. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Day work under supervision of Owner. Three storeys. Plans prepared.

25 residences, cost $50,000, Herkimer St. General contractors and Owners, H. Day & Co., 323 Queen St. S. 2½-stys., brick and cement block construction.

Residence, cost $5,000, St. Clair Ave., for G. M. Jones, 129 Victoria Ave. N. General contractor, A. Heatley, 7 East Ave., S. Brick construction, cement block foundation.

Three residences, cost $10,000 each, Inglewood Drive, for S. McPhie and L. Donaldson, 701 Bank of Hamilton Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Mason, Geo. E. Mills, 614 King St. E. Carpentry, Donaldson & Patterson, 229 Bay St. South. 2½ storeys, pressed brick and cut stone construction, stone foundation.

Montreal, Que.

Two flats, cost $12,000, 189 Vendome. Owners and general contractors, D. H. Scott & Co., 148 Vendome ave. Two storeys, 25 x 52, concrete foundation, brick construction, felt and gravel and corrugated iron roofing. Permit issued.

Flats, cost $10,000, Notre Dame ave., for V. Trudeau, St. Lambert. General contract not awarded. Concrete foundation, frame and brick construction. Excavating started.

Two flats, cost $6,000, Clifton. Owner and general contractor, D. Blay, 162 Geo. E. Cartier Sq. Two storeys, 25 x 36, concrete foundation, felt and gravel roofing.

15 flats, cost $15,000, Richelieu, for J. P. Tremblay, 341 Oxford Ave. Architect, R. Charbonneau, 15 St. James St. General contractor, Owner, will probably call for tenders on some trades. Three storeys, 80 x 68, concrete foundation.

Residences, cost $15,000, Outremont (Durocher), for W. Boileau & Frere, 332 Chambord. Architect, Chas. Bernier, 70 St. James St. Builders, Boileau & Frere. Three storeys, 50 x 75, cement foundation, brick construction.

Flats, cost $6,000, Lachine (La Salle Park), for Mr. Leblanc, St. James and 17th Ave., Lachine. Architects, Benoit & Girard, St. Catherine and Bluery Sts. General contractor, Owner. Day labor. Three storeys, concrete foundation, brick construction.

Four flats, cost $10,000, Bordeaux, for Lapointe & Pilon, 1101 Ontario E. General contractor, Owner. Day labor. Three storeys, 23 x 85, concrete foundation.

Residences, cost $8,000, Melrose Ave., for A. Halcro, 260 St. James St. General contractor, J. H. Lebocuf, Montreal W. Two storeys, 24 x 25.

Residence, cost $42,000, Westmount (Mt. Crescent Heights), for N. P. Bryant, 84 St. Francois Xavier. Architect, R. E. Bostrom, McGill Bldg., McGill St., Montreal. General contractor, C. Blakely, Argyle Ave., Westmount. Three storeys, 30 x 65.

Residence, cost $7,000, Vendome, for J. S. Cameron, 46 St. Luke St. General contractors, Anglins, Ltd., 65 Victoria. General Contractors doing all trades. One storey, 25 x 39, concrete foundation.

Cottage, cost $8,000, Apt. 8 Vendome, for J. W. Brown, 65 Summerhill Ave. Architects and general contractors, Archambault & Conway, 332 Bleury St. Tenders are being called now for painting, heating and plumbing. General Contractor doing all other trades by day labor. Two storeys, 25 x 50, concrete foundation, stone and brick construction.

Ottawa, Ont.

Residence, cost $5,500, Flora, for D. L. Morrison, care General contractor, S. J. Hunt, 170 Arlington. Two and a half storeys, double brick veneer construction, stone foundation.

Residence, cost $5,000, Daly Ave., for Mrs. John Clarey, c/o General Contractor. General contractor, M. J. O'Connor, 495 Somerset. Double brick veneer construction.

Quebec, Que.

Flats, cost $14,000, St. Cyrille, for E. C. Brochu, 166 Lockwell St. General contractor and mason, E. C. Brochu, 166 Lockwell. Foundation only to be built this fall. Three storeys, 69 x 36, concrete foundation, steel beams, frame, red and Scotch brick construction.

Flats, cost $17,000, Richelieu, for Jno. Perkins, 22 St. Louis Rd. Architect, J. A. Pageau, 528 St. Valier. General contractor, O. Legare, 234 Massue. Other trades not yet awarded. 3½-storeys, 175 x 35, concrete foundation, Scotch brick construction.

Regina, Sask.

Residence, cost $5,000, Robinson street. Owner and general contractor, G. Middleton, 2169 McIntyre St. Brick and frame construction, brick foundation.

Toronto, Ont.

Residence, cost $16,000, Warren Rd., for J. E. Atkinson, Toronto Daily Star. Architects, Langley & Howland, 157 Bay St. Mason, Albert Webb, 13 Shirley Ave. 2½ storeys, 46 x 80, brick and stone construction, slate roofing. Walls started.

Two pair residences, cost $9,000, Earl Gray Road. General contractor and Owner, Dr. J. A. Gallagher, Langley and Broadview. 2½-storeys, 36 x 42, brick construction and foundation.

One detached residence, cost $6,000, Russell Hill Road, for R. G. Brown, 41 Admiral Road. Mason, Bert E. Brobyn, 153 Campbell Ave. Carpenter, Booth & Co., 249 Davenport Road. 2½-storeys, 24 x 34, brick construction and foundation.

One detached residence, cost $7,000, Foxbar Rd., for Mrs. Geo. Acheson, 77 Essex Ave. General contractor, Chas. Parker, 17 Boswell Ave. 2½-storeys, 24 x 33, brick construction, stone foundation.

Winnipeg, Man.

Apartment block, Wellington avenue, for E. Kline, Suite 3, Victoria Court, William ave. Architect, Edgar Prain, Fort St. General contractors, Daykin Scott Construction Co., 127 Higgins ave. Steel, Manitoba Bridge & Iron Works, Winnipeg. Heating and plumbing, Townsend & Gavin, Portage ave. Roofing, plastering, painting and electric, tenders to be called in November.

Welland, Ont.

Residence, cost $6,000, Merritt, for F. G. Gourlay. Architect, T. L. Nicholls. General contractor, J. E. Cutler. Three storeys, 28 x 34, roughcast construction.

Windsor, Ont.

Residence, cost $10,000, Ouellette, for A. A. Little, Architects, Leybourne & Whitney. Owner will do work. Two storeys, 52 x 32, brick and stucco construction.

Power Plants, Electricity and Telephones

Dundas, Ont.

Electric lighting, for Town Council (Water, Light and Power Commission). Clerk, J. S. Fry. Chairman of Commsn., Mayor, R. W. Karch. Estimates have been submitted to Council. Tenders will not be asked but supplies purchased through Ontario Hydro-electric Commission.

East London, Ont.

Sub-station No. 4, cost $20,000, for Hydro Commission. Chairman, Philip Pocock. Architect, H. J. Glaubitz. Motors, transmitters, etc., required. Two storeys, red pressed brick construction, concrete foundation. Plans in progress.

Mount Hamilton, Ont.

The Dominion Power & Transmission Co., Hamilton. Company propose to construct new 35 or 40 pole line extension for electric light service, etc., on or near Concession St. if permit is granted by County Officials. Further information from E. Coleman, c/o Company, Terminal Station, Hamilton.

Smithville, One.

H. Gracey, furniture dealer, wishes information re cost of plant to generate current for about 1,000 c.p. electric light. Gasoline engine prefererd as form of power, also storage attachment sufficient to provide current for 1 to 2 hours after engine is shut down.

Swift Current, Sask.

Gas wells planned by Town Council. Sec.-treas., G. D. Arnott. Engineer, G. D. Mackie. General contractors, North West Drilling Co., Ltd., Calgary, Alta. $11 per foot for a minimum of 2,000 feet. Contractor must bore 1,500 feet at least. Work to start at once.

Power house, cost $9,310. General contractors, Gillstrom Contracting Co. Work to start at once. Sec.-treas., G. D. Arnott. Eelectrical superintendent, A. V. Ross. Engineer, Geo. D. Mackie.

Winnipeg, Man.

Switching gear required by Board of Control. Engineer, J. G. Glassco, 54 King St. Switch for gear and accessories for generating station at Point du Bois. Tenders received by Board till November 4th.

MacLean Daily Reports Limited

The only systematic method yet devised for reporting BUILDING AND ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.

220 King Street West - TORONTO

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3:57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per/ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Argenteuil Granite Co., Limited
42 Craig Street West, MONTREAL

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Our up-to-date cutting plant, excellent quarries and good shipping facilities enable us to make close prices.

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Some of the cleverest refractionists of the country are with our organization and their skill and experience is at the disposal of our customers.

If you have a lighting problem—bring it to us and we will show you how it can be solved.

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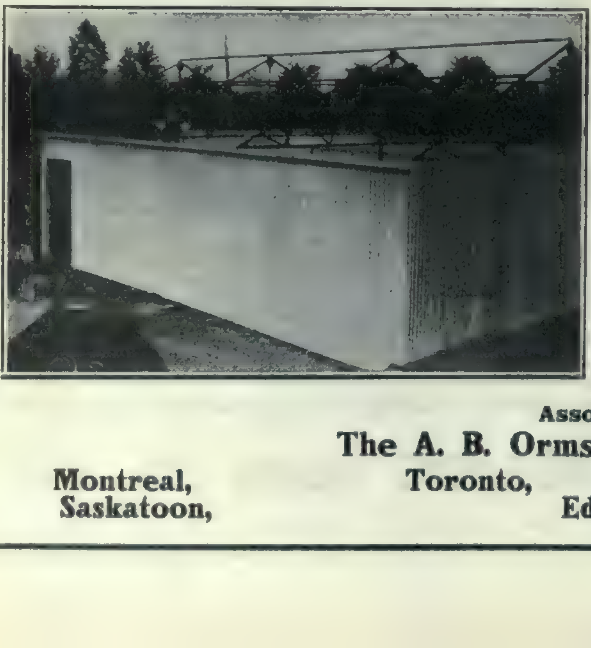
¶ We have the best possible facility for making all kinds of storage houses of one storey, no matter of what dimensions.

¶ We will undertake to furnish and erect such buildings complete ready for occupancy.

¶ No steel building is too small or too large for us to figure on.

¶ We shall be pleased to furnish estimates and sketches on this class of work at any time. Write us and tell us what you need and we will prepare estimates for you at once.



Cut shows an all-steel building used for storing expensive patterns and dies. The size of this is 18′ x 39′ and it has been doing service for years and gives the same good service as when erected.

The Metal Shingle & Siding Company, Ltd.

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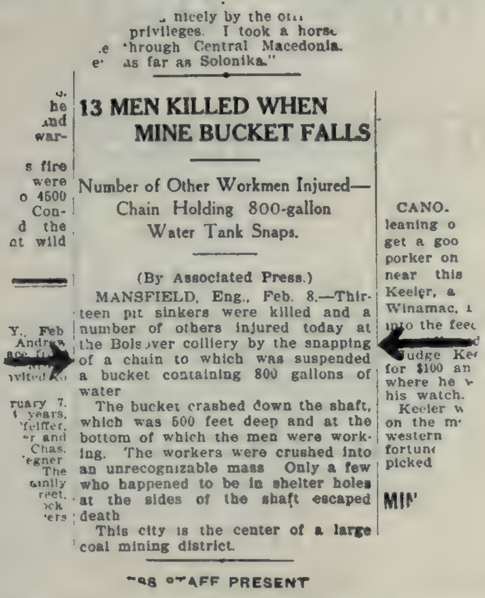

nicely by the
privileges. I took a horse
through Central Macedonia
as far as Solonika."

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press.)

MANSFIELD, Eng., Feb. 8.—Thirteen pit sinkers were killed and a number of others injured today at the Bolsover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death

This city is the center of a large coal mining district.

Save money as well as loss of life and property by using a Canadian made electric-welded chain.

McKinnon Chain Company
St. Catharines, Ont.

Dowling Ave. Highway Bridge, Grand Trunk Ry. Toronto, Canada. Waterproofed with J-M Waterproofing Materials.

Scientific Waterproofing

under the direction of capable, experienced engineers, by the J-M method.

¶ The materials used are pure **Natural Asphalts, pliable bituminized Stone Felts** and **Impregnated Fabric**—refined and manipulated in our own factories from the crude materials to the finished product in place—under our own personal supervision.

¶ Any work, large or small, simple or difficult, in either waterproofing or mastic, will receive our careful and prompt attention.

¶ This department is successfully executing some of the largest mastic and waterproofing work ever undertaken. We very much desire to co-operate with engineers and architects. Our engineering division is at your disposal. "We will not do it unless we can do it right."

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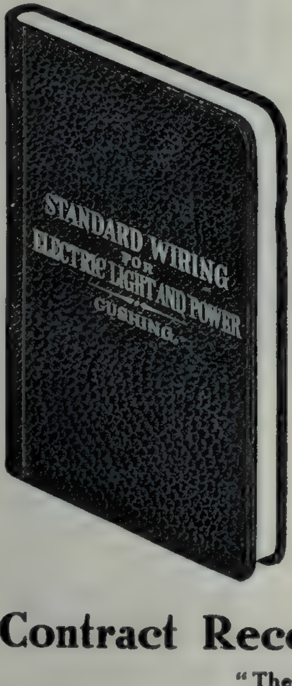

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National Electrical Code

which it contains, explained and illustrated. The 1912 Edition has been completely revised from the first to the last page, and contains new illustrations, tables and diagrams in accordance with the latest and best practice.

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- Sky Lights and Metal Windows.
- Steel and Kalameined Doors.
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- Taylor Gravity Underfeed Stokers.
- "Pen Dar" Metal Lockers.

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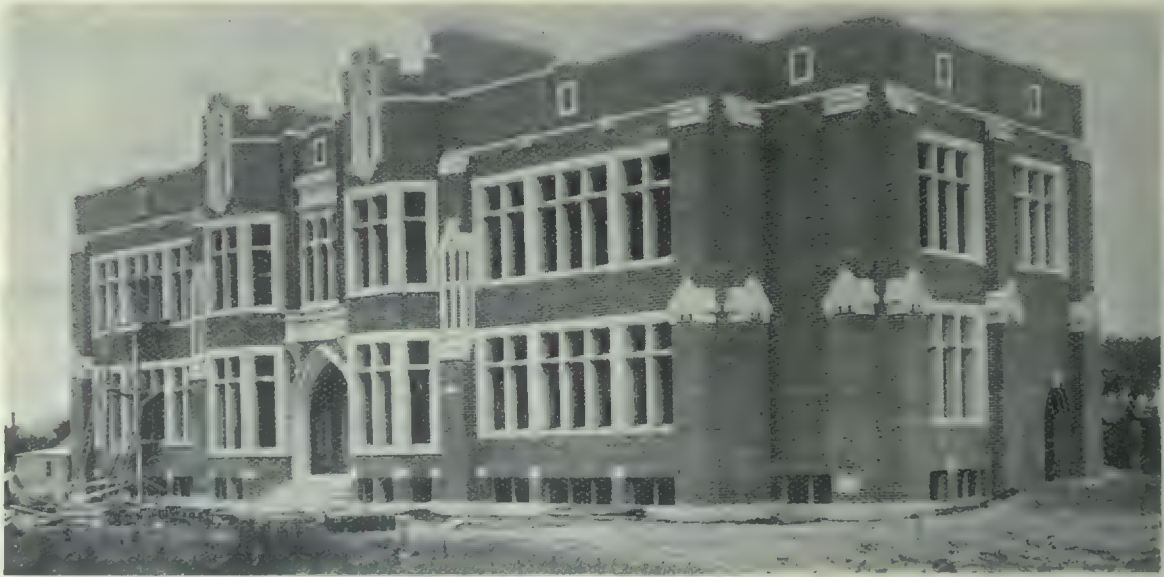

Architects, Page & Warrington. North Toronto High School Contractor, T. Palmer.

Sun Bricks were used in this building because of their exceptional hardness, uniform color and general first-class quality.

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ESTABLISHED 1886

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and Engineering Review

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Alphabetical Index of Advertisers
Page 16

Vol. 27 October 29, 1913 No. 44

Trade Prospects for 1914

We are again approaching that season of the year when it is the general custom to take stock of the last twelve months' business and make plans for the next season. For this reason, as well as for the fact that the past year has been attended with very unusual conditions, a few remarks on the trade outlook for the coming year will be opportune.

Whether or not the year 1914 will be an active period for us industrially, depends, in the main, on two factors: (1) the natural demand for manufactured products, and (2) our financial ability to purchase these products. Without question there is only one answer to the first. Canada's capacity for almost unlimited development is established beyond the shadow of a doubt, so that our manufacturers may be assured of an ever increasing demand for practically every class of manufactured article. It remains then to discuss only the ability of Canadians as individuals, municipalities or private companies to provide the purchase price.

During the past summer, tight money has been a very real obstacle in the way of certain lines of activity. This condition was brought about partly by the unusual requirements of the European continent; also to a considerable extent by the amount of money that had become tied up in realty investments from one end of the Dominion to the other; but these conditions were intensified by the conservative, ultra-conservative we believe, attitude of our banks. Arguing that the signs foreshadowed a repetition of the crisis of 1907 and similar previous periods, and believing that prompt action would save the situation, they have followed the policy, apparently quite consistently, of lending no money which, as they thought, could by any possible chance be used to encourage the general extravagance to which Canadians were rapidly becoming habituated—the result largely of a number of years of unusual prosperity and plentiful money which had turned the heads of a large percentage of our citizens. This action of the banks has caused a great deal of discomfort to even their most deserving customers, and while it is generally conceded that caution, in reason, was the wisest course that could have been followed, it appears to us that the banks, by taking the extreme course, have unnecessarily curtailed the circulation of money and have done much towards producing the very condition—a trade reaction—they sought to prevent. Just how far their course was justified is difficult to determine, and it has undoubtedly placed the banks in a sound position so that at no time have they had to refuse assistance for developments which, in their own judgment, they have considered necessary. As a result the larger industrial life of the country has not suffered seriously, nor is there any sign of it in the future, for want of sufficient capital. Certain industrials report the biggest year's business in their history.

As already indicated, the extent of the demands to be made on our factories during the next twelve months will depend on the amount of money in the hands of (1) the individuals; (2) municipalities, and (3) private corporations. Our recent bountiful harvest has been an all important circumstance which will mean that the general public is pretty well supplied with ready money. The farmer only knows through the newspapers that money is scarce. As a result, the small retailer of general supplies such as hardware, boots and shoes, etc., except in the larger centres, will probably not experience any diminution in trade; this means continued prosperity for the wholesale dealer and manufacturer. In the building industry is it not a fact that practically every city and town in Canada is under-supplied with both public and residence buildings; and the population still continues to increase at a rapid rate. While building permits issued during the last month or two indicate a slackening in this line of trade, this, we think, is explained, in large measure, by the very general feeling that both workmen and supplies will be obtainable at lower rates; also, due to tight money, a certain amount of sacrifices have been thrown on the market. We see no sign of a diminished demand, however, and this slight reaction will just mean an increased activity in building trades of all kinds as soon as the money situation has readjusted itself. With an already inadequate supply of buildings, an ever increasing population, and a fair distribution of money among the middle classes, the demand for all kinds of building materials seems assured.

With the larger municipalities and private corporations the outlook may not be so entirely optimistic. These have found it necessary, often, to go outside of Canada for their supply of money, which has not been so readily forthcoming during the last few months, on account of similar demands from other sources. Canada's natural resources, however, constitute a splendid security which stands behind all her industrial undertakings and we are confident that, even in a world competition, she can obtain the necessary supply of capital; perhaps, just at this time, at a little higher rate, but not so high that the resultant developments will not amply justify the increased cost.

And after all has been said on both sides Canada's immediate and ultimate prosperity is inseparably tied up with the prosperity of her great rural population, which at the present moment is possibly not equalled in any other country in the world. Our crops, just harvested, will put into the pockets of the farmers during the next few months in the neighborhood of $300,000,000. This will soon find its way through the usual channels to the manufacturers. To this sum might be added dividends from investments which are being distributed to the general public at the annual rate of something over $150,000,000. This will also indirectly reach the manufacturer. The extent to which the natural frugality of the average citizen will assist in the readjustment of conditions is of course difficult to determine in dollars and cents, but there is no doubt that at a time like the present a general policy of curtailment is being followed by most of us and these accumulations will be ready for circulation as soon as the general public judges the opportune moment has arrived.

Summing up the situation, while we anticipate that difficulties will continue to be encountered for some time in obtaining large sums of money abroad, this condition we believe will be more than offset by favorable local factors of which we may mention: (1) the unsatisfied demand for every kind of manufactured product; (2) unexampled prosperity of our great rural population; (3) good security and high returns of Canadian investments which means ability to borrow abroad; (4) present low conditions of stock supply; it is generally conceded that the retailer is running very low following the general policy of caution.

Engineering in the West

ONE of the prominent features of western progress, is the great amount of engineering work that is being carried out. The rapid growth of the population, the development of the cities, and the expansion of agricultural and other industries, create a demand for new railways, improved roads, waterworks, sewerage, sewage disposal works, steel and reinforced concrete structures, bridges, gas works, electrical works, agricultural implements, iron foundries, brick works, coal mining, mills, quarrying, refuse incinerators, laundries, heating, ventilating and many other branches of engineering works, all of which give employment to engineers.

While this is true, there is also enormous room for further engineering enterprises. The utilization of local materials await fuller development. Practically all sewer pipes, terra cotta, and other clay products are imported, yet there is an abundant supply of clay, which only needs thorough scientific investigation to find a process by which it can be manufactured into pipes, tiles, bricks, etc.

Winter employment is a problem which requires greater attention, for if all workmen could be employed twelve months in the year, instead of only a few months each year, it would produce an important economic result. At present there is a rush of outdoor work in summer and frequent dislocations due to strikes, whilst in winter there is much less doing and consequently no strikes. The moral effect of more continual work would certainly be great.

Mixed farming would be the means of introducing new industries, for instance, stockyards, abattoirs, packing houses, creameries, cheese factories, tanneries, and various leather and other works would be established.

Electro-chemical works would convert the nitrogen of the air into fertilising or other commercial commodities. A process can, doubtless, be found which will convert lignite into transportable fuel and to extract the tar and oils. Sand and gravel could be made into concrete slabs in winter to be laid in summer. Flax seed could be crushed to extract the oil and a number of new industries would follow. While it is desirable to introduce new industries and to expand those already established, it will be well to bear in mind that new industries can also be created which will be indigenous to the country, and of great advantage to the community. The foregoing constitutes only an indication of few of the possibilities which await the efforts of engineers and chemists to be developed into actual realities.

Suggested Re-Organization of the Canadian Society

THOSE who attended the last annual convention of the Canadian Society of Civil Engineers will recall that one of the live incidents in connection with the meeting was the strong plea made by the British Columbia members for the institution of a provincial section of the society in British Columbia. No active measures were taken, however, and it is fair to assume that the matter was left for the careful consideration of the society at a later date —whatever and whenever that means.

For some time after the meeting, the subject was kept alive by an interesting discussion in this journal, to which many prominent members contributed, but although numerous valuable suggestions were brought forward, there were no apparent results, except perhaps the crystallisation of engineering opinion. In our issue of February 5th, 1913, and in subsequent numbers of this journal, we expressed agreement with the views of certain members of the society in British Columbia. We gave it as our opinion that the representatives from the coast province had made a clear case in favor of a strong local authority. We made bold to criticise the inactivity of the parent society and to commend the characteristically western enterprise of the Vancouver and other supporters of the provincial section idea.

Now we find the old topic brought up once more —this time, officially, by the Vancouver branch, supported by members of the Victoria branch. A resolution in favor of instituting a provincial section for British Columbia has been forwarded to the society and will have to come up for consideration at the annual meeting in January. The proposition was dealt with very ably by Mr. Conway in an address reported on the following page.

One cannot remain altogether unconvinced after reading some of Mr. Conway's observations. The history of engineering in British Columbia is not of the kind to provide great encouragement for the profession in that province and it would seem that some active policy were not only advisable, but vital. At the Montreal convention last January, the society was reminded of how an outside engineer, having an outside staff, was engaged in connection with the New Westminster harbor works, an undertaking entailing the expenditure of over four million dollars. This is only one example of many that could be brought in evidence of the poor status of the profession in British Columbia. Mr. Conway hopes to see the Canadian Society in the same plane as the Institution of Civil Engineers of Great Britain. If this ever comes about, it will be through working for just such high ideals some of the western members have formed.

One might refer to definite aims rather than to ideals after reading those sections of Mr. Conway's address dealing with educational facilities and also with the opportunities for harbor development in British Columbia.

Here, perhaps, is the distinction. The parent society has the ideal—a hazy, poetic, romantic vision of a society of highly-trained engineers working always along purely professional lines for the advancement of engineering knowledge. This is very fine, but there is something associated more intimately with the bread-

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As for the imm er
Victoria Branches, we are justifi
and we look forward to their consummation. It remains for the big men of the parent society to decide whether they are big enough to direct the destinies of a bigger organization.

The British Columbia Engineer and His Problems

An impressive address bearing upon engineering conditions in British Columbia and the peculiar problems which the profession in that province have to solve, was delivered by Mr. G. R. G. Conway, Chairman of the Vancouver Branch of the Canadian Society of Civil Engineers, in his opening address of the winter session on October 13th. Copious extracts from Mr. Conway's address are given below, while editorial comment is made on the preceding page.

Plea for a B. C. Section of the Society

The British Columbia Engineer has been, and is still, daily confronted with many great and serious problems. During recent years the enormous development of the natural resources of the province, the building of railroads, the construction of water power plants, irrigation works and manufacturing industries, have attracted to the west engineers of no mean ability who have directed and carried out works that rank with any that have been constructed in other parts of the Empire—works that bear witness to indomitable resources and the inventive genius and ability to control and harness natural forces with economy for the benefit of the community. In the great work that is now going on around us, the Canadian Society can with pride claim no small measure of credit, for, with few exceptions, the real live men who are responsible for the great engineering works are members of the Society.

It is because of their real, as well as numerical, strength, that the British Columbia members feel that a closer union between themselves is vital and necessary. It is true that we have important branches in Vancouver and Victoria, but we feel that our parent society with its headquarters at Montreal is somewhat out of touch, both geographically and in spirit, with western ambitions. The local branch in Vancouver has been in existence now for about four years, but that is a long time as we measure our growth here. The Victoria branch is even more youthful, but we feel that we must arouse ourselves into vigorous activity so that our honoured and venerable parent will appreciate the fact that her lusty western branches have arrived at years of discretion and are able to judge what is good for their own progress, and how that progress can assist the national society. In anything we suggest, we wish to be quite emphatic that nothing shall be done that will divorce use from or alienate the sympathies of the parent society. The wish of all of us is to broaden and increase the influence of the Canadian Society of Civil Engineers, so as to make it a truly representative national society, wielding a more powerful influence over the whole Dominion than it does at present. We do not want it to become—as Western members are inclined to think sometimes it may become—a purely local society for members in the neighborhood of Montreal and Ottawa, living under the influence and fostering care of McGill University, but a society that shall also adequately represent the engineering activities in all the great provinces. At the present time in British Columbia we have about 240 members who gain practically nothing from the parent society and who feel that any benefit that comes to them from membership is entirely dependent upon local efforts.

As you are aware, we have been discussing for some time past the formation of a British Columbia Section of the members, so that our influence in the province will be recognized more fully and in order to obtain for ourselves a greater share in the government of the society—so far as our provincial interests are affected—than is possible under present conditions. We have taken up these matters with the Council of the Society and are now proposing to forward for consideration at the annual meeting in January at Montreal, a definite proposal, which it is to be hoped, will be cordially endorsed by all the members in British Columbia.

Briefly, the proposal is that we shall form a Provincial Division of the Society and still retain the local branches, but who will co-operate in all matters that are vitally important to the members in British Columbia. This co-operation, we believe, is of great importance when approaching the Provincial Government on public matters, so that in any petitions it will be felt that we are a united body of trained specialists, who, in an advisory capacity, might be of great assistance in the many problems that arise where engineering counsel is necessary. Furthermore, we wish to impress upon the government that the employment of our own countrymen in carrying out the great public works of the province is essential, and we wish it to be recognized that from the ranks of the Canadian Society the best engineering talent in the Dominion of Canada can be found. If the British Columbia Division is formed, we shall become so influential that no government can afford to dismiss our proposals or suggestions lightly. It is our ambition to place the Canadian Society upon the same influential plane as the Institution of Civil Engineers of Great Britain and the American Society of Civil Engineers, whose recommendations to their governments are not only welcomed but eagerly sought after.

Educational Facilities

There is another matter in which we, as members of the Society, are profoundly interested, and that is the new University of British Columbia. We are proud of the spirit that has been shown by our provincial legislature in recognising that British Columbia needs a university that will adequately cope with the higher educational problems of a great province, and where the youth of British Columbia, scattered as they are over 400,000 square miles of territory, can be trained for the business of life—a university where the intellectual resources of our people can be cultivated to the highest degree. Such a university will help to make many of the western problems easier to solve. We have great sted in

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nal side also. professors and lecturers in engineering must be large-hearted and versatile men, not only skilled in their special science but also in touch with the practical world of engineering practice and business. In the University, we feel that in addition to the essential departments of civil, electrical, mining and mechanical engineering, special attention should also be paid to the problems of economic geology and mineralogy, and there should be a department for the special study of irrigation and the conservation of water. The future of the great central portion of British Columbia is dependent upon a scientific understanding of the proper storage and disposal of water upon the land.

A forestry department, needless to say, must not be overlooked, when we realize how much must be done to prevent waste, and how great the conservation problem in the lumber industry will become.

As a great seaport, encouragement should be given to the study of naval architecture, and in view of the need for the establishment of new industries, many technical classes should be established, such as those in the Glasgow and West of Scotland Technical College, and in similar institutions.

All these things we hope for and must constantly urge upon the authorities, and I believe the Council of the University already appreciate the claims of engineering to a prominent place in the University's calendar. If that be so, we shall have a real university that will be the intellectual centre of the province, beneath whose notice nothing that wisely contributes to the needs of our time will be neglected.

We are fortunate in having on our programme for the present session the name of the President of the University, Dr. Wesbrock, and I think that it is a happy augury of the future that he is to talk to us at an early date on "Pioneers and Engineers."

Looking backward and looking forward, we are proud of the great engineering works in the province. Think of the problems now involved in the construction of three thousand miles of railway, at a cost of $175,000,000; of the engineering work of the municipalities, of the development of our vast water-power resources—resources which I think in British Columbia might conservatively be placed at 3,000,000 horse-power; of the problems met in mining engineering and the lumber industry. With all this, much remains to be done, and in the department of harbour engineering there is unlimited opportunities for the engineer on our coast.

Let us pause for a minute to think of the local situation. I am aware of industries that are being crippled by the lack of proper dock accommodation in Vancouver. As we think of the blasting away, a few days ago, of the great Gamboa Dyke that will soon permit the waters of the Atlantic and Pacific Oceans to meet at Panama for the purpose of changing the great shipping routes of the world, we cannot help wondering how prepared or how unprepared Vancouver will be in 1915 when Europe wishes to send her great steamers to our port. We are spending $175,000,000 on great railroads in this province to link up the east and the west of our Dominion, but are we doing enough to assist in making these great railroads of material benefit to use when they are completed? In Burrard Inlet we have, I believe, with the exception of San Francisco, the finest harbour on the Pacific Coast—a harbour that needs no great expenditures to protect it from the fury of storms, as many famous harbours ave done, but one where the requirements are chiefly wharves and docks that will be absolutely necessary if we are to maintain a great trade with Europe—or, perhaps, even what is more important, a great trade with the awakening Orient.

The engineer can transform Burrard Inlet into one of the finest harbours in the world. Although some activity has already been shown by our parliamentary representatives in arousing interest in these enterprises, we are delaying too long in starting the projects.

The same problem is confronting New Westminster, and with Government aid Victoria's harbour is being improved; but Vancouver is destined to be the greatest port in Canada, and it behoves us all to realise the priceless natural heritage we have and do our best to stimulate its development without further delay, along rational and progressive courses.

As engineers engaged in the design and construction of public and private engineering works, we have a great responsibility. Remember that we must "hitch our wagon to a star" and keep before us the highest ideals of our profession. In carrying out engineering works, we must prevent extravagance, remembering that the funds that have to be raised in England and elsewhere for the expansion of this province, must be expended wisely so that the confidence of the investing public can be maintained and fresh inducements given for gaining their further support. In carrying out great public works, we need engineers who fully realise their responsibilities. The Canadian Society will become a strong and potent influence, so that engineers and engineering are not made to suffer by the caprice of minor politicians.

Broadly speaking, the engineering work in British Columbia has been well carried out. There are instances of extravagance, but, in most cases, the engineer has not been responsible, and, as I have already said, we can point with pride to what has been accomplished in the past, what is being done at the present and what is being planned for the future.

PROPOSED CHANGE IN THE BY-LAW OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS

At the conclusion of Mr. Conway's address, and after some discussion, the following resolution was submitted to the meeting, which was attended by a strong delegation from the Victoria branch. It was resolved unanimously to forward the resolution to Montreal for the consideration of the parent society.

A new by-law, to be numbered 56, and to read as follows:—

A Provincial Division of the Society may be established under the authority of the Council at the request of the majority of the corporate members residing in the Province.

All members residing within such Province shall be members of the Provincial Division so formed.

The Officers of a Provincial Division shall be a Chairman, a Secretary-Treasurer, or a Secretary and a Treasurer, and a Committee of four or more members. The Committee shall be elected by a letter ballot of the corporate members residing in the Province. The Chairman and the Secretary-Treasurer, or the Secretary and the Treasurer, shall be elected by the Committee.

The Constitution and By-laws of all Povincial Divisions shall be subject to the approval of the Council of the Society. The Secretary of the Provincial Division shall transmit to the Council, copies of all minutes of meetings, and reports of all proceedings of the Division. The Secretary and the Treasurer shall present a yearly report to the Annual Meeting of the Society.

The Parent Society shall, in addition to the rebate to the branches, grant a further rebate to the Provincial Division of One ($1.00) Dollar per head for every corporate member in the Province, other than those connected with the Local Branches."

This by-law was forwarded to the Secretary of the Society. It was formally signed by the most prominent and representative engineers in the West, of whom many are among the oldest members of the Society, and also by the Chairmen of the Victoria and Vancouver Branches. The names of those signing were Messrs. H. J. Cambie, Thos. H. Tracey, T. H. White, A. E. Hill, F. L. Fellowes, F. C. Gamble, G. R. G. Conway, J. H. Kennedy, R. F. Leslie, G. H. Webster, H. M. Burwell, J. F. Garden, H. B. Smith, H. Carry and J. R. Grant.

James Spelman on Grain Elevator Construction

MEMBERS of the Canadian Society of Civil Engineers, Montreal, opened their winter session on October 16th, when Mr. James Spelman, vice-president of the John S. Metcalf Company, Limited, gave an address on grain elevator construction. This is the first occasion on which the members have met, for lecture purposes, in their new premises, Mansfield street. The hall is a great improvement on the old one, being better lighted and more adapted for its purpose.

Mr. Spelman, who brightened his address with many humorous asides, gave a brief history of grain elevators, pointing out that the class of elevator designed depended upon the location and upon the nature of the business for which it was required. He described in detail one of the structures on Georgian Bay, and also spoke of the problems which had to be dealt with. Elevators were, he said, at one time constructed entirely of wood, by mechanics, who had not scientific knowledge of pressures, etc. The difficulties were overcome by the natural ingenuity of the mechanic, who sometimes showed more ingenuity than the college bred man. About 1895 there were demands for fireproof elevators, owing to the increased cost of lumber and high insurance rates, and steel, tile, and finally concrete were employed in building elevators. At that time, too, great attention was given to the question of pressure, and Mr. Spelman detailed experiments made to ascertain the pressure of the grain in the elevators. He also referred to the methods of erecting concrete elevators, the rate of construction of bins—averaging 6 ft. per day in summer—and described the mechanical appliances for delivering and discharging the grain. The address was illustrated by a large number of views thrown on to a screen.

In the discussion which followed, Mr. J. A. Jamieson spoke of the importance of economical handling, which was the great problem in this class of engineering. Even with the latest appliances the handling of grain in elevators, and the loading and unloading from cars and vessels, were subject to delays. Elevators in some cases had been put up more with a view to storage capacity than economic handling of grain per bushel, and he thought the problem of the future would be to secure expeditious and more economic handling.

Mr. F. W. Cowie, chief engineer of the Montreal Harbor Commission, thought the construction of elevators would for a long time remain a field for specialists, on account of the special design and intricacies of the machinery required. It was pointed out that the Montreal Harbor Commissioners' elevators had tremendously increased the grain capacity of the port. In the past six years elevators had been constructed there at a capital cost of four and a half million dollars, handling at the rate of forty-five million bushels a year, and earning a revenue of $250,000, while the grain was handled in them at a rate of 7-10 of a cent a bushel.

Foundation Difficulties at Regina

Considerable difficulty has been experienced by the engineers engaged upon the construction of the new Grand Trunk Pacific Railway hotel at Regina in securing a good foundation for the edifice. Owing to the yielding nature of the ground, and to the fact that rock bottom cannot be found, piles were useless for the purposes of securing sound footings. In order to overcome the difficulty presented by this combination of circumstances, it has been necessary to construct a mattress of reinforced concrete over the bottom of the entire excavation upon which to erect the structure. This mattress, by distributing the load of the building over a large area, will prevent subsidence, and should prove satisfactory so long as the reinforcements are placed judiciously and in a manner which will avoid rupture. The mattress has a thickness of five feet, and will add materially to the cost.

LETTERS

Analyses of Sewage at the Springfield Disposal Plant*

New York, October 23, 1913

Editor Contract Record:

Enclosed please find copy of a report giving the results of analyses made of the raw and treated sewage at the Springfield, Mo., sewage disposal plant. At the time the samples were taken, the plant was operating at an average daily rate of 3,000,000 gallons. Sample No. 278 is the effluent from the percolating filters after two hours' settling in the final settling basin.

Yours very truly,
Alexander Potter.

Laboratory No. 275 is crude sewage; No. 276 is effluent from settling tanks; No. 277 is effluent from the percolating filters; and No. 278 is the effluent from percolating filters after 2 hours standing.

	No. 275	No. 276	No. 277	No. 278
Nitrogen as				
Organic	107.0	68.4	27.2	15.6
Free Ammonia .	16.5	14.0	3.7	2.9
Nitrites	None	None	0.288	0.864
Nitrates	None	None	None	None
Oxygen consumed ..	59.3	23.8	10.0	14.5
Suspended Matter				
Total	135.0	41.2	9.2	8.8
Volatile	115.0	28.0	6.4	6.0
Fixed	20.0	13.2	2.8	2.8
Dissolved Oxygen ..	None	Slight trace	Trace	Trace
Temperature	69*F	68*F	67*F	
Total number of bacteria per cc.	9500000	6450000	1110000	360000
B. Coli Communis in 0.0001 cc. approximate % positive samples .	100%	95%	90%	65%

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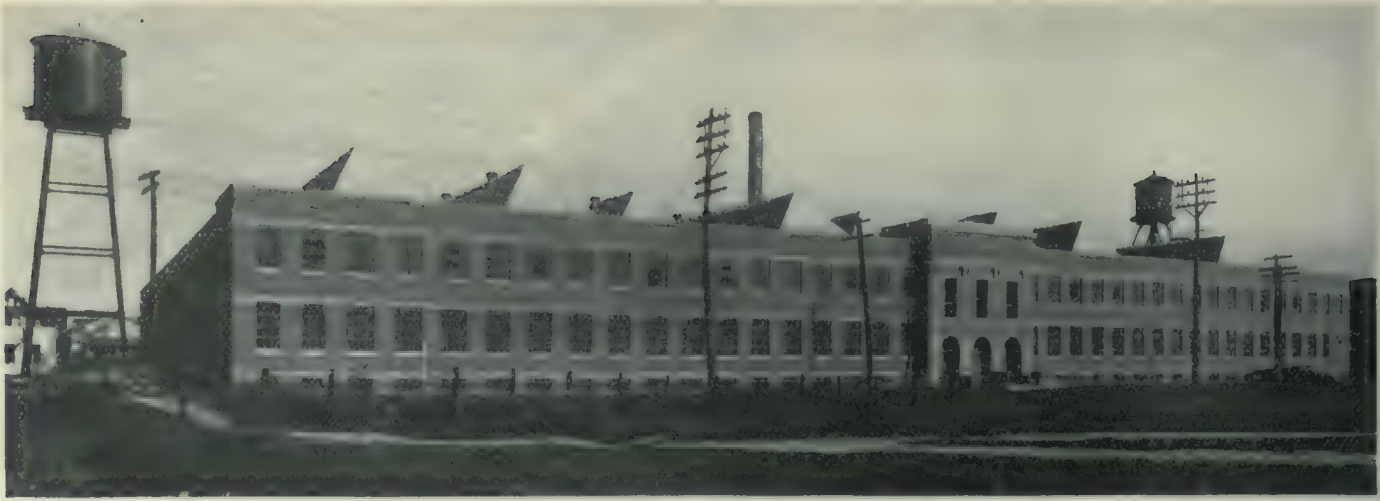
* Described Contract Record, October 22, 1913.



Front elevation and main entrance of new factory building for Messrs. Rolph & Clark, Limited.

The Construction of a Modern Printing and Lithographing Factory at Toronto

By A. E. Wynn, B.Sc.*

THE largest and most up-to-date lithographing and printing factory in Canada has just been completed for Rolph and Clark, Limited, Toronto. A description of this building should be interesting to readers of the Contract Record as it is the only one of its kind in Canada, used for lithographing purposes.

As, in this business, good light is of extreme importance, this was given the first consideration. Accordingly, a design was adopted for the building, having a large proportion of window surface, and a sawtooth roof with deep skylights on the north sides. Other points of importance were that the building must be fireproof, all machinery must be on one floor, and every department visible from the overseer's office. The last two conditions decided that it must be a one-storey building.

The factory has a frontage of 300 feet on Carlaw Avenue, with a depth of 250 feet. A 20 ft. lane is provided for on the south and east sides, while on the east is a G. T. R. spur. It is 41 ft. high to top of roof, with a gallery 45 ft. wide running all round it, 12 ft. 6 in. above the main floor. Under the front part of the building is a basement, 43 ft. wide by 300 ft. long, 9 ft. deep.

Foundations

Excavation of the basement was begun in October of last year. A steam clam was used to take out the 5,000 cu. yds. of material, which was used to fill in the adjoining lot. The land falls about 5 ft. south to north. Good hard clay was met with at a depth of 4 ft. to 6 ft., so it was not necessary to dig deep to obtain good foundations.

After the whole site had been cleared of soil and vegetation, a network of 3 in. of weeping tile was laid, running in diagonal branches from a 4 in. tile drain, which emptied into a 6 in. drain in the basement. Weepers were also laid along the footings of the walls. All the drainage was collected in a sump at the south end of the basement and was pumped out by a pulsometer, which was kept working every day until the building was finished, considerable surface water always flowing in the drain.

The walls, up to 2 ft. 6 in. above grade, are 18 in. concrete, carried on concrete footings 2 ft. 6 in. wide by 12 in. deep, a bearing pressure of 2 tons per sq. ft. being allowed on the foundations. No waterproofing material was used, but the outside of the walls was given two coatings of tar. A 6 in. reinforced concrete wall was built up to grade, 3 ft. away from the front wall, to form an area way. The piers under the floor are 15 ft. c. to c., from 4 ft. to 5 ft. square at bottom and 15 in. to 21 in. square at the top, having footings 12 in. deep. On these are concrete columns, 15 in. to 21 in. square and 1 ft. to 6 ft. high, varying with depth of foundation. These carry the floor beams.

Brick piers, 18 in. and 22 in. square, set in cement mortar, carry the beams over the basement. In all, over 1,350 cu. yds. of 1:2:4 concrete were used in the foundations and walls.

Brick Work

The brick work is of superior factory type. The walls consist of 3 ft. by 18 in. piers, with 4 ft. 6 in. by 6 ft. 6 in. window openings, the curtain walls being 13½ in. Red pressed brick was used on the outside and grey stock inside. The walls were finished off with tile coping.

The front wall is of best picked red brick, with stone sills and continuous bands of stone over the window frames. It is carried up 3 ft. higher than side walls, forming a parapet, and is finished with stone coping.

The principal feature of the front is the main entrance, the architectural style of this portion being Italian Renaissance, with fluted pilasters and Corinthian caps. The name of the firm appears on the frieze above. In all, including interior walls, over 600,000 brick were used. On the sides and back of the building the window heads are all reinforced concrete, poured in place.

Hope's steel window frames were used in all the walls, glazed with rough rolled opaque glass—in all, 9,000 sq. ft.

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*Superintendent for Messrs. Sproatt & Rolph, Architects, Toronto.

Floors

All the floors and beams are reinforced concrete. The Kahn system of reinforcing was adopted. The main floor was designed to carry the heavy live load of 250 lbs. sq. ft. plus 20 lbs. for finish, and the gallery floor a live load of 125 lbs. sq. ft.

In designing the floors it was found more economical to decrease the thickness of slab and increase the number of beams, the design having to comply with the Toronto City by-laws, which call for 16,000 lbs. for steel in tension, 650 lbs. for concrete in compression and 100 lbs. in shear for steel and concrete combined.

The girders of the main floor run north and south, have a span of 15 ft. and are 12 in. by 28 in. reinforced with two ¾ in. by 2 in. Kahn standard bars, one ¾ in. by 2 in. Kahn centre shear bar, two ⅝ in. bent rib bars and one 1⅛ in. straight bar. The intermediate beams are 5 ft. c. to c., 8 in. by 18 in., with two ¾ in. by 2 in. standard bars and two ½ in. bent rib bars.

The gallery beams are similarly spaced. The girders are 10 in. by 24 in. and the beams 8 in. by 16 in. Where the girders are carried by the brick walls concrete padstones were put in. The main floor slab has an area of 73,000 sq. ft. and is 4 in. thick. The gallery floor slab is 40,000 sq. ft. and is 3½ in. thick. Both are reinforced with expanded metal and the concrete is mixed 1:2:4. Beams and slab were poured together, cut offs being down the centre of girders. The slabs were left rough.

The average day's pour was 80 cu. yds., the total amount of concrete in slabs and beams being 2,600 cu. yds. A hoisting tower was erected, but it was found more economical to use wheelbarrows, although this necessitated a long wheel.

As the greater part of the concreting was done in winter, the sand and stone were heated by steam pipes. Warm water was used for mixing, shavings being spread to a thickness of 2 in. over the slab. A special feature of the main floor is a pit, 75 ft. by 14 ft., dropped 15 in. This is carried independently of the floor by 14 in. brick walls and reinforced concrete beams 5 ft. apart. It is used to carry the heavy presses.

In considering the question of floor finish it was necessary to have a hard, durable, dustless floor. Specimen cement finishes were put down, the one adopted having a thickness of 2 in. and containing nothing but ¼ in. granite or traprock and cement in proportion 3:1, trowelled up perfectly smooth and covered with shavings kept wet for a week. Although this was put down two months after the rough slab a perfect bond was obtained. The gallery floor has a similar finish ½ in. thick, put on the day after the rough slab was poured.

To keep the basement floor dry, 2 in. concrete was laid on 5 in. cinders and covered with 3-ply ready roofing, mopped with tar. This continued over the footing and 1 ft. up the back of the wall, the top being turned into the wall; 3 in. of concrete was then laid and trowelled up smooth with a drier of traprock and cement 3:1.

The floors of the offices, lunch rooms and lavatories are laid with Sanorto, which gives a hard, durable, dustless and noiseless floor.

Steel Work

The roof is carried on 215 steel columns, 30 ft. c. to c. north and south and 15 ft. c. to c. east and west. Those in the centre of the building are built up of two

Basement and form work for main floor. Feb., 1913.

6 in. channels, 23 ft. high, laced back to back. The others carry the gallery as well and are 8 in. by 8 in. H section up to floor and 5 in. by 5 in. H section above, with brackets to carry the beams. Intermediate 6 in. by 6 in. H columns help to support the gallery.

The roof trusses are sawtooth shape, 30 ft. span and 15 ft. high, built up of light angles.

Four rows of 8 in. channel purlins are bolted on the south side of the trusses. The last two rows of trusses on the east and west sides of the building are wind-braced with 2 in. by 2 in. angles.

Roof

A flat roof 14 ft. wide, falling ½ in. to the foot, extends all around the building, and is made of 3 in. by 6 in. t. and g. spruce, spiked to a plate on the wall and resting on 8 in. I-beams carried by the columns.

The south sides and ends of the trusses were covered with 3 in. by 6 in. t. and g. spruce, spiked to plates bolted to the purlins. The north sides were similarly covered for 4 ft. 6 in. up, and finished off with a 3 in. by 6 in. sill to carry the glazing bars. Hope's patent double glazing, in all about 40,000 sq. ft., was used throughout in the skylights. The inside glazing was rough-rolled wired glass carried by galvanized iron bars 2 ft. apart and 9 ft. long. The outside rough-rolled glass was carried by lead bars 2 ft. apart and 9 ft. 6 in. long.

Both the sills and the cornices were flashed with lead, and lead condensation tubes were inserted in the sills between the glazing. The amount of lead used was enormous, there being about 16,000 lbs. for flashing purposes alone. The lineal feet of bar used were 19,100.

The whole roof was waterproofed with Johns-Manville roofing, the sawtooths being covered with 4-ply asbestos roofing. The valleys and flat roof were built up with 2-ply asbestos roofing and 2-ply felt paper, mopped with asphaltic paint, and the gable ends with 2-ply asbestos siding. Gutters were put in the valleys and along the flat roof to drain the water to copper hoppers fitted into the conductor pipes, one hopper being placed at the end of every truss on the flat roof and three in each valley. The pipes are taken down the columns to the main drain under the floor.

Interior Work

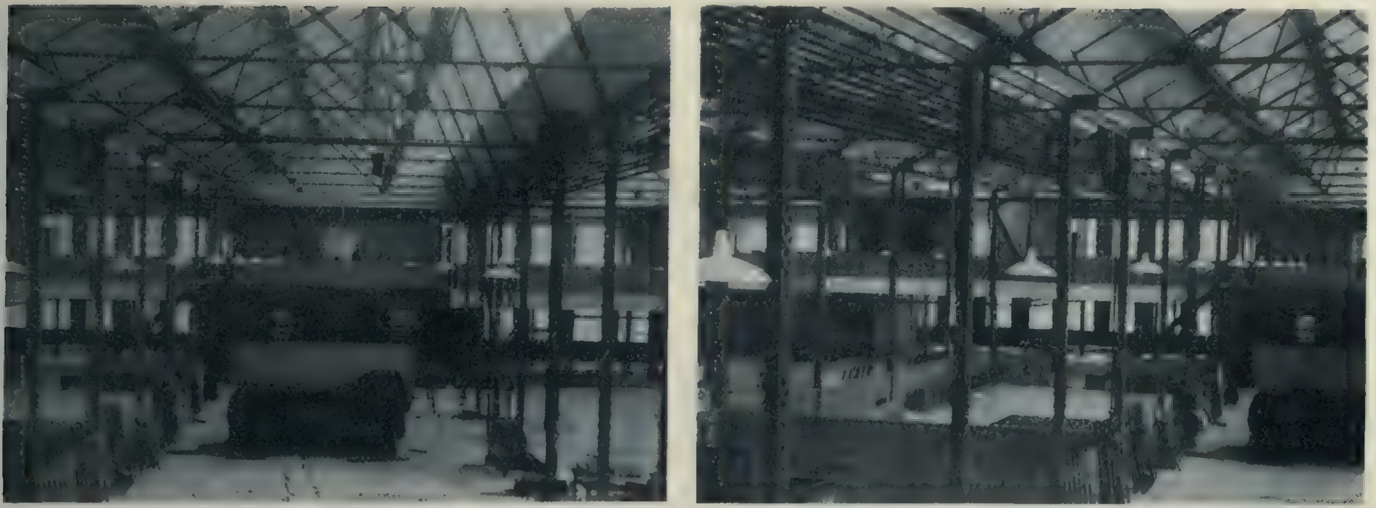
The different departments are divided off by wood and glass partitions. An innovation in extensive partition work was the use of Hope's steel frames glazed with clear glass, set on 3 in. spruce partitions 4 ft. 6 in. high. The whole of the gallery is also enclosed with this kind of partition. This enables the overseer to see from his office every employee in the building, and it also has the advantage of cutting off no light, as would have been the case if solid partitions had been used.

An interesting feature is the bronzing room, 75 ft. by 30 ft. This had to have plenty of light and be roofed over so that the fumes would not escape into the building. The roof is a hipped skylight carried by four light steel trusses bolted to the latticed columns. The whole of it is lead-glazed with Hope's patent glazing, the bars being carried by purlins and notched to a 3 in. angle bolted to the top of the side frames.

General view of building during construction, in particular showing the gallery. June 1913.

The offices occupy the front gallery. The partitions and ceilings are metal lath and plaster and all the woodwork is oak. The offices are connected with the main floor by a wide iron staircase. Five large vaults were built of brick—two in the basement, two on the main floor and one on the gallery. The overseer's office is situated under the gallery in front of the entrance hall. It is 24 ft. square and has a hardwood floor carried by joists, 3 ft. above the main floor, so that from here the whole of the interior of the building can be seen.

The basement is entered from the outside by a flight of concrete steps and is partitioned off into four parts, staircases connecting them with the main floor. As its floor is below the level of the street sewer, it was necessary to put in a concrete tank, taking the place of the sump used during construction. This is



On the left, under the gallery in front of the main entrance, the Overseer's Office, from which all the various departments can be seen; on the right, the Bronzing Room (without the roof).

fitted with two electrically-driven pumps controlled automatically by floats, with a hand pump in reserve. The tank collects any seepage from under the floors and any drainage from the boiler room.

The wide central doorway of the main entrance gives access to an arcade, leading to a spacious hall on the main floor connected with the offices above by means of a fine oak staircase. The arcade has a groined ceiling and the entrance hall is covered with a large skylight. The floors of both are red terrazzo marble. The woodwork of the roof and the concrete ceilings are kalsomined, increasing by reflection the light in the building. The partitions are painted green and the steelwork grey.

Two electrically-driven hoists, to carry 3,000 lbs. each, are installed.

The boiler room is situated in the south-east corner of the building and is 45 ft. by 45 ft. by 21 ft. 6 in. high, its floor being 9 ft. below the main floor. The floor is 6 in. concrete set on 5 in. cinders. Concrete foundations were put in for boilers, fan and pumps.

Above the pumps is a mezzanine floor carried by reinforced concrete beams and columns. The boiler room is connected by a tunnel at same floor level with the coal bunker, both being built of reinforced concrete. The tunnel is 7 ft. wide, 6 ft. high, and 20 ft. long. The walls are 12 in. concrete with ½ in. vertical rods 12 in. c. to c. The roof is an 8 in. slab, reinforced with expanded metal, and forms the lane round the corner of the building. The coal bunker is 30 ft. long, 12 ft. 6 in. wide, and 10 ft. 6 in. high, having a capacity for 100 tons of coal. Its walls are 12 in. concrete. The sloping roof is a 6 in. slab carried by a reinforced concrete beam on two 8 in. H columns, and is provided with three large iron doors and three windows. Two pockets are built out from the bunker under the siding,

View of Press Room.

enabling drop bottom cars to dump right into them. The track is carried over the pockets by two 18 in. I-beams, built into the walls.

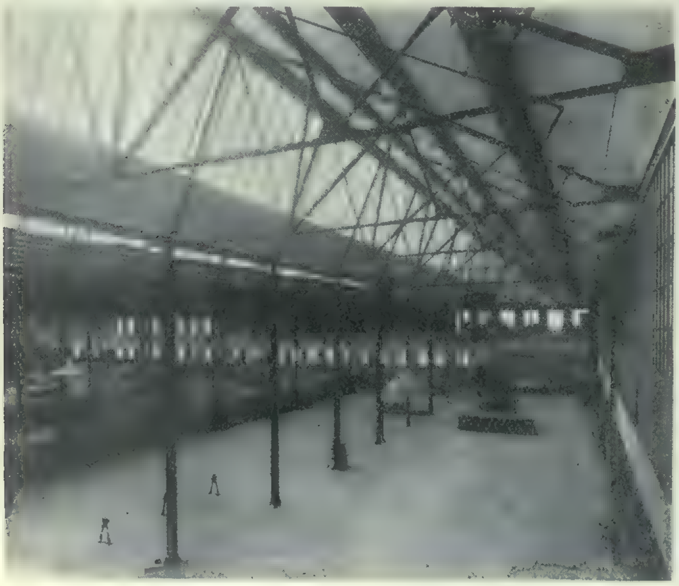
Heating and Ventilation

The system used consists of direct radiation throughout the building and forced ventilation in the central portion and in part of the offices. The boiler equipment consists of two horizontal return tubular boilers, each having 1,800 sq. ft. of heating surface and designed to operate under a pressure of 125 lbs. per sq. in. These boilers are set in battery and are equipped with two Fulton smokeless mechanical stokers. Draught is furnished by a radial brick stack, 50 in. in diameter and 125 ft. high, built on a massive concrete foundation. The boilers are equipped with high and low water alarms. A uniform pressure will be maintained by an automatic damper regulator.

The auxiliary equipment consists of two Dean of Holyoke Vacuum Pumps, two Boiler Feed pumps, and Keiley Pump Governors. All radiation is equipped with Dunham Vacuum Traps.

The building is heated by about 20,000 sq. ft. of cast radiation and wall coils distributed around all of the outside walls of the building and placed under the skylights in the roof. The steam is distributed to the heating coils at from 0 to 5 lbs. pressure through mains below the floor, and the condensation is drawn through the return-line traps and a system of return mains by the vacuum pumps back to the boiler room. The vacuum pumps discharge into a receiving tank, from which the water of condensation is returned to the boilers by the boiler feed pumps.

The ventilating equipment consists of a No. 11 Sirocco Fan, of the latest type, belted to a 20 h.p. electric motor. This motor is controlled by a speed regulator and the apparatus is designed to supply from 30,000 to 50,000 cu. ft. of air per min. The air passes first through a tempering coil, consisting of 1,296 sq. ft. vento cast iron radiation, then through an Acme air washer and through a re-heating coil. The temperature of the air entering the washer will be automatically controlled during the winter season by Powers Thermostats, controlling the diaphragm steam valves on the tempering coils, and the temperature of the air leaving the re-heating coils will be controlled in the same manner. The thermostat controlling the tempering coils is located in the temperate air chamber, while the one controlling the re-heating coils was placed in the main discharge duct from the fan. This system will give a constant temperature and percentage of humidity to the air supplied to the building, which is very essential in a printing factory.


Finishing Room, showing roof construction and glass partitions.

Transfer Room, under the north gallery. Separate wash basins are provided for each hand press.

Power and Light

The machines in the building are driven by individual motors, amounting in all to 200 h.p. Current in the building is 550 volt 3-phase a.c. supplied by the Hydro-Electric and transformed by a 150 kw. motor-generator set. The lighting throughout is general illumination, with 150 single watt units, the spacing of tungsten lamps being 15 ft. c. to c. The lamps are fitted with Holophane steel, white enamelled reflectors. Independent of the motor-generator set are two 20 kw. transformers which will light the whole building. The dynamo room adjoins the boiler room and is laid out in such a manner that the plant can be doubled when necessary.

Sprinkling System

The building is equipped with International Sprinklers, with a city connection as a primary supply and a 50,000 gallon tank on a 75-ft. tower as a secondary supply. The 8-in. main that supplies the inside sprinklers continues round the south, north and west sides of the building, having a 2-way hydrant on the south and north sides and also having three 6 in. valves on the south side controlling the three separate units on that side of the building, the same applying to the north side. A concrete pit is provided for the city checks. The system installed for heating the tank on the tower consists of hot water circulation generated by a brass coil in a heater at the base of the riser.

General Plan

The general layout of the different departments is very simple. The central portion of the building is occupied by the press room, bronzing room and finishing room. The whole space under the north gallery is the transfer room and under the east gallery the stock room. The south side on both floors is occupied by Blackhall & Company, bookbinders.

Under the west gallery are situated the stonecutters and shipping room, two wide shipping doors in the south end giving access to the lane. The east gallery is given over to photography, finished stock and two lunch rooms, while the north is occupied by the artists' and proving room. The basement is divided into locker room, carpenter's shop and two storage rooms. The accompanying photographs give a good idea of the construction and general arrangement of the building.

The light, which was the chief point in the design, is all that could be desired, and the wide spaces and open construction give an imposing appearance to the interior.

The cost of the building works out at about eleven cents per cubic foot.

The architects were Messrs. Sproatt and Rolph, North Street, Toronto. The steam generating, heating and ventilation equipment was designed by Jas. McAlear, consulting engineer, 186 King Street West, Toronto.

The contractors for the different work were:—Excavation, brick work and concrete, Jennings & Ross Limited; steel work, McGregor & McIntyre, Limited; carpentry, A. Weller & Company; heating, plumbing, ventilation and sprinklers, W. J. McGuire, Limited; electrical installation, The O'Connor Electric Company; tunnel and coal bunker, Beck & Poole.

" Macadam "

By Major W. W. Crosby, M. Am. Soc., C. E.

GENERAL agreement as to the meaning of the word "macadam"—commonly used to refer to a type of road surfacing—would prove of great convenience. The writer does not know that there is at present much diversity of opinion as to what is covered by the term, but it has been stated to him that no general agreement has been reached on this point; that, in more or less numerous cases where experience had been limited to the use of construction of, say, a few kinds of broken stone, it seemed that little, if any, thought had been given to arriving at the limits of meaning of the term "macadam," it being granted that it applied to the work in hand, and that, accordingly, it might be wise to discuss the possibilities of its definition, and to suggest one such as a concrete starting-point for the discussion.

Any definition of "macadam," meaning a type of road surfacing, which limits the material to be used for its construction to crushed stone would, the writer thinks, be too narrow to be either correct or convenient. M'Adam, the engineer from whose name the term is derived, himself used no "crushed" stone, nor did he confine himself even to broken stone. He specifically refers, in his "Remarks on Road Making" (London, 1820), to the use of "gravel," "flint," "limestone," "whinstone," and "large pebbles mixed with sand," and says, "Excellent roads may be made with any of these materials." Then he later lays down certain principles for the use of "different materials," condensed extracts from which are quoted below in the order he gives them:—

> The size of the largest pieces of road metal should not "exceed an inch in any of its dimensions."
>
> The road (i.e., road crust) ought to be considered as an artificial flooring or roof over the foundation, which latter really carries the bonds, and to that end must be kept dry.
>
> The admixture of earthy or other fine material to broken stone is injurious, and a mechanical bond or interlocking of angular pieces of road metal is necessary. This should not be discouraged or interfered with by the presence of fine material.
>
> The road metal should preferably rest on a firm, but resilient, foundation, rather than on a hard, rigid one, such as ledge or rock paving.
>
> The thickness of the road metal should be no greater than necessary to preserve its integrity as a roof to keep the foundation dry.

Throughout the whole book may be found many references to the use of gravel by M'Adam, his criticisms of it as well as of various stones, and his suggestions for the use of each.

The point the writer wishes to make is that our term "macadam," considering its derivation, means the attainment of certain results based on the observance of definite principles rather than the use of particular materials or methods.

M'Adam had no steam rollers, no stone crushers, and the available materials for his road metal were limited to stone and gravel. Had good slag, for instance, been as available then as to-day, is it reasonable to suppose that so practical a man would have ignored its possibilities?

It seems to the writer that if we recognise the principles of M'Adam, referred to briefly above, and the wider resources for both materials and machinery now open, a proper definition of our term may be made as follows:—

> Macadam is a road crust composed of gravel, shells, slag, broken stone, or similar material, in which the largest particles do not exceed a certain maximum size (dependent in any case, to some extent, on the quality of the material used, but generally about 2 in. for the longest dimension), whose particles, having a size preventing their passing a ¾-in. ring, are compacted together so as to be interlocked and mechanically bound together to the utmost possible extent, and whose then remaining voids or interstices are filled, by the aid of water, with smaller particles and fine material from the same or similar sources. True macadam has no particles in the surface exposed to travel whose size is so great as to render them unstable under horse-drawn vehicular travel. Macadam built on top of an artificial foundation of paving is usually called "Telford," or "Telford Macadam."

In case a general acceptance of such a definition is had for "macadam," several related or subsidiary terms may be most conveniently used with an increase of clearness in their use. For instance, "shell road" may be used to designate a road surfaced with dredged shells, which are generally mixed with sand, silt, etc., while "shell macadam" would differentiate the surfacing built with clean shells, compacted and then filled (as to its voids) with only the necessary amount of sand or fine material. "Gravel road" would mean a road with a crust of unscreened or "bank" gravel, while "gravel macadam" would indicate the adherence to the principles of M'Adam. A "slag road" would be built of slag from the pile, unscreened. "Slag macadam" would indicate that breaking and screening the material had taken place in some way. Further along this line, the term "bituminous gravel (or shell or slag or broken stone) macadam" would then logically be a most convenient term for differentiating such a surfacing built by the penetration method from one built by the mixing method (a bituminous concrete).

It seems to the writer that it is up to highway engineers to adopt promptly such reasonable nomenclature in their work as will indicate by its saving of breath and ink their appreciation of the engineering demands, as well as those of the times, for efficiency.

The Leonard Locomotive Shops of the N. T. R. at Quebec

THE general layout of the repair shops of The National Transcontinental Railway at Quebec, P.Q., shows that not only has convenience of operation been the general principle governing the design, but future needs have also been provided for. Each shop is capable of extension without interfering with any other, and any department can be increased separately as occasion may require.

There are ten buildings in all, of various dimensions, each suitable for the special work to be done in them. These buildings consist of a locomotive, erecting, machine and boiler shop (under one roof), forge shop, freight car shop, power house, planing mill, dry kiln, lumber shed, forge stores and scrap bins, oil house, and office building for the executive staff. The total area covered is about five and one-half acres.

In the erecting shop there are eighteen pits, placed transversely, over which a 120-ton crane lifts locomotives into, and removes them from, their respective positions. A 20-ton crane, operates over the same area at a few feet lower level, and carries small material and make many light and rapid lifts.

The "transverse-pit layout" has the advantage of doing away with many side doors in the building for the "in-and-out" movement of locomotives. There are two doors, conveniently placed, through which engines and material enter and leave. This arrangement is economical in the matter of heating. It does away with the necessity of a transfer-table with all its inconvenience from snow and ice. The practically unbroken sidewall permits the use of jib cranes, one serving the fronts of two locomotives, being capable of lifting smoke stacks, main valves, smoke box doors and rings. The use of these very handy cranes would be most difficult if the wall of the shop had been cut up into a series of doors.

The large crane is carried on a series of built-up columns, so that the heavy load is central over the line of foundations. As one crane does the work of lifting and placing each locomotive, there is no chance of confusion such as might occur when two cranes are used, and where two men do the work. The single powerful crane has also the advantage over the usual twin crane arrangement in economy of first cost and maintenance.

All the overhead cranes are provided with effective safety appliances. One of the most important, prevents the load from being "overwound" by the lifting drum, either by accident or otherwise. It consists of a device which, when the maximum lift has been reached, automatically opens a switch on the hoisting circuit and so cuts off the current, thus suddenly removing the driving power. The cessation of the current immediately brings into powerful action a gravity operated brake, which is normally held out of service by the flow of current.

The direction in which the midway crane operates is a new departure in railway shop construction, which has been brought out by Mr. W. J. Press, Mechanical Engineer of The Commission, as it secures substantial advantages. The midway is laid out so as to be alongside of the shops, and not at the ends of the buildings as is frequently the case. The object of this arrangement is that when material is brought by the midway crane from the storehouse, forge shop or foundry to the machine, erecting or boiler shop, it is placed at the door nearest to the machine on which the material will be handled, or to the engine upon which it will be used. In this way the delivery of material is not concentrated at one spot at the extreme end of the building. It avoids distribution from a congested area, and it obviates the "long haul" through the shop. Material is laid down at a point as near as possible to its destination, and economy of time and labor, as well as facility in handling is thus secured.

The system of placing machines is such that the movement of material will be in one direction and the distance over which any locomotive "part" is carried, will not be unnecessarily lengthened by journeys forward from one machine and back to another. The continuous one-way movement of material saves time and labor and prevents interference.

The pits in the locomotive shops are supplied with steam, compressed air, hot and cold water. Depressions in the pit walls carry the pipes. By this arrangement the working space in the pits is not restricted and the pipes are not where they can be easily damaged by workmen dropping material on them.

The forge shop and boiler shop are placed as near as possible to the power house. This is important, for in the case of the forge shop, where hammers are operated by live steam, the short distance between boiler and hammer reduces condensation and delivers steam where it is required with small loss. A similar condition holds good in a sense, for the delivery of compressed air to the boiler shop machinery. The nearer the source of supply, the less the pipe friction involved and the smaller the losses due the forcing of air through the pipes.

Industrial tracks form convenient means of communication between the various shops. The buildings, cars, engines and supplies are protected by a water-system arranged to be readily put in use in case of fire. A further protection is afforded by reason of the use of concrete and steel in the various structures.

The shops are situated at Quebec and have been named after Major R. W. Leonard, Chairman of The National Transcontinental Railway Commission, under whose administration they were projected. The outlay has been carefully supervised so that excellent results will be attained and full value received for the money expended.

The whole plant has been laid out under the supervision of Mr. Gordon Grant, Chief Engineer. It is designed in such a way that the latest and most modern railway practice has been provided for.

The permanent and substantial character of the shops and the size of the whole plant will be of material advantage to the City of Quebec, by providing steady employment for a considerable number of men the year round. The contract for this important piece of work has been awarded to Mr. Joseph Gosselin, of Pt. Levis, Que.

The design and laying out of the plant, the relative size, arrangement and position of the buildings and the selection of the machinery and appliances has been entrusted to Mr. W. J. Press, Mechanical Engineer of The Commission, who has had charge of similar work at the Transcona Shops of the National Transcontinental Railway, near Winnipeg. The Transcona shops are now being operated. In general plan and in kind and quality of equipment they are of the most up-to-date type. The Transcona and the Leonard shop (when completed), will embody the latest design and the most modern practice, enabling them to be operated with a very high degree of efficiency. Altogether they will form a most valuable addition to the second of the great National "cross-continent" highways of Canada.

A Method of Contract Payments Based on Cost

By George I. Battelle

THE method of payment for heavy grading, as in railway work, where classification is the basis of settlement, has long been recognized as a makeshift and merely an attempt to base payment upon cost. This method results in more or less friction on almost all contracts, for there are generally some strata in a section of grading which, strictly speaking, may be classified under the specifications as belonging to a formation which calls for a less payment than the actual cost of doing the work, with the result that the contractor justly feels that equity has not been done him in the matter. This condition obtains more generally than its reverse, wherein the work is thrown into a higher classification than that warranted by its cost and the contractor takes an excessive profit.

In some cases recourse is had to force-account as a means to obviate the above difficulties, but this means is usually undertaken on minor work, or if of any size, with a contractor in whom the engineer has confidence. Force-account work, however, lends itself too readily to the undue benefit of the contractor and is not generally resorted to except on small work coming up in connection with a large contract. Force account work is merely cost plus a certain percentage. Another method of contracting is cost plus a fixed sum. This has not been used in railroad work, but is merely mentioned as an attempt to make the interests of the two parties to the contract as nearly identical as possible when referred to the cost standard.

General usage, therefore, prescribes for railroad work a contract which is based on cost under the guise of geological segeration with numerous tests and conditions to be met as the determining factors in doubtful cases of classification. The interval wherein honest differences may wander is generally of a larger scope than should be allowed, but under the classification idea can not be escaped from.

In what follows will be presented a method that is definitely based upon the actual cost of doing the work with nearly all incentive to pile up the cost removed. Under this method it is to the interest of the contractor to keep the cost as low as possible, for the lower his cost the greater his percentage of profit and at the same time the less is the total amount he is paid, thus reaching ends desired by both parties to the contract.

There are two variations in the use of the method, the first of which is primarily adapted to railway work, while the second is applicable in all branches of construction.

First Application

The first method would apply to a railway-grading contract of considerable extent wherein there are various graduations of strata differing in cost of handling. The procedure is as follows:

(1) Estimate as closely as possible the average unit cost of handling the major portion of the material.

(2) Establish an upper and a lower figure of which the average estimated in (1) is the mean with the upper figure twice as great as the lower; i.e., the upper figure is 4/3 the average in (1) and the lower figure 2/3 that average.

(3) For each section of the work the contractor is to get a unit price equal to the actual unit cost of that section plus one-half the difference between that cost and the upper figure established in (2); provided

(4) That the profits be not less than a certain minimum percentage or more than a certain maximum percentage established beforehand.

Should the bulk of the material be estimated to cost less than the remainder, the price schedule would be made an ascending one and a descending one if the reverse was the case. A table can then be easily prepared showing payments of increased percentage profits with decrease of cost below the estimated cost and decreased profits with increased cost.

For illustration, suppose the estimated cost of doing the bulk of the work under a certain grading contract to be 15 cents per cubic yard with the remainder of the work costing more. It is decided to allow a minimum profit of 10 per cent. and a maximum profit of 40 per cent. The price schedule under these conditions would be an ascending one of 10 cents, 20 cents, 40 cents, 80 cents, $1.60, and Table I. shows the unit price to be paid, with its attendant profit, when the actual cost has been determined.

Thus if the actual cost is the same as estimated, i.e., 15 cents, the pay price would be 17½ cents, showing a profit of 16 2/3 per cent.; but if the actual cost be cut down to 13 cents, the contractor would be paid 16½ cents, but his profit would be 27 per cent. On the other hand, if the actual cost amounted to 17 cents, the payment of 18.7 cents would give him only a 10 per cent. profit, which profit would continue until the actual cost ran up to 22½ cents, when his profit would be 40 per cent. on that cost.

Under this method all variations in cost of handling the same geological formation under the different conditions in which it might be found or of uncovering and moving a formation not contemplated under the classification of the contract, would automatically bring its own payment and obviate all discussion with the engineer as to the justness of a higher classification, and the skill used by the contractor in meeting the different conditions would determine the size of his profit.

The jumps in the table between 11 and 11½ cents, 22 and 23 cents, and 44 and 46 cents, correspond to, though they are not so great as, the variations of price under the usual classification contracts. It is near these points that the only incentive to increase cost exists and where the engineer in charge of the work would have to carefully watch the cost account of the contractor and be sure that he was neither lying down on him or trying to slip in outside costs in order to slightly raise his cost to that allowing the higher percentage. With a carefully estimated cost to which the price schedule is adjusted this contingency is quite remote.

In the measurement of volume to determine cost, individual cuts could be taken by themselves should the same method be taken of working them throughout, instead of measuring the volume of the different strata. Total yardage of a cut into total cost of removing it would point out its own payment and be an easier solution of the price to be paid than long bickering between engineer and contractor with a probable lawsuit showing on the horizon over difference in judgment as to the proper classification to be allowed for some certain yardage.

The variation of this cost method of payment referring to a single cost schedule where each figure therein is double its predecessor is applicable to any piece of large work composed of varying units, since in the railway grading for which it is written the cost of doing a unit portion widely varies by reason of uncontrollable conditions and may be anything between two extreme minimum and maximum prices.

Second Application

The price schedule under this variation is determined as under the first and is applicable to all forms of construction, as well as railway work.

Using railway work for an example, instead of asking for a bid for which the contractor is willing to remove certain kinds of material, a bid is sought upon the eliminated cost of doing the work by different methods, i.e., by scrapers, by wheelers, by steam shovel and wagon, by steam shovel and cars, or by whatever method the contractor is equipped for and the situation is favorable to. The difference between the two applications lies in the fact that in the first the bid is based upon a rather hazy estimate of the different priced yardages to be handled which is often very misleading. In the second case the method of handling a closely known yardage is the basis of the bid, with each party sharing in the decreased cost if the estimated cost is found to be too large.

Corresponding to the figure bid for each of the different methods proposed for handling, a table of payments could be made by referring the actual cost of any certain yardage to a figure one-third larger than the bid and dividing this difference between both parties to the contract up to the points where the minimum and maximum percentage were reached, beyond which points their respective percentages would obtain on the actual cost of doing the work. This may be illustrated in Table II.

The second variation is merely a special case of the first. In the first, one price schedule is used throughout for all methods and final costs and is obtained by doubling each preceding figure to obtain the succeeding one; in the second, a single short table is made for each figure bid and though the cost may increase it never jumps into the next higher table, for the one table always applies to the method of handling upon which it was based.

Though the illustrations of both variations of the method are made by reference to railway grading, the second way lends itself very readily to concrete, steel, or brick work, timber framing, roadwork, pile-driving and in fact to all construction where payment is made upon the number of units of various kinds incorporated in the work.

Under this method the one letting the contract would have to be supplied with, as well as check, all pay rolls, original bills of material, equipment rental, and stock rental, if not more, to the cost record on a contract as he now gives attention to the workmanship under it.

Among the advantages to be cited for this method of contracting may be mentioned:

The range of bidding on any one contract is larger than under the present, for in addition to the range of prices there is the variations in the minimum and maximum profits to be considered, for while two or more bidders might submit the same figure as to actual cost there might be some considerable difference as to the range between minimum and maximum profits that they would consider equitable.

As the contractor is guaranteed against loss each

TABLE I. PRICE SCHEDULE 10c, 20c, 40c, 80c, $1.60. MINIMUM PROFIT 10 PER CENT, MAXIMUM PROFIT 40 PER CENT.

Cost c.	Deduction from next highest price*	Pay Price c.	Profit c.	Profit %	Cost c.	Deduct* c.	Pay c.	Profit c.	Profit %	Cost c.	Deduct* c.	Pay c.	Profit c.	Profit %
					20	....	22.000	2.00	10	40	....	44.00	4.00	10
					21	....	23.10	2.10	10	42	....	46.20	4.20	10
10	.....	11.000	1.000	10	22	....	24.20	2.20	10	44	....	44.40	4.40	10
10½	.....	11.550	1.05	10	23	8.50	31.50	8.50	36.96	46	17	63.00	17.00	36.96
11	.....	12.100	1.10	10	24	8.00	32.00	8.00	33.33	48	16	64.00	16.00	33.33
11½	4.250	15.750	4,250	36.96	25	7.50	32.50	7.50	30.00	50	15	65.00	15.00	30.00
12	4.000	16.000	4.000	33.33	26	7.00	33.00	7.00	26.92	52	14	66.00	14.00	26.92
12½	3.750	16.250	3.750	30.00	27	6.50	33.50	6.50	24.07	54	13	67.00	13.00	24.07
13	3.500	16.500	3.500	26.92	28	6.00	34.00	6.00	21.44	56	12	68.00	12.00	21.44
13½	3.250	16.750	3,250	24.07	29	5.50	34.50	5.50	19.00	58	11	69.00	11.00	19.00
14	3.000	17.000	3.000	21.44	30	5.00	35.00	5.00	16.67	60	10	70.00	10.00	16.67
14½	2.750	17.250	2.750	19.00	31	4.50	35.50	4.50	14.52	62	9	71.00	[illegible]	14.52
15	2.500	17.500	2.500	16.67	32	4.00	36.00	4.00	12.50	64	[illegible]	72.00	8.00	12.50
15½	2.250	17.750	2.250	14.52	33	3.50	36.50	3.50	10.60	66	7	73.00	7.00	10.60
16	2.000	18.000	2.000	12.50	34	2.60	37.40	3.40	10	68	5.2	74.80	[illegible]	10
16½	1.750	18.250	1.750	10.60	35	1.50	38.50	3.50	10	70	3.0	77.00	7.00	10
17	1.300	18.700	1.700	10	36	0.40	39.60	3.60	10	72	0.80	79.20	7.20	10
17½	0.750	19.250	1.750	10	37	....	40.70	3.70	10	74	....	81.40	7.40	10
18	0.200	19.800	1.800	10	38	....	41.80	3.80	10	76	....	83.60	7.60	10
18½	.....	20.350	1.850	10	39	....	42.90	3.90	10	78	....	85.80	7.80	10
19	.....	20.900	1.900	10										
19½	.....	21.450	1.950	10										

*Equals one-half difference between cost and next highest price.

TABLE II.

Suppose the price bid as the actual cost to be 12c and the minimum and maximum profits 5% and 30%; 16c would then be the figure to which the following table is built to fulfill the conditions:

Cost	8	8½	9	9½	10	10½	11	11½	12	12½	13
Pay	10.4	11.05	11.70	12.35	13	13.25	13.50	13.75	14	14.25	14.5
Profit	30%	30%	30%	30%	30%	26%	23%	19.6%	16.67%	14%	10.46%
Cost	13½	14	14½	15	15½	16					
Pay	14.75	15	15.225	15.75	16.275	16.800					
Profit	9.26%	7%	5%	5%	5%	5%					

contract would give the contractor the profits on that contract and he would not be looking to make a succeeding contract stand the loss of a former. This is as it should be, for no matter what the conditions it is not fair to any of the parties concerned to carry a loss from one contract to another. Each contract would be required to meet the labor, material and weather conditions which exist during the completion of that contract. Unforeseen emergencies are provided for their actual cost instead of being figured as probable and the attempt made to provide therefore by tacking a lump sum upon the figure for which, under normal conditions, the contractor would be willing to undertake the work. It is not claimed for this method, however, that it leaves nothing to be desired, for under it the incentive would still exist to slur the workmanship in order to reduce the cost.

The contract being let at an estimated cost which carries with it a payment allowing a fair profit and the one letting the contract sharing in any saving or decrease in cost, he cannot in justness feel that the contractor has the best of it if the contractor makes a larger percentage profit, inasmuch as the latter would receive a total sum less than the estimated total. The method is not at all complicated, but is essentially a sliding-scale payment which readily fits into present practice of cost keeping and competitive bidding.—Engineering News.

A Review of Good Practice in Sewage Collection and Disposal

THOSE phases of sewage collection and disposal which are most closely related to sanitation and to the successful working of sewer systems and sewage treatment plants were reviewed in the progress report recently made to the American Public Health Association by the Committee on Collection and Disposal of Sewage. The report summarizes the best present practice in sewerage, and portions of it are here abstracted and quoted, as given by our Chicago contemporary, Engineering and Contracting.

COLLECTION OF SEWAGE

Sewage Intercepted for Treatment.—The best practice in intercepting sewage for treatment is to build an intercepting sewer parallel to the natural water course, into which the treated sewage is finally discharged, and to connect this sewer to the collecting sewers so that the dry weather flow of sewage and first flush of the rain storm flows into the intercepting sewer. During times of storm the excess rainwater and the very much diluted sewage overflow into the water course, for the expense of treating all rain water would be prohibitive. In England the requirements of the authorities stipulate that the storm water overflows shall only come into operation when the flow of sewage is increased six fold and the sewage works must be constructed to deal with six times the normal dry weather flow. Since the consumption of water in England is approximately 40 gals. per capita per day, and the consumption in America sometimes exceeds 200 gals. per capita per day, it is evident that the dry weather flow of sewage in America is nearly five times as dilute as that of English cities. Arrangements, therefore, for intercepting the dry weather flow of sewage and the first flush of a rainfall compare well with English practice.

Velocity of Flow.—The gradient of sewers should develop self-cleaning velocities. The best practice indicates that the velocity of flow should be not less than 2 ft. per second in the separate system and 2½ ft. per second in the combined system. Steep gradients, however, necessitate deeper trenches, and here, as in most engineering problems, a solution must frequently be found between the ideal and that economically possible. As a result, flatter gradients than will give the above named velocities are often used, and while more frequent flushing is made necessary, no trouble has resulted, provided the sewers are constructed with due care to obtaining a smooth interior surface. Where the expense of obtaining steeper gradients is material, an actual velocity of 1 ft. per second in a well constructed sewer, taking domestic sewage, will, with a reasonable amount of flushing, keep the sewer clean. Trade wastes of certain character, however, require higher velocities to prevent deposits.

Ventilation.—Ventilation of the system becomes a problem where the sewers are not kept clean by the normal flow, or by flushing. Unless deposits form and decomposition results, there is little odor from sewage, and the danger of disease transmission by sewer gas negligible. The omission of the house trap and the use of the main riser through the house to a point above the roof, is the most effective means of inducing circulation of the air in the sewers, and with proper inspection of the plumbing system, involves no danger, but the best solution of the problem of ventilation is, as already stated, to maintain clean sewers.

Trade Wastes.—Sewer systems are primarily designed and built to carry domestic sewage and rain water. The introduction of trade wastes having certain characteristics is therefore liable to injure the sewers in the following ways:

(a) Heavy mineral solids, such as lime from glue works, dust from marble yards, etc., can form deposits in the sewers which retard the flow and reduce the carrying capacity.

(b) Gelatinous materials, hair from tanneries, grease from wool works, and similar substances, by adhering to the perimeter, increase the roughness of the interior surface and so reduce the carrying capacity.

(c) Acid wastes injure the cement joints between brick work or pipes, or attack concrete, causing leakage and destruction of the fabric of the sewer.

(d) Liquids of high temperature may soften and injure the bituminous joints in pipe sewers used to prevent the infiltration of ground water.

(e) The discharge of live steam, volatile liquids or inflammable gases, or the sudden emptying of vats of hot water, cause a serious menace to men working on the sewers.

Trade wastes having the above properties should be strictly excluded from the sewer system, unless submitted to sufficient treatment to remove the objectionable characteristics—as, for instance—the wash water from garages contains gasoline, which can be easily removed by passage through an intercepting tank, as required in London.

In regard to the admission of other trade wastes it may be said that it is cheaper to dispose of manufacturing wastes in combination with the sewage than separately, and sometimes purification is only made possible by admixture with the sewage. Generally, it is good civic policy to aid manufacturing interests by providing an outlet for the liquid wastes, but obviously, since there is no greater obligation on the part of the community to take care of liquid than of solid manufacturing refuse, the power should be given those in authority to levy special assessments, based on some logical expression of the increased cost of maintaining the sewerage systems caused by the entrance of these wastes. Further, it is evident that in many cases preliminary treatment of the manufacturing wastes must be required, and none should be admitted which will injure the sewer, increase the cost of maintenance beyond that involved in independent disposal, or prejudicially affect the treatment of sewage.

Ground Water.—The reduction of the leakage of ground water into sewers where treatment of the sewage is required, is a feature which is of sanitary interest. Many disposal plants are overworked, and overflows into the neighboring water-courses made necessary because of leakage in the seasons when the ground water is high. It is believed that the expenditure of the money necessary to secure tight joints is well justified and should be given careful consideration.

In connection with the reduction of leakage, it is good practice to lay underdrains beneath the sewers, lowering the water-table, and, by improvement of subsoil conditions, subserve the interest of public health.

Finance.—While not strictly within the scope of this discussion, a few words in regard to the financing of a sewer system may not be out of place. Very frequently the sanitary necessity for improved sewerage is confined to a limited section of the town or city. Those living outside of this more congested section are satisfied with their present method of individual disposal, and oppose the undertaking of a municipal system. The result is that very often the work is thus delayed because of a feeling that the entire community will have to pay for something from which only a part will obtain commensurate benefit. The answer lies in a proper method of assessment, which will require contributions in proportion to the benefits conferred. Thus, if a small part of the total expense is met by a general levy on all property to express the sanitary betterment to the entire community, a larger part is raised by assessment on property abutting on streets where sewers are built, whether these sewers are used or not, and, a still larger part is obtained by rentals for actual use, the relative benefits will be fairly indicated, and the opposition to the improvement by those not particularly in need of sewers may be thus removed.

In planning a comprehensive sewerage system it should be borne in mind that the discharge of sewage from a town into a stream through a number of sewer outlets is less likely to overtax the diluting power of that stream than when the intercepting sewer has collected all the sewage of the town and discharge it at one point.

Sewage Treatment

Need for Economy.—Viewing the problem broadly, it is a fact that to purify sewage to a degree which will render it innocuous to health will entail an expense which is not commensurate with the benefits to be derived therefrom. The tax rate in American cities is rapidly increasing, owing to rapid growth and the demands of modern civilization. Municipal funds may be used to greater advantage and benefit in other ways than attempting to purify sewage to the complete elimination of its potentially dangerous qualities.

Recognizing the basic fact that surface waters are bound to be polluted, and recognizing the futility of attempting in general to render the sewage innocuous to health; that is, to destroy all the pathogenic germs it may at any time contain; it then becomes necessary to determine to what degree sewage must be treated.

The Degree of Treatment Required.—To determine the degree of treatment required for sewage in any particular case requires consideration of the whole water-shed of the stream. On a large drainage area there are usually a number of communities which have a unity of interests. It is not always possible to prescribe the exact degree of cleanliness which should be maintained in the water-course, because it will differ with each stream and at different points along the same stream. As, for example, in the case of two communities, one near the head-waters of the stream and having several communities below it; the other near the mouth of the stream, which may be a tidal estuary.

The degree of treatment required in each case will depend on the amount of pollution permissible in the light of the use to be made of the water of the stream below the point of discharge of the effluent.

These are cases where it is doubtless expedient and wise to purify sewage to a greater degree than in others, as, for instance, where numerous cities and towns are located within a relatively close distance of one another and each taking its water supply from and discharging its sewage into the same river.

Other things being equal, it is always easier to satisfactorily purify and render safe a polluted water the less polluted that water is.

Logical reasoning forces the conclusion that all waterways are necessarily polluted, and where such waters are used as a source of water supply, that they should be purified before consumption. Basicly, the broad problem may be stated as follows:

1. Sewage, or effluent from treatment works must continue to be discharged in increasing quantities into running waterways and tidal estuaries.

2. The establishment and maintenance of conditions offensive to the aesthetic senses through such discharge of sewage must be guarded against.

3. Where sewage is treated so that upon its discharge into the rivers and tidal estuaries no offensive conditions are set up as regards objectionable appearance and odors, and no undue load is placed upon the water filters within the influence of the sewage discharged, and where a suitable margin of safety is allowed; the problem of sewage disposal, broadly speaking, has been solved.

With few exceptions, all sewage should receive some form of treatment, in order that offense shall not result. These refer, first, to overtaxing the digesting or oxidizing power of the diluting stream; second, to the formation of sludge deposits on the bed and banks of the stream, these deposits putrefying later and setting up and maintaining offensive conditions; and, third, the presence of floating material and oily sleek.

Omitting from the problem of sewage disposal the influence of water dilution and adequate velocities, screening to remove floating matter is the minimum degree of treatment required in any case. Usually, however, it is necessary to go further and remove the heavy suspended matter, leaving only that which is light enough not to deposit in the stream and if the flow of the stream is sufficient to dilute the clarified sewage and prevent offense the problem is solved.

The reasonable solution would appear to be a study of each problem in the light of minimum stream flows and volume of sewage, and under summer conditions. The character and extent of treatment of the sewage should then be adequate to meet these extreme conditions.

Even though water filtration be used the source of water supplies should not be so polluted, but that in cases of emergency the raw water cannot be sterilized and delivered safely into the mains. This points to the proposition that to preserve the public health it is not only necessary to purify the water supply, but also to protect its source. It is feasible, for short periods, to render river water that is slightly contaminated pure and wholesome for domestic use through the application of a chemical germicide; but such mode is not sufficient where the water is very much polluted with sewage. Existing statutory laws of the several states differ. Constitutional provisions necessarily control to some extent. Uniformity of laws will not be approached until there is some Federal authority, like a national board of health, whose duty, among other things, it shall be to exercise proper control over interstate stream pollution.

Trade Wastes.—The trade waste phase of sewage disposal is perhaps more difficult of satisfactory solution than the main sewage problem, for the following reasons:

Trade wastes come from industrial development which constitutes the financial back-bone of the country's welfare.

If the industries are compelled by certain local conditions to purify their wastes before discharge to a greater degree and at a higher cost than their competitors more favorably situated, where competition is sharp, their business profits may be seriously affected and even result in their financial ruin.

Generally speaking, the presence of trade waste, in the proportion usually found in normal city sewage, does not affect the efficiency of sewage treatment.

Where, however, large industries add certain wastes to a sewerage system, the treatment works of which were designed for purely domestic sewage, it is possible that the works may be totally unable to successfully treat the mixture.

Industrial wastes are frequently discharged from tanks in large volumes during a short time. This places an unnecessary burden upon the treatment works and can be prevented by the discharge of such tanks at a slow rate.

There are trade wastes which, under certain local conditions, affect the efficiency of water purification works, adding to the expense of their operation and even seriously affecting their hygienic efficiency. When such injurious conditions are caused by trade wastes two solutions appear possible:

1. For the producer or manufacturer to so treat the waste before its discharge that the obnoxious conditions are removed.

2. For the producer or manufacturer to reimburse the affected parties for the additional cost of treatment caused by the trade waste.

Removal of Suspended Matter from City Sewage

The minimum amount of treatment usually consists in the removal of the coarser suspended matter and the heavy mineral detritus. The use of coarse screens will prevent the offensive appearance of a water-course caused by floating solids of sewage origin, and the silting up of the point of discharge is prevented by the retention of the detritus in grit chambers.

Where the diluting power of the stream is not sufficient, or where velocities of flow are such that deposits would form, which, by decomposition and putrefaction deplete the water of its natural oxidizing powers, more suspended matter must be removed from the sewage. This can be accomplished by the use of either fine screens or sedimentation tanks. If the settling solids are removed by tanks the deposits of sludge are prevented. The biological forces of the water-course, therefore, are only required to care for the finely divided and soluble organic matter of the sewage effluent.

While dilution may care for the liquid effluent after sedimentation, the sludge removed from the fine screens or from the tanks must be handled in a sanitary manner. Screening stations usually are accessible to power or garbage disposal plants where the screenings can be burnt.

In Germany, and in this country, it has been shown that the separation of the settling sewage and the decomposing sludge in two-storey tanks will keep the sewage during its retention nearly as fresh as received. If the sewage be stale and odorous, however, this type of tank has no deodorizing effect, as its only function is the removal of suspended matter and decomposition of sludge.

The sludge withdrawn therefrom is practically odorless, drying quickly, and is suitable for filling low land or lightening heavy soil for agricultural purposes.

Removal of the Putrescence of Sewage.—Where sewage must pass into water-courses of limited volume, or where for sanitary reasons it is necessary to still further treat the sewage, the removal of the settling suspended matter is supplemented by biological treatment in prepared beds. The sewage should preferably be freed of its settleable solids before such treatment in order to secure higher rates of operation.

The intermittent filtration of sewage on sand beds accomplishes complete treatment, inasmuch as the suspended matter in the crude sewage applied is collected at the surface, the organic matter is almost completely oxidized in the pores of the filters and the bacteria largely removed by the smutzdecke. The rate of filtration is necessarily low.

In bacteria beds or the rapid coarse grain filters, however, the action is much less complete, since it only converts the putrescible material into fairly stable forms, so that when such an effluent is discharged into the water-course the purification begun in the artificial works should continue.

Design and Operation of Sewerage Works

It has already been stated that expert services are required for the efficient design of a sewer system and treatment works. Equal necessity exists for the skilled supervision of the operation of these works, the extent to which such supervision should prevail depending upon the type or class of works. It is possible to determine along general lines what the proper attention for each class of plant should embrace. It follows that skilled supervision of the operation of sewage works must be compulsory. State or Federal control is indispensable, although supplementary in character.

The foundation for efficient and economical operation of sewage treatment works generally must be based upon careful statistics of operation. Records of daily operation of works should be uniform for the same class or type of plant and to enforce such records requires the exercise of not only local but also of state and national police power.

The need of proper management of works is well expressed by Mr. John D. Watson, as follows:

One word with regard to management. However well a plant may be designed, if it is not well and skillfully managed it will become a nuisance and bring discredit to the engineer who designed it. The disposal of the liquid filth of a great community has an enormous potentiality for evil and if a town authority believes it necessary to avert this by expending large sums of money on constructional work, it is their bounden duty to see that the plant is placed in the most competent hands. Local authorities are by no means sufficiently alive to this aspect of the question, with the result that too many works are left to the management of untrained men. Hitherto anybody has been deemed good enough to look after a sewage work, but the day has now come when the manager should be a highly trained technical expert, if a local authority hopes to get full value out of the sensitive entity which we call a bacteria bed.

Laboratory Control.—The operation of a sewage treatment works is usually controlled by laboratory observations. The methods generally used are largely adapted from the sanitary examination of water, and in many ways this work could be simplified.

What the operating engineer needs to know is whether each part of the works is being operated at its maximum efficiency and whether the final effiuent is suitable for discharge into the stream to maintain the standard set for that stream. For the purposes of comparison with other cities more complete analyses are often desired of the crude sewage and of effluents. For instance, in the operation of a grit chamber the only important observation is the percentage of the dry residue which is organic, for if it is too high the velocity of flow through the grit chamber should be increased.

In the operation of a percolating filter it is most important to know whether the filter is delivering a stable effluent, and the storage and unloading of the suspended matter.

The most important facts required on sewage or effluent are the amount of settling material contained, the avidity for oxygen, and possibly the prevalence of pathogenic organisms.

The methylene blue test for stability marked a considerable advance, but even this has its limitations owing to the need of more extended data. Perhaps if natural conditions could be more nearly imitated the results would be more valuable. Small sample bottles, incubated air tight, afford quite different conditions from those existing in a normal stream with its constant absorption of oxygen from the air and the addition of oxygen liberated from green plants in the water.

Tests which show the results of the biological activity in the exhaustion of available oxygen in the sample tell more clearly the fitness for an effluent to be discharged than the quantitative chemical analyses of the sample.

The Midland Railway Company is taking steps towards the establishment of a new industrial centre in Winnipeg, on property adjacent to its trackage. Water service is to be installed for the benefit of firms locating on this property, together with sewers, electric light and other modern conveniences. The district will be laid out on the most approved lines, with broad thoroughfares, and every inducement will be offered to industrial firms to settle on the property of the company, where the best of railway facilities will be available.

Terra Cotta Walls

NEARLY all builders are familiar with hollow tile for fireproofing large steel frame buildings, but terra cotta is something quite different, and used without a framework of steel. In short, terra cotta hollow tile are specially designed and manufactured blocks which take the place of bricks, stone or other like materials in the walls and partitions of a building. They support the floors and roof just as other walls do, but they do far more than that and far more than other building materials, and these different functions are what we want you particularly to notice.

Everybody knows that air cells make the best possible insulator against the passage of heat. Terra cotta hollow tile divide the walls up into a multitude of air cells, and these cells prevent the passage of heat through the wall from outside to within, or from within to outside. As a result, any building having walls of hollow tile is warmer in winter than buildings of other materials, for the heat generated by the heating apparatus within is not dissipated from the walls of the building; while in summer weather the house built of hollow tile is cooler than any other, because the heat of the sun beating down on the walls cannot penetrate to the interior. The economy of hollow tile walls follows as a natural consequence of the non-passage of heat. The conductivity of walls is one of the great heat problems of the heat engineer, more heat being being required to keep the walls warm than to heat the interior.

But hollow-tile blocks are not the only kind of building materials which resist the passage of heat. Stone and brick walls do likewise, although not to so great an extent. Stone and brick walls, however, while they prevent to a certain extent the passage of heat, very freely conduct water into the building. Capillary attraction and the solid nature of the walls are the causes leading to this result. With terra cotta hollow tile, on the other hand, there is no capillary other than that necessary for the holding of mortar; even if there were, the air cells formed in the wall by the partitions in the hollow tile would prevent any moisture whatever from reaching the interior of the building. This difference between walls of solid masonry and those of hollow tile can be seen by examining the furniture in houses built of the different materials. In a stone wall building you will find that the keys in the piano stick after the house has been shut up without heat for a few days. In a terra cotta hollow tile home, heat can be shut off indefinitely without any evidence whatever of dampness becoming apparent. This saving of furniture, together with the saving of fuel and saving on insurance will go a long way toward making hollow tile buildings the cheapest as well as the best type of building in the long run.

A feature of home building which heretofore has received but scant attention from architects and builders, but which is of prime importance to the owners or occupants of a building, is perfect privacy in the home. What is more annoying to sensitive persons than a home, hotel or other building, for that matter, where there is no privacy? When anything is said or done it is telegraphed all over the building by the frail-lathed partitions acting as sounding-boards.—Construction News.

History of Water Sterilization by Chemical Methods[*]

By S. Rideal, D.Sc., F. I. C.

BEFORE entering on the subject it would be as well to lay down certain principles clearly, at the risk of speaking truisms: Drinking water has got to be wholesome, not sterile. What we have to do is (1) to prevent the entrance of disease organisms, (2) to kill them if they do enter. In both subjects the engineer and the chemist must collaborate, and the bacteriologist must keep watch.

It has been many times supposed that you could get perfectly innocent water for a city by going far enough to mountain gathering grounds, collecting all the brooks into a reservoir, and sending the water down by a long conduit. Such aqueducts in Great Britain range from 43 to 99 miles. The original water of the brooks is by no means pure bacterially owing to animals, even if the watershed is cleared of human beings. The British Local Government Board reports give several instances of epidemics occasioned by upland water. We may presume that during the long transit the pathogenic bacteria will disappear, but this is a very expensive way of attaining the object.

Pollution of rivers, both by sewage and by manufacturing effluents, had reached a flagrant and dangerous degree, but has since been greatly abated in most countries, and by sand filtration a water of considerable purity is obtained from rivers by a majority of communities. I need hardly dwell on the obvious advantage of this course. The river is adjacent; constant attention to the cleanliness of its bed and the inoffensiveness of its water are imperative for sanitary and commercial reasons. On the other hand, a long aqueduct is enormously expensive for construction, maintenance, and care against lateral contamination, besides the fact that the water is not always initially unimpeachable. Cities and towns are built on rivers, and why should we not use the water brought to our doors? No city depending on a long conduit is safe from a water famine for three chief reasons: (1) Accident, (2) drought on the uplands, and (3) the possibility, which we may think remote, of an enemy destroying the aqueduct. The last reason led to the ruin of many cities in history.

Purification Always Necessary

Dependence on wells is of limited application, and is notoriously unsafe; even deep wells in chalk are liable to pollution through fissures. The fact of the matter is that a system of purification is needed in all cases. Disease bacteria are apt to penetrate sand by "growing through" or by their minuteness; therefore the product of sand filtration is not always innocuous. Dr. Houston, in London, recommended storage as a method of rendering Thames water safe, but the storage must be for not less than two weeks, and might with advantage be for from one to two months. This involved the construction of enormous and costly reservoirs for London's water supply, and, in addition, the raw water must first be passed through settling basins to remove coarser impurities. Even then, in the Seventh Report of the London Water Board, December, 1911 (p. 36), it is found that, "despite the remarkable improvement effected by storage . . . . it seems unwise to trade too greatly on this circumstance if any practicable remedy, even of a partial kind, is available." Later, in the Eighth Report, of February, 1912, Dr. Houston, after investigation, proposes an "excess lime" method, founded on his observations that "quicklime (about 75 per cent. CaO) added to raw Thames water in the proportion of 1 part of this quicklime to 5,000 parts of water, kills B. coli in from five to twenty-four hours . . . and, inferentially, but certainly, the microbes also of epidemic water-borne disease—e.g., the typhoid bacillus." The excess of free lime is to be then neutralized by one-third of the volume of "adequately stored water," which must, of course, be previously examined.

This is one way of chemical sterilisation which has been often tried, the attraction being the cheapness of lime, and also the softening effect on the water. It is really, however, an expensive one on account of the amount of lime needed—equal to about 1 ton per 1,000,000 gallons, and there is the need to test the water both before and after the process, and, in addition, the difficulty of getting rid of the huge deposit of carbonate of lime formed.

Several more efficient sterilizers have been introduced, but to work with economy must always have the proviso that the water is at least roughly filtered beforehand, in order not to waste the reagent on such matter as can easily be separated mechanically. The introduction of mechanical filters has made the operation comparatively simple, and enables necessary chemicals to be added under control. It has been pointed out that the unstable yet powerful bacterial toxins are not likely to be destroyed by the comparatively mild oxidising agency of the mechanical filters, or even by the sand filters, in the winter. They are removed, neutralized or destroyed, however, by the best methods of chemical sterilization.

We may rapidly pass in review a number of the sterilisers available under certain circumstances. In 1892 Dr. Christmas showed that 1 in 100,000 of citric acid was fatal to cholera organisms, but that ten times the quantity was required for typhoid organisms. This amount gave an acid taste, and was unduly expensive. In 1901 Dr. Parkes and myself introduced the use, for possibly polluted waters in the field, of tabloids of bisulphate of soda. These removed any danger of enteric origin.

As to copper salts, you are more familiar with their use in America than we are in Europe. I have published some researches on the point which agree with other investigators in showing that, employed in rather large proportions, they kill objectionable algae, but are not of much good against bacteria. A fault is the immediate precipitation of the copper salt by the natural carbonate of lime in the water, and, although an insoluble copper salt can act germicidally, as proved by the use for phylloxera, the action is local and irregular. The application, accomplished by towing boats with bags of sulphate of copper over the reservoir, has been expensive, and it is very difficult to make it uniform. Subsequent filtration is necessary, and there is a chance, even then, that traces of copper may remain in organic solution, so that it is fortunate that there are safer methods.

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[*] Paper read at the Fifteenth International Congress on Hygiene and Demography, held at Washington.

Numerous Oxidising Agents Have Been Employed

Potassium permanganate was used on a large scale for the drinking water of the soldiers in the Franco-German War of 1870, and in India it was widely applied to wells and tanks, which were regularly "pinked" by officials as a defence against cholera. Later reports on the efficiency of the practice have, however, been unfavorable. In 1899 I suggested the use of sodium peroxide; it reacted with the dissolved carbonic acid, giving nascent oxygen and sodium carbonate, so that softening and sterilization were done together. The quantity required for sterility varied between 1 in 1,000 and 1 in 10,000; cholera was killed in eight hours, typhoid in six. Reichel (Z. f. Hyg., 1908) found that 1 in 2,000 of hydrogen peroxide killed B. coli in twenty-four hours, and 3 in 2,000 sterilized in six hours. Hetsch stated that calcium peroxide was more energetic, and it was sold for the purpose under the name of "bikalzit." Magnesium peroxide (Croner, ibid, 1908) is made for the same object by the "Oxidinsterilisierungswerken," but is likely to introduce magnesium hardness.

Bromine (Braithwaite, Schumberg, 1897-98) and iodine (Allain at Marseilles; Vaillard, Arch. de Med. milit, 1902) have been limitedly used for water treatment in emergencies, but are objectionable. Even the fluoride and silicofluoride of silver have been placed on the market as water sterilizers under the names of "tachyol" and "isotachyol." (Gaz. Chim. Ital., 1907).

A condition of drinking water sterilization is that no substance should be left behind which can in any way be injurious to health, and, if possible, that nothing extraneous to the water should remain. It is at the same time a disadvantage if a disinfectant, however powerful in its first onset, is very evanescent, as many disease germs are strongly resistant, and we know that the time factor is of extreme importance in sterilization.

Ozone Used Considerably

In the first of these conditions ozone suggests itself as an ideal reagent, producing nothing by complete oxidisation of organic matter but carbonic acid and water, while the combined nitrogen is partly liberated in the free state and partly oxidised to harmless nitrates, and the organic sulphur and phosphorus give equally innocent minute quantities of sulphates and phosphates. It has been asked whether intermediate compounds might not be formed which could have some physiological effect. I have not found any such in my examinations of the process, and the water is singularly pure afterwards. Ozone is now rather extensively used in Europe for sterilising partly purified water. In 1908 I was called upon to examine the De Frise system at the Paris waterworks of St. Maur, and found very successful results. The river Marne water, after ordinary sedimentation and filtration through gravel and sand, was still unfit for a supply, but by afterwards ozonizing it gave a well-aerated brilliant liquid of natural bluish tint and quite inodorous, containing per cubic centimetre only one or two innocuous organisms of the subtilis type. The coli test became invariably negative, although altogether 1,580 cubic centimetres were examined, with a maximum of 200 cubic centimetres at one test. I found that 57 kilowatt hours per 1,000,000 imperial gallons were required for the sterilizing operation, and 76 kilowatt hours for pumping. These figures would be reduced to 47.5 and 63.4 kilowatt hours respectively per 1,000,000 United States gallons. The De Frise apparatus used Siemens-Halske ozonizers with a simple and efficient ozonizing tower and a circuit by which ozone escaping after action was returned and used again, thereby effecting an important economy. The Paris Municipality decided, in July, 1910, that the part of the city drinking supply derived from the Marne (about 20,000,000 gallons daily) should, after coarse filtration, be sterilized by ozone—half by the De Frise and half by the combined Otto process. The latter employs "emulsers," which are injectors effecting a mixture of ozonized air with the water, the action being completed in "columns of self-contact." Ozone sterilisation has been installed in about thirty French towns, in Roumania for the Danube, at St. Petersburg for the Neva, at two waterworks in Holland (the pioneer), Belgium, Germany, Italy, Spain, Brazil and Egypt, and experiments have been undertaken at Darjeeling, in India, while an installation is in course of construction at the Knutsford waterworks, Cheshire, England.

Other processes differing in mechanical details are the Vosmaer, tried at Philadelphia, and the Howard-Bridge, at Lindsay, Ont.

St. Petersburg Has Largest Ozone Plant

The largest plant at present is that at St. Petersburg, Russia, for 11,000,000 gallons per day. The water is first treated with sulphate of alumina, then passes on to thirty-eight sand filters at a rate of 1,000 gallons per square metre of filtering surface per hour, and finally enters the five sterilising towers along with ozonised air. There are 128 Siemens-Halske water-cooled ozonizers. The air is freed from moisture by refrigeration, and is ozonized to the degree of 2.5 grammes per cubic metre. The total cost from the raw river to the finished water was recorded in 1911 as 0.86d. to 0.97d. per 1,000 gallons. At St. Maur, Paris, M. Colmet Daage estimated that the cost, under the most favorable circumstances, was 0.31d. per 1,000 gallons, excluding interest, amortisation and repairs. At Nice, where cheap water power is available, the average last year was given as 0.164d. per 1,000 gallons, and at Rimiez, where there is, besides, no pumping, it was only 0.125d. A portable ozone purifier has been adopted by the Spanish Government for the water supply of armies in the field.

The preference for ozone as a water-sterilizing agent has been hindered by several difficulties. One is the question of expense. In this regard the manufacture has been considerably cheapened. Another is that it has to be applied in the gaseous form diluted with air so that a large quantity of inert gas must be pumped, and with this admixture the ozone does not very readily dissolve. The latter fact has been overcome by using towers and saturators, as mentioned above. Moreover, the conversion of oxygen into ozone is a reversible action, requiring a number of precautions as to detail. In spite of the numerous researches, the best conditions are not yet fully agreed on; therefore, we have not reached finality in the economy of ozone production. It is stated that "the best results ever obtained with a silent discharge apparatus gave 36.7 grammes of ozone per kilowatt hour, the theoretical yield being over a kilogramme." A certain amount of the loss is due to the formation of ultra-violet light in the machine. When an ozonizer is acting properly the interelectrodic space has an almost uniform violet illumination, without any sparking. Regener (Ann. d. Physik, ix., 1,033, 1906) showed that the presence of ultra-violet light limits the concentration of ozone within certain limits, above which it exercises a de-ozonizing effect. These rays are well known to have also a sterilising action, and my son, Eric K. Rideal, has devised an apparatus in which both activities are utilized. (English patent 18680 of August, 1910).

Siemens and Halske have several devices for preventing corrosion of the metallic parts of the apparatus. British patent 17787, of 1910, reverses the usual procedure by drawing ozonized air through the water instead of forcing it through from below, so that the main work shall be done, and the ozone almost entirely used up, before entering the pumps. This appears expensive mechanically. Their French (international) patent 431402, of 1910, introduces small quantities of water into the pumps at the same time that the gas is admitted.

The Chlorine Process

Chlorine sterilisation is effected in practice by means of hypochlorites prepared either chemically or electrolytically. It will be well known to you that "chemical chlorine," chiefly chloride of lime, is largely used in America; it is also employed at some places in Europe and in India. After three noted epidemics of typhoid in England, chloride of lime was used at Maidstone for disinfecting the mains, pipes and reservoir; at Lincoln for the city water supply; and, quite lately, for the same purpose at Cambridge. At Johannesburg the Witwatersrand supply is sterilized by the addition of chloride of lime equivalent to 0.25 to 0.5 part per 1,000,000 of available chlorine. (Leitch, Proc. Inst. Civ. Eng., London, 1911).

The objections to the lime compound are avoided by electrolytic hypochlorite, which, having soda as a basis, leaves behind only an unimportant residue of common salt, and slightly softens the water, besides having, apparently, a somewhat greater bactericidal effect. The addition of 1 to 2 parts per 1,000,000 of available or active chlorine, which is all that is generally needed, does not affect the taste, and even where a water is excessively polluted, and more is necessary, the product is even then not brackish like many present supplies.

I first began trials on a large scale at Maidenhead, England, in 1898, and found that 17 parts per 1,000,000 of available chlorine killed, in fifteen minutes, all the organisms in a filtered sewage effluent entering the Thames. In 1904, at Guildford, I observed that, with 2.5 parts per 1,000,000, tertiary effluents were practically sterilised—in fact, were purer bacterially than the town water supply. I next tried experiments on the latter, which contained ninety organisms per cubic centimetre, with coli present in 4 cubic centimetres. After treatment with 0.75 part per 1,000,000 of available chlorine, the total organisms were reduced in five hours to fourteen per cubic centimetre, and coli was absent from 20 cubic centimetres. A portion purposely infected with 100 coli per cubic centimetre was treated with 0.8 part per 1,000,000 of available chlorine, and after one hour's action there were no coli present in 20 cubic centimetres, and this condition remained for a considerable distance in the channel. Since then I have been directing the application of chemically prepared sodium hypochlorite to 100,000 imperial gallons daily to the drinking water supply of a North of England town with success, in the proportion of 1 to 2 parts available chlorine per 1,000,000; practical sterility is attained; there are no coli in 75 to 85 cubic centimetres, and the taste is not affected.

Not sufficient notice has been taken of an explanation I gave in 1909, at the Leeds Health Congress (J. R. San. Inst., London, xxxi., 2), of the fact that with hypochlorites the first rapid consumption is succeeded by a slower action, which continues for some hours or even days to favor sterility. It is due to the formation, by the action of chlorine on ammonia and nitrogenous organic matters, of strongly germicidal compounds, chiefly chloramine, NH_2Cl, and hydrazine, N_2H_4. These, in the traces present, are not injurious to higher animals, and soon disappear. The removal of any residual traces is hastened by cascades which have also been used with success in ozone treatment.

Value of Testing

A great advantage both of the ozone and chlorine processes is that they can be so easily controlled by the starch-iodide test. It is sufficient to observe that the reagent is faintly blued by the treated water to insure adequate sterilization. Systematic testing in this way avoids the risk of underdosing or overdosing, and does away with the need of removing any excess of the sterilising agent by a secondary treatment, such as the addition of sulphites or filtration through prepared charcoal or iron turnings and sand, processes that increase cost, time and space required. I have found that if the process is controlled, as above, without such further treatment, the water usually becomes free from odour and taste in one and a half hours.

The cost of chlorine sterilisation will, obviously, depend greatly, among other things, on the price of materials. If 1 part per 1,000,000 of available chlorine be required, and if its cost be about £14 per ton when derived from chloride of lime, and £21 per ton when made as sodium hypochlorite (J. Soc. Chem. Ind., Jan. 31, 1912), this item alone will reach 0.022d. in the second. The lime compound is more suitable for sewage than for drinking water, since it increases the hardness and affects the taste. There is for many reasons an advantage in making sodium hypochlorite electrically at the waterworks, especially if cheap power is at hand.

The Ferrochlor (Duyk) method adds about 8 parts of ferric chloride and 0.2 part of available chlorine as bleaching powder per 1,000,000 gallons of water to effect coagulation and sterility. One objection is that it is advisable to do all coagulation and sedimentation before sterilizing in order to avoid recontamination.

Three Suggestions for Good Concrete Pavements

By James O. Heyworth.

The most important features to be considered in concrete highway construction, in my opinion, are:

1—Do not use a top mortar finish, unless it is applied simultaneously with the foundation concrete.

2—Construct the pavement as monolithic as possible, avoiding blocking it off into small units. I consider a small unit less than 100 square yards and suggest that 100 square yards be considered a minimum. Would recommend making the units, 1,000 to 3,000 sq. yds. or more.

3—Do not make pavement too narrow and thereby force vehicles to travel over the same part of the pavement, forming ruts, but provide a good liberal margin to act as a shoulder and thus prevent breaking off the sides of the pavement.

Ottawa Water Supply—Accepted Report

Recommendations of Sir Alexander Binnie Finally Approved—The Thirty-One Mile Lake Scheme, Which Involves a Cost of Nearly Eight Million Dollars

THE solution of Ottawa's water supply problem appears to be at hand. After having reports prepared upon all available sources of supply the City Council, upon October 17th, approved and passed the scheme of bringing water from Thirty-one Mile Lake in accordance with the recommendations of the English expert, Sir Alexander Binnie. The estimated total cost of the undertaking is $7,985,000, and the time of completion is placed at nearly four years from date. Copious extracts from the report are given below:

Thirty-one Mile Lake and Pemichangaw Lake are situated on the east bank of the Gatineau River at a distance of about forty miles to the northward, measured in a straight line from Parliament Hill to the south end of Pemichangaw. The surrounding area of land which drains to these lakes is dotted with numerous other smaller lakes, but the above mentioned are the only lakes of any importance and extent.

The quantity of water which can be derived from any given drainage area depends on three factors:—1, the extent of the drainage area, which in this case would be 150 square miles approximately; 2, the quantity of rain or snow which is annually precipitated on that drainage area; and, 3, the proportion of the precipitation which flows from the ground and can be collected, known as the run-off.

Taking 13.6 inches of rain on the catchment area of 150 square miles, the average yield would be during the three driest consecutive years approximately 81 million gallons per diem, and would, therefore be ample to meet the requirements of a population of 750,000 persons.

Quality of the Water

Apart from bacteriological or chemical examination the character of a water can be very largely predicted from an examination of the drainage area. In this case the rocks are gneiss and crystalline lime stone and are apparent at or near the surface over almost the entire drainage area which is covered with trees and undergrowth, very little clearing having been done, the entire resident population amounting to only 130 persons, or less than 1 to the square mile. In addition to this resident population there are a certain number of summer visitors and lumbermen, who are at work round the lake in the early summer months. The shores shelve rapidly into deep water almost all round the lakes and the islands with which they are dotted. No soundings have yet been taken except at certain points, but we are informed that there are places in the lakes over 200 feet in depth. The drainage area has now been examined at a great number of points and has been found free from peat or other surface deposits liable to discolor the water, and the total area of swampy ground is insignificant. It might be expected that water flowing from such a drainage area would be of exceptional purity and such is the case. This water, having been under observation during the whole of this year, has always proved to be bright and clear, the bottom being plainly visible at great depths. About the beginning of September certain organisms called Rhysopods make their appearance in all the lakes examined, except some of the small ones, and disappear in a short time. In appearance they resemble minute sea urchins but are plainly visible to the naked eye, and are, in fact, of such dimensions as to be readily removed by fine mesh screens. It will therefore be necessary to provide such screens at the outlet to prevent both these organisms and fish from entering the pipe. If steps are taken by the City to prevent contamination in the future by human pollution there will never, in my opinion, be the slightest necessity to filter this water, and should Ottawa adopt these lakes as a source of supply one of the finest water supplies in the world would be secured.

Method of Collecting and Storing the Water

There are four lakes which form a chain stretching approximately north and south. Commencing at the north is Mitchell Lake, a small lake which discharges through a narrow gorge at its outlet into a channel which finds its way into the Gatineau. This lake has a surface area of .7 square miles, and water level in September was 523 feet above datum. It receives the entire discharge of Thirty-one Mile and Pemichangaw, and the narrow rocky gorge already referred to forms an admirable site for a dam. The next in the chain towards Ottawa is Thirty-one Mile Lake which is about 18 miles in length with a water area of 18 square miles, the water level this summer being about 530 feet above datum. Immediately to the south, and separated by a narrow neck of land, lies Pemichangaw with a water area of 6 square miles and a length of about 5 miles, the water level this summer being about 552 feet above datum. Crossing the height of land to the southwest of Pemichangaw we come to Long Lake, having a length of about 1¼ miles, and a water area of about one quarter of a square mile. The distance between Pemichangaw and Long Lake is about 3,000 feet, and the water surface of Long Lake is 561 feet above datum. It is proposed to tunnel through the ridge between Pemichangaw and Long Lake and by means of the dam at the outlet of Mitchell Lake to bring all the lakes to one level, namely, 570 feet above datum, and to start the aqueduct to Ottawa from the south end of Long Lake. This would mean raising Mitchell Lake 47 feet, Thirty-one Mile Lake 40 feet, and Pemichangaw Lake 18 feet. The contour surveys to determine the top water area at this level are not yet completed, but it may be roughly assumed that the total top water area of the lakes when brought to this uniform level of 570 feet above datum will increase to about 35 square miles in area. One foot difference in level of a water surface having an area of 35 square miles represents about six thousand one hundred million gallons, and 18 inches would give a year's storage of a daily flow of 25,000,000 gallons, 3 feet would give sufficient storage for 50,000,000 gallons per diem, and 4 feet 6 inches sufficient for 75,000,000 gallons per diem. The maximum variation in water level would therefore be small.

Steps to be Taken to Afford Immediate Supply

It has already been stated that the dam would be constructed so as to raise the level of the lake to 570 feet above datum which means that Thirty-one Mile Lake would have to rise 40 feet, and Pemichangaw 18 feet. Owing to the enormous area of Thirty-one Mile Lake it would take five or six years before this lake would rise even to the level of Pemichangaw, that is 22 feet, and ten or twelve years before it reached the final level of 570 above datum. It is obvious that the scheme should be so laid out as to enable water to be brought forward to Ottawa as soon as the equduct and service reservoir can be completed, which can be effected in the following manner:—

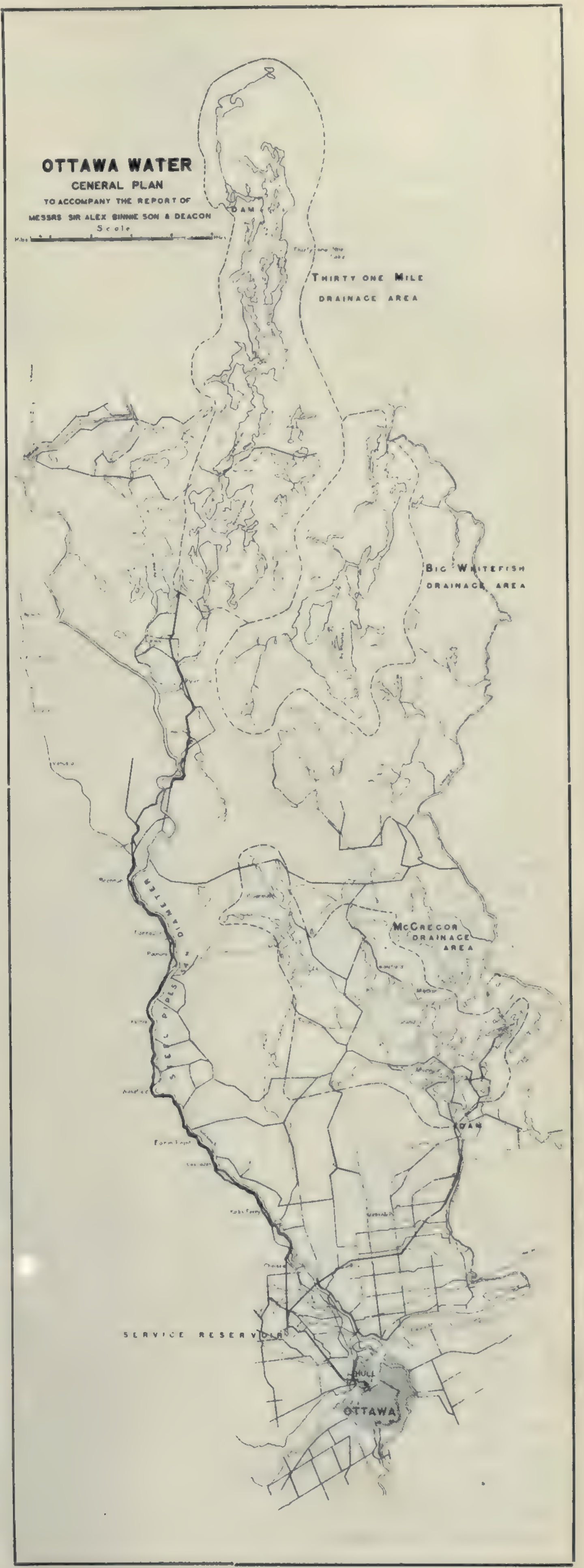
Pemichangaw and Long Lake have a total drainage area of about 41½ square miles and would yield on the basis of a run-off of 13.6 inches about 22½ million gallons per diem, or sufficient for the needs of the City for a good many years.

The level of Pemichangaw Lake varies between about 554 and 552 feet above datum, and the lake is separated by a narrow neck of land known as Point Comfort from Thirty-one Mile Lake which is about 30 feet lower in level. This neck of land acts as a natural barrier which retains water at the higher level in Pemichangaw, and is traversed by a narrow gorge through which the water is discharged into Thirty-one Mile Lake. This gorge is blocked by a wooden dam provided with sluices and the fall of water from one lake to the other is utilized for a sawmill. Water also finds its way into Thirty-one Mile Lake from Pemichangaw through debris overlying the rock filling the bottom of what no doubt was at one time a valley of discharge from one lake to the other. I was informed that there were underground fissures connecting the two lakes, and the measurements which have been taken this summer show that when the water level in Pemichangaw stood at 554 feet above datum the amount of water which got through this debris or surface fissures in the rock amounted to approximately 8,000,000 gallons per diem; but when the water level in the lake had fallen to 552 datum the discharge was very small indeed, showing that the water was really finding its way from one lake to the other through a comparatively shallow channel. Of course there may be some deep underground fissures which would be incapable of detection, but there is no doubt that any water lost by them is insignificant provided the present level of the lake is not materially altered. I should therefore propose as one of the first steps to be taken to open a trench across the old channel and fill this concrete so as to cut off the water now leaking away through the debris when the water level is raised to 554 feet above datum, and to make a water tight dam in lieu of the existing leaky dam which holds up the water for the mill. These works would enable the water to be retained in Pemichangaw Lake and the City could draw upon that lake as soon as the aqueduct was completed. The present water area of Pemichangaw is about 6 square miles and 5 feet in depth on that area would represent the total storage required for the first installment of 25,000,000 gallons per diem. Assuming that the minimum draw-off level was to be 549 feet above datum or 3 feet below the present level, the maximum level at which the water would overflow would be 554 feet above datum. Although in this way the storage required for the first installment would be provided it must always be borne in mind that Thirty-one Mile Lake will take years to be brought up to the level of Pemichangaw, and it must not be forgotten that on the basis of my figures the Pemichangaw area will not quite yield sufficient for the first installment of 25,000,000 gallons or as much as the aqueduct will carry, and the sooner Thirty-one Mile Lake is brought up in level the better.

The dam at the outlet of Mitchell's Lake should therefore be proceeded with as soon as the necessary arrangements could be made so that Thirty-one Mile Lake can be gradually raised to such a level as to flow towards Ottawa by means of the aqueduct. I have therefore included in the estimate for the supply of 25,000,000 gallons the cost of the dam at Mitchell's Lake, and also the necessary clearing to bring Thirty-one Mile Lake and Pemichangaw Lake to the level of 570 feet above datum when storage will be provided for the full yield of the drainage area or 81,000,000 gallons a day.

To bring the water of Pemichangaw into Long Lake from which lake the aqueduct would start, will necessitate construcing a tunnel through the height of land between the two lakes, a distance of about 3,000 feet, as already pointed out. This tunnel should be made about 7 feet internal diameter so as to permit of the whole available yield, namely, 81,000,000 gallons per diem being passed through into Long Lake without appreciable loss of head.

The best location for the invert of the tunnel would be about 6 feet below the present level of Pemichangaw or at


OTTAWA WATER
GENERAL PLAN
TO ACCOMPANY THE REPORT OF
MESSRS SIR ALEX BINNIE SON & DEACON
Scale
Miles
DAM
Thirty one Mile Lake
THIRTY ONE MILE DRAINAGE AREA
BIG WHITEFISH DRAINAGE AREA
McGREGOR DRAINAGE AREA
DAM
SERVICE RESERVOIR
HULL
OTTAWA

about 546 feet above datum, 24 feet below top water level when brought up to 570 feet above datum.

This tunnel would terminate at each end in covered shafts, the water entering the shaft at the inlet end and leaving the shaft at the outlet end well below the water level of the respective lakes.

In this way there would be no danger of the water in the tunnel freezing even if the lakes were drawn down to the level of 549 feet above datum, which is the minimum draw-off level, during the construction of Mitchell's dam and during the period while the lakes are filling up to 570 feet above datum.

In order to enable the tunnel to be driven from an open face to obviate the necessity of pumping any water which may be met with, and also to facilitate the construction of the outlet works, it is proposed to draw down Long Lake during construction in the manner to be presently described.

Works at Long Lake

Long Lake varies in depth from about 20 feet to 50 feet, being shallow towards the north end and deep towards the south. This lake, like Pemichangaw, is formed by a natural barrier, and the water issuing from it passes over this barrier by means of a series of small falls and cascades to the valley below, dropping 50 or 60 feet in a short distance.

A short cutting through this barrier will therefore enable the water to be drawn down 20 or 30 feet without any difficulty.

The shores of the lake are steep and rocky but at times during and after windy weather the sediment in the bottom is stirred up by wave action. This action does not extend to any great depth probably not much below 10 feet. It is therefore proposed to remove the sediment, logs, etc., when the lake is drawn down so as to prevent similar action taking place in the future.

Outlet Works

These works would consist of a straining tower about 50 feet high, covered at the top and provided with copper gauze screens; the water entering the tower at a depth of 7 or 8 feet below the minimum water level of the lake and after passing through the screens leaving by means of a culvert through the natural barrier already referred to, to the commencement of the pipe. It is proposed to install a small water-driven turbine so as to work a pump for supplying high pressure water for washing the screens. The power for this turbine would be supplied by allowing water to pass from the lake to the valley below, the turbine being situated at the foot of the fall which has already been referred to. The screens would be made so that they can be lifted in rotation for cleaning purposes without interfering with the flow of water and the dirty water, after cleaning, would be discharged into the valley before the straining tower.

Description of Pipe

The top water level of the service reservoir which will presently be described, would be 445 feet above datum. The distance between the outlet and the service reservoir is about 235,000 feet and allowing for losses of head at the reservoir the hydraulic gradient would be approximately 1 in 1,960, and with this gradient a welded or lock-bar steel pipe, 54 inches in diameter, would deliver 25,000,000 gallons a day allowing for future encrustation. If rivetted steel pipes were used the internal friction is slightly greater on account of the rivet heads and the diameter of the pipe would be slightly larger to discharge the same quantity of water. The estimate has been based on approximate quotations received for 54-inch welded steel pipe, 7-16th of an inch in thickness. With soft water considerable encrustation may be anticipated, but seeing that the Thirty-one Mile Lake water contains about four and a half grains of lime per gallon it is probable that this may not take place to any appreciable extent. The Ottawa River water contains about two and a half grains per gallon and appears to have had very little effect on steel pipes which were laid many years ago without any protection by means of coating. It has been found that steel pipes are also liable to corrode from the outside if laid in saline or marshy ground unless special precautions are taken. The best protection in such cases is to surround the pipe with tarried hessian or jute, and provision has been made in the estimate for this precaution where the pipes would be located in swampy ground. To prevent freezing in winter the pipes should be laid so that the bottom would come a minimum of 8 or 9 feet below the surface of the ground, and the estimate has been got out on this assumption.

Service Reservoir

The function of this reservoir is two-fold:—

1. To provide against a water famine in the town should the water have to be cut off in the aqueduct to allow of repairs being executed.
2. To meet the daily fluctuations in demand as the water supplied to a town varies throughout the day, the maximum draught or peak load being nearly twice the average. A reserve must also be available in case of fire.

Supposing no service reservoir were provided it would be necessary to lay two pipes all the way from the source of supply in order to be able to shut off one line while the supply was kept up by the other. It is far more economical to lay out a gravity scheme of this nature so as to include a service reservoir of ample size than to lay a duplicate main when the aqueduct is long and a good site can be found for the reservoir at a suitable level. Fortunately a good site at a suitable level has been found where the water would be stored in a basin having a flat bottom and surrounded by hills. The bottom of the reservoir varies from about 410 to 416 feet above datum and by means of three small dams the water would be held up to a level of 545 feet above datum. The water area would be about 54 acres and one foot in depth would represent approximately 15,000,000 gallons. The probable variation in water level to meet the daily fluctuation in demand would therefore be less than one foot. The contents of the reservoir between the level of 420 and 445 feet above datum would amount to about 295,000,000 gallons and represents a reserve of about 12 days supply which is very ample when compared with what is allowed by other cities. The average number of days supplied in the service reservoir of the large towns in England is from three to four days reserve. The static pressure given by this reservoir would represent 118 pounds at the pumping station or 81 pounds at Parliament Hill, and is about the maximum pressure that the house fittings would stand in the lower parts of the City.

Pipes From the Service Reservoir to the City

These pipes should be designed so as to be able to discharge for short periods during the day a much larger quantity than the pipes from the source to the service reservoir for the reasons which have already been given. The maximum rate of consumption is taken at 110 gallons per head per diem and if unavoidable waste is added to this, say 40 gallons per head per diem, the total maximum rate of consumption would amount to 150 gallons per capita per diem. To this should be added the amount required for say 25 fire streams which would be equivalent to a rate of discharge of another 36 gallons per head per diem, so that the pipes should be designed so as to be capable of discharging 186 gallons per capita per diem as a peak load. On the basis of a population of 250,000 persons the above rate would represent a discharge of 46½ million gallons per diem. Two 51 inch pipes would deal with this peak load so that when the population increased to 250,000 persons the pressure would not fall below 110 pounds at the existing pumping station even should a serious fire occur during the period when the maximum demand was being made for water for domestic purposes.

I have directed considerable attention to the question of this river crossing and various routes have been investigated. I am emphatically of the opinion that the pipes should be carried over the various channels at this point on bridges, as if the pipes are carried over a bridge it is an easy matter to inspect and maintain them in good condition, but once they are laid in the river bottom it is a very different matter. Another method which is equally effective is to construct a tunnel under the river and to lay the pipes through this tunnel. I am adopting this latter method in the crossing of the River Dee on the aqueduct from Wales to Birkenhead and have considered the possibility of crossing under the Ottawa in the same manner. The rock, however, is full of joints and I should anticipate considerable difficulty owing to the amount of water which would be met with in driving the tunnel under the river, so I have come to the conclusion that it would be better to pass over and not under the river. There are four channels which would necessitate first,—a bridge about 300 feet long on the Hull side of the river, then a bridge 500 feet long over the main channel of the river, then two short spans, one of 80 and one of 120 feet, the latter crossing the tail race canal from the present pumping station.

For the present I confine myself to an aqueduct crossing only, the bridges being designed so as to interfere as little as posible with the existing surface of the ground and of sufficient strength to carry four 51-inch diameter pipes which would give a maximum discharge at the rate of 93,000,000 gallons per diem without material loss of head between the service reservoir and the City.

Summary Estimate

Having now considered the main features of the project it remains to give the estimate of the cost of the necessary works which is as follows:—

Head Works	
Dam at outlet of Mitchell's Lake to raise water surface to 570 feet	130,180
Clearing and burning area to be submerged	128,000
Tunnel between Pemichangaw and Long Lakes including shafts, etc.—3,000 lin. ft.	119,630
Outlet works at Long Lake—straining tower, etc.	43,660
Smaller works about lakes, including subsidiary dams at depressions in height of land, temporary works at Pemichangaw, lowering and clearing Long Lake, etc.	72,000
Aqueduct to Service Reservoir	
54 in. Steel Main 7-16 in. thick between outlet tower and service reservoir—235,000 lin. ft.	4,314,080
Bridge on Gatineau River	30,000
Various smaller stream crossings and culverts	110,000
Service Reservoir	
Dams	212,150
Clearing and stripping site	21,460
Inlet and outlet works	26,600
Aqueduct Service Reservoir to City	
51 in. steel main 7-16 in. thick between service reservoir and City—two lines of pipe each 32,000 lin. ft.	1,101,120
Various smaller stream crossings, culverts, etc.	20,000
Bridge across the Ottawa River	180,000
Total for Works	$6,508,880
Add 15 per cent. for engineering and contingencies	976,320
	$7,485,200
Land, Lakes, compensation and Wayleaves as per Mr. Gendron's estimate	500,000
Total estimate	$7,985,200

Road Builders' Convention at Philadelphia

Enterprising Arrangements

PLANS for the coming convention of the American Road Builders' Association at Philadelphia, Pa., December 9, 10, 11 and 12, which will be the tenth annual gathering of that organization, are being rapidly matured by the convention committee having the matter in charge.

Although the entire programme of the technical sessions has not been definitely decided upon, a general scheme for covering the various subjects to be considered has been prepared and many assignments of papers have been made. The matters to be discussed at the convention will be taken up under three general heads—organization, construction and maintenance. These will be further subdivided so as to cover every phase of road and street work.

A departure from the usual method of conducting the congress will be made this year by the holding of a popular session on Thursday evening. At this meeting, addresses will be made by prominent public men who have evinced an interest in highway betterment.

On Thursday afternoon the delegates will be taken on an inspection trip through the city. This will afford an excellent opportunity to view street improvements and other work of a like nature.

The local committee is making extensive plans for the entertainment of the delegates and the social features of the convention are being carefully arranged. One of these will be a theatre party for the A. R. B. A. members, the exhibitors and official delegates on Wednesday evening. Special provisions are also being made for the entertainment of the ladies attending the congress. An automobile ride around the city has been planned for them on Wednesday afternoon, and other entertainments will be provided.

Applications for space are being received in large numbers and the indications are that it will be necessary to accommodate some of the larger and heavier exhibits outside of the building. The number of spaces already assigned not only assures the success of the exhibition but also indicates that it will be one of the greatest displays of road-building machinery and materials ever made at a road congress. The officers of the association will be quartered at the Bellevue-Stratford Hotel. The sessions of the convention and congress and the exhibition of machinery, materials and methods, as well as place of registration of delegates, will be at the First Regiment Armory.

Personal Mention

Mr. S. H. Reynolds, at one time Assistant City Engineer of Winnipeg, has been appointed commissioner by the administration board of the Greater Winnipeg Water District. Mr. Reynolds is living in Victoria, B.C.

Mr. Yasuichiro Tomita, chief of the District Construction Department of the Imperial Government Railways of Tokyo, has been a visitor to Montreal. He is going round the world, and has been to Great Britain and several United States cities. His object in visiting Canada is to see the St. Lawrence bridge now in course of construction.

Mr. H. Grattan Tyrrel, bridge engineer, of Chicago, a graduate of the University of Toronto, gave an illustrated lecture on October 15th, before the Engineering Society of the Northwestern University on the subject of "Bridge Engineering." Mr. Tyrrell was formerly Chief Engineer for one of the Ohio bridge companies, and afterwards special engineer of bridges for the Harriman Railroads in the Western and Pacific States. He is the author of several books on bridge and structural engineering.

From the Saskatchewan Capital

Correspondence of the Contract Record

REGINA, Oct. 24th.—Building activity has been increasing of late with the easier money conditions now obtaining. The crop prospects have given a fillip to business generally and many important works are contemplated and under way. The outlook for the coming season was never better.

A matter that is receiving considerable attention at the hands of the city council at the present time is the question of better street lighting. For some time past the ratepayers have been agitating for increased street lighting and the city council recently decided to accede to the request. The standard pillar tungsten lighting system had numerous supporters, but the arc lighting was also favored. In order that the majority should rule, the city council held a conference with representative systems with regard to the class of lights to be installed. The cost of the tungsten system was not favored, and the selection lies between the high arc lamps and the inverted arcs.

The firm of Campbell, Wilson & Strathdee, with warehouses in several different western cities, have decided to erect a new warehouse in Regina, the present one having become inadequate. The new warehouse will have a frontage of 108 feet on Dewdney avenue and will be five storeys in height. No statement has been given out as to the estimated cost of this building.

Constructional view of the new Anglican College at Regina, now nearing completion.

The Emerson Brantingham Implement Company, with headquarters at Rockford, Illinois, have decided to move their Canadian headquarters office from Winnipeg to Regina. The Reeves Company. It is understood that large extensions will be necessary.

The Regina works committee has decided to further extend the sewerage system, so as to provide drainage for the low-lying land in the northeast section of the city and also to serve the abattoir. Several additional extensions of the company will occupy the premises formerly occupied by the sewer have been decided upon. One of them is to serve the new Wetmore school in the southeast section.

Reilly, Dawson, Hancock & Reilly, architects, Westman Chambers, Regina, have been awarded the contract to superintend the erection of Swift Current's latest and most up-to-date school. Twenty-six architects submitted plans. The plans accepted provide for twelve class-rooms, each to accommodate forty-two pupils; large departments for domestic science and manual training; an assembly hall 54 feet by 52 feet, with large stage and dressing room; and all necessary smaller rooms, such as principal's office, library, rest room, teachers' room, etc. The cost is estimated at $120,000.

The plans and specifications for the proposed station, to cost $134,000, are being prepared.

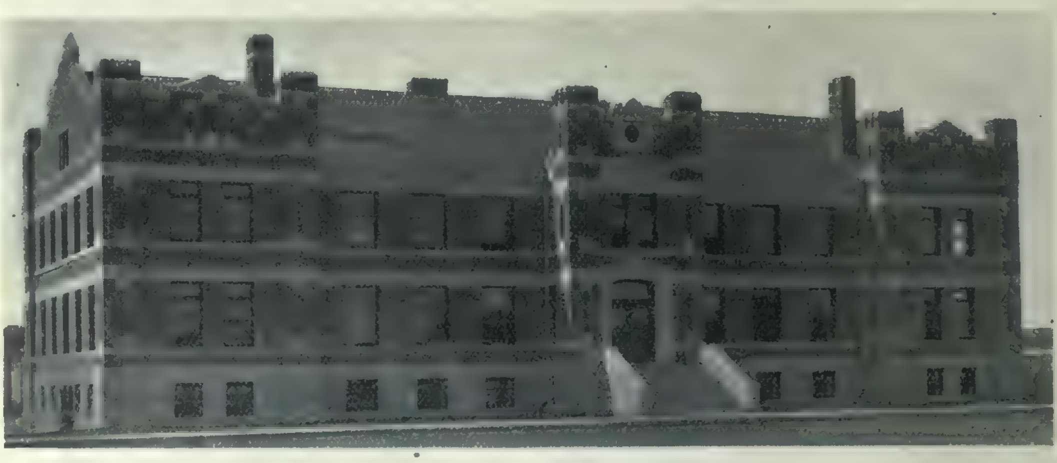
E. A. Brown, Regina, has invented a tube bender for conduit work. This is his third invention, the other two appliances for conduit work having been sold to a firm in London, Eng.

The Broad Street subway is now nearing completion, only the paving of the roadway now remaining.

New Filtration Plant

In order to deal with the matter of sewage disposal in the city of Regina in a more efficient manner, three new percolating filters were recently added to the existing plant. These filters are of particular interest as they constitute the first disposal plant that has ever been designed with the special purpose of overcoming the climatic difficulties which are met with in the Regina district.

Each of the three filters which comprise the plant is of circular plan, 110 feet in diameter at the base and 100 feet in diameter at the surface. The depth is 8 feet in every case. The floors are of concrete, and the containing walls are also of the same material, suitably reinforced. The former slope to effluent channels at an incline of 6 per cent., collecting galleries being also provided. The roofs or covers of the filters are carried on superstructures of rolled steel I-beams, which are carried by short steel columns bolted to concrete piers in the containing walls. These covers afford excellent protection from the weather in winter, and are so arranged that they can be easily removed and the filters opened up during suitable weather. Each filter is fitted with automatic revolving sprinklers of the Adam's Cresset type. The filter-



Head Office Building of the Royal Northwest Mounted Police, Regina, completed recently.

ing media is of broken stone of one-inch and two-inch to three-inch section, one uniform size to each filter.

The filters are designed to deal with 150 imperial gallons of effluent per 24 hours per cubic yard, dry weather flow, but are also capable of dealing with three times this amount during storm periods, and once they are matured they will give a non-putrescible effluent that will meet all the requirements of the provincial board of health. After leaving the filters the effluent is conducted into a main effluent pipe large enough to accommodate the outflow of nine additional filters.

Mainly Constructional

The News in Brief—From Coast to Coast

The next important step in the construction of the C. N. R. will be the double-tracking of the system from Winnipeg to Fort Frances, according to Sir Donald Mann.

Work is now in full swing on the new Twenty-fifth street bridge across the South Saskatchewan river at Saskatoon. This bridge will cost $400,000, and will take over a year to build.

Arrangements have been made to manufacture in Montreal the Van Noorden standard fireproof windows, the agents for which are the Fire Prevention Company of Canada, Limited, Montreal.

The people of Essex County will vote January 1st on a scheme to spend $1,000,000 on good roads. The road plan would give the county a system of concrete roads completely encircling it and encompassing all the small towns.

For the year ended 31st March last, the P. Lyall & Sons Construction Company, Limited, earned $258,697, of which bond interest absorbed $63,298, preferred dividend $106,166, and reserve account $40,000, the surplus being $49,231.

The Port Weller Land Company, Limited, has been incorporated with a capital of $40,000 to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are W. R. Wadsworth and D. R. Leask, of Toronto.

At a meeting of the Montreal Board of Trade, a joint fire prevention committee presented a report recommending a higher standard of building construction in Montreal and the appointment of a board of inspectors to see that the city by-laws were better observed.

The Windsor Sand and Gravel Company, Limited, has been incorporated with a capital of $40,000 to manufacture and deal in contractors and builders' supplies, with head office at Windsor. The provisional directors are H. A. White and F. W. Barclay, both of Windsor.

The Niagara Brick and Tile Company, Limited, has been incorporated with a capital of $100,000 to erect buildings and deal in building material, with head office at Niagara Falls. The provisional directors are F. W. Griffiths, H. F. Upper and W. B. Masters, all of Niagara Falls.

Canadian Bitumastic Enamels Company, Limited, has been incorporated with a capital of $40,000, to carry on business as a general contracting and building company, with head office at Toronto. The provisional directors are A. W. Holmested and A. B. Mortimer, Toronto.

Plans have been completed by Mr. A. M. Jeffries, city architect of Edmonton, for a combined fire hall and police station, costing $350,000, to be erected at Elizabeth street and Fraser avenue. It is announced that work on the structure will proceed early next season. The structure will be of five storeys and full basement and will have dimensions of 100 x 165 feet, the materials of construction being brick, steel, concrete and stone.

The Confederation Contracting Company, Limited, has made application for incorporation. The provisional directors include Messrs. M. J. O'Brien, of Renfrew; Hugh Doheny, Quinton and Robinson, of Toronto and Montreal. The new enterprise is capitalized at $2,000,000. The company will operate this winter as sub-contractors on the Welland canal.

Actual work on the Shoal Lake water scheme of the city of Winnipeg was started on its way last week at a meeting of the administration board of the Greater Winnipeg Water district, when Commissioner S. H. Reynolds and Chief Engineer W. G. Chace were formally instructed to proceed immediately with the necessary surveys and the preparation of plans and specifications, and such other information as is required to carry out the scheme.

The contract for the construction of the Canadian Northern Pacific from Patricia Bay to the entrance of the Songhees Reserve terminals at Victoria, which will complete the rail and ferry service between Vancouver and the provincial capital has been let to J. Macdonald and the Littleton-Bruce-Elsback Company, the work embracing a joint contract. Construction has already commenced, and the work will be rushed to completion as fast as possible.

The work of grading the Canadian Pacific Railway extension from Victoria as far as Union Bay will be finished by the end of November, according to Clarence Hoard, who has a contract for the grading of the section between Courtenay and Union Bay. Men are busy on the concrete abutments and piers ready for the steel bridges which will be erected by the railroad company. There are two of these spans on this section, and the contractors will be ready for their erection at the end of the present month.

The Government has decided to utilise the Champlain Market site in Quebec for the erection of a station for the Transcontinental Railway, for which plans are now being prepared. The Champlain Market site was selected by the late Government for the main terminal of the Transcontinental Railway in Quebec, but was subsequently found to be unsuited for use in this way and arrangements were made for another location. It has now been decided to build a station on the original site, to be used in conjunction with the main terminal and to take care of river traffic. The scheme is also understood to include a belt line around the city.

Within a few months Prince Rupert, B.C., the Pacific coast terminus of the Grand Trunk Pacific, will have its first permanent hotel building. This will be "The Premier," now well advanced in construction, and which is being completed as quickly as possible. The building is the first modern fireproof brick, steel and concrete hotel erected north of Vancouver in either Canadian or American territory. The building has a frontage of 50 feet on Second avenue and 100 feet on Sixth street, and overlooks the Grand Trunk Pacific reserve, which is to be laid out in a park. The hotel is five storeys high and contains eighty bedrooms, with hot and cold running water in every room, the majority of the rooms being furnished with private baths. The cost of the building is $100,000.

At a recent meeting of the bondholders of the Canada Iron Corporation, a resolution was passed authorizing the liquidators to borrow up to $250,000 to carry on the business and giving the money so borrowed priority over the bonds. Arrangements have been made to carry on the foundry business, which comprises plants at Fort William, St. Thomas, Hamilton, Three Rivers and Londonderry. The foundry business of the corporation amounted to about $4,000,000 last year and while it has been affected by liquidating proceedings and may not be as great this year, it is yet sufficiently large to form the basis for the reorganization which is now being worked upon by the English bondholders. It is not proposed to operate the furnace and mine departments of the corporation during the period of liquidation. Some of the plants are already closed and the rest will probably be closed shortly.

A sewage disposal plant costing between two and three million dollars, to be located on the west bank of the Don River, near the second dam and about half a mile north of the Don Valley Brick Works, is proposed by the municipal engineers who have been preparing a scheme of sewers for the northern part of Toronto. It is planned that all sewage originating in the districts of North Ontario, Cedervale and Moore Park shall pass through this purification plant, where the solid matter is to be separated from the clear water, the latter being turned into the stream of the Don, and the former undergoing a treatment which will convert it into fertilizer, which the city will sell to farmers. The whole North Toronto sewer scheme involves an outlay estimated at more than six million dollars, including the disposal plant. It is planned to lay trunk sewers, eight and nine feet in diameter, through the several ravines in the northern parts of the city.

The Imperial Steel & Iron Company, Limited, who will erect a plant in Prince Albert for the manufacture of horse shoes, plates for bridge iron and corrugated sheeting, announce that, when completed, the works will employ between 600 and 700 men and will be capable of handling 4,000 tons of iron a month. The site covers 31 acres and the buildings number eleven in all, as follows: a jobbing sheet and plate mill, containing galvanizing and paint shops, 80 x 208 feet; a horse shoe factory, run by electricity; the finishing mill, 260 x 80 feet, containing a 9-inch and 12-inch finishing mill, a Belgian train and two waste heat boilers for steam generating. The combination muck bar and bar crane is located in a building 200 x 80 feet, which will also house 250 horse-power waste heat boilers and a 700 horse-power engine. The scrap shearing and preparing department is provided with seven pairs of shears. The power house is divided into two portions, half of the building to be used as a boiler house with 1,000 horse-power boilers, and the other half for electric generators. The other buildings comprise warehouses and storing sheds.

Increased Harbour Facilities for St. John, N.B.

The announcement by Mr. Bosworth that two new C. P. R. liners, larger than the present Empresses, will be completed next year and run direct to St. John in winter, emphasizes the plea for a policy of more rapid harbour development at this port. Sir Thomas Shaughnessy told a St. John delegation last week that the facilities at St. John were inadequate at the present time, and that they could not be increased too rapidly because of the increasing business which must come to St. John in winter over the rails of the C. P. R. The city council and board of trade will now bend all their energies to the effort of getting wharves and warehouses built more rapidly. Two new steamship berths will be completed by the winter of 1914-15, but more will be required, and, as the task of building them is considerable, it will be necessary to make a beginning next year. This relates to the facilities at West St. John. There must also be a large expenditure to provide harbour facilities at East St. John for the traffic of the Grand Trunk Pacific and, it is hoped, the Canadian Northern Railway. The present dispute about the terminal port of the mail steamships has brought out in the strongest manner the fact that increased harbour accommodation is urgently needed both at St. John and Halifax, if Canadian trade in winter is to be carried to an increasing extent through Canadian channels. St. John is now asking that ten additional steamship berths be provided as soon as possible.

Ontario Architects' Association

The following officers were elected at the closing session of the Ontario Architects' Association at Grimsby:—Mr. C. H. Acton Bond, Toronto, president; Mr. D. H. Moore, Toronto, first vice-president; Mr. L. S. Taylor, Ottawa, second vice-president; Mr. J. P. Hayes, Toronto, treasurer; Mr. F. E. Delfry, Toronto, registrar.

The following were elected as members of the council: Mr. C. P. Meredith, Ottawa; Messrs. J. F. Wegman, C. A. Acton Bond, J. P. Haynes, H. E. Moore, C. H. C. Wright, Toronto; Mr. L. Jennings Taylor, Ottawa; Mr. J. Power, Kingston; Mr. A. E. Nicholson, St. Catharines; Mr. W. W. Stewart, Hamilton; Mr. W. R. Greig, Toronto; Mr. C. E. Langley, Toronto.

Railway and Bridge Builders' Convention at Montreal

Mr. A. E. Killam, of Moncton, N.B., the head of the American Railway and Bridge Association, presided at the 23rd annual convention held in the Windsor Hotel, Montreal, last week. Mr. Killam is known as a foremost Canadian bridge builder, and was responsible for many structures in the Maritime Provinces, retiring from the Intercolonial Railway last May.

In connection with the convention, there was an exhibition of many appliances, building and other materials in a room adjacent to the meeting hall.

The first day was spent in welcoming the members and the presentation of reports. Mr. William McNab, principal assistant engineer of the Grand Trunk Railway, welcomed the members. He spoke of the tie between the Americans and Canadians who were engaged in the same branch of work, and the beneficial influences of such a gathering, referring to the technical and social elements entering into the proceedings. It was appropriate that the convention should take place in Montreal, where in the immediate vicinity were two noteworthy bridge structures. One was the Victoria bridge; the other the C. P. R. bridge which had just been rebuilt.

Mr. McLean, past president, spoke upon the lines of the mutual interests of Canada and the United States.

The president, who also welcomed the members to Montreal, referred to the history of the organization and its last meeting on Canadian soil, in Quebec, speaking of the value of the technical reports and expressing his satisfaction at the work of the various committees.

Reports on the Preservation of Timber, temporary structures for supporting tracks during the construction of permanent work, snow ferries, cattle guards, sewers and drains, and the construction and maintenance of track scales were presented and discussed during two days of the convention.

Several social functions were included in the programme. The members also visited the St. Lawrence Bridge Company's plant.

"The Illumination of Construction Work" is the title of Bulletin B 3269, issued by the Canadian General Electric Company, Limited, Toronto. The contractor engaged in operations where time is an essential factor cannot fail to find some interest in the matter of the efficient lighting of his work after hours. The G.-E. Type W. Flame Arc Lamp of the above company is especially adapted for all classes of construction work. It has a remarkable brilliancy of from 1,500 to 2,000 candle-power. It is economical in operation, simple in construction and burns from one hundred to one hundred and twenty hours without attention.

Rapid Concrete Paving Work at Toronto

Started July 24th, 1913. Finished July 31st, 1913.

An interesting piece of concrete paving was carried through this season by the Godson Contracting Company of Toronto. Shortly before Toronto's big Exhibition opened it was decided by the city authorities to pave the roadways of the Exhibition Park. It became a question of quick work. The Godson Contracting Company were entrusted with the undertaking. To give an idea of the rapid manner in which the work was carried out it is interesting to learn that 14,378 square yards of 5-in. concrete were laid in five days and seven hours (days of nine hours). Two one-bag Austin Cube Street Machines were used, with spreading arm and bucket to mix and lay the above quantity of concrete in the time mentioned. The average day's work of each machine was 1,178 square yards per day of nine hours.

Godson Contracting Company, of Toronto, using two Austin Cube Street Machines.

For a number of years the Godson Contracting Company have been firm believers in the Cube principle of mixing. Five years ago they purchased probably the first Cube Mixer to be used in the city of Toronto. This machine also helped to pave the Exhibition roadways, putting down 1,178 square yards of concrete in a day of nine hours.

The Cube differs from any other batch type of mixer by reason of the fact that the mixing action is done entirely by the cubical-shaped drum. Scientifically, there can be no mix as perfect; practically, there can be no mix as rapid. By doing away with the blades and paddles the entire batch flows from the plane of the cube with nothing to retard the free movement of the mixed mass. The special street machine does away with wheeling in barrows from the discharge end of the mixer. A bucket is provided which runs in and out on a long arm and takes the entire contents of the batch, discharging at any point within a radius of 40 feet. The machine is also propelled under its own power and the engine made reversible, so that it moves backward or forward equally well.

The city of Toronto have also two Austin Cube Machines: one two-bag traction machine, without spreading arm, which was used last year by the Railways and Bridges Department, and this year by the Roadway Department; and a one-bag machine, with spreading arm and bucket, which has been used this year by the Roadway Department with excellent results.

The city of Montreal (not to be outdone by Toronto) purchased two Cube Street Machines this year. Our information is that these machines have proven most satisfactory.

The Highways Department of the Provincial Government of Ontario, to further the cause of the Good Roads Movement, have also purchased an Austin Cube Street Machine, which is now working at Aylmer, Ont.

Messrs. Lecky & Collis, Limited, of Napanee, Ont., and 335A Craig Street West, Montreal, are the Canadian agents for these machines. It is due to their efforts that so many Cube Mixers can be seen in operation in all the principal cities where the forward movement in concrete road-making has taken firm hold. Upon application they will furnish a little booklet, "The Science of Mixing Concrete," which is of much interest to the roadway engineer and contractor.

Labor-Saving Sidewalk Tools

The Abram Cement Tool Company of Windsor, Ont., whose "Wrist Motion" sidewalk tools are well and favorably known to many readers of this journal, have favored us with the latest copy of their catalogue. This publication is illuminating in regard to the possibilities of the high grade of work—executed with more speed and less labor—which the company's finishing tools hold forth. Each of the company's tools is equipped with a long handle and a special patented device that gives the tool the correct motion and enables the workman to stand erect at the work. The catalogue illustrates very forcibly the manner in which this "wrist motion" device automatically gives the blade the proper position. The company manufacture the complete line of tools required in sidewalk construction. The fact that these tools have been adopted by many of the leading contracting firms in Canada and the States is a sufficient argument in favor of the investigation of their merits by every contractor. We have seen these tools in operation a number of times and have no hesitation in commending their labor-saving principles and general construction.

Paving the Midway, Exhibition Grounds, in record time.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chapleau Twp., Ont.
Extension to water mains, cost $5,000, planned. Clerk, T. J. Godfrey, Chapleau, Ont. Ratepayers will vote on by-law November 3rd.

Metcalf Twp., Ont.
Tile drain planned by Twp. Council. Tenders received by Clerk, Geo. Lewis, Kerwood, Ont., until Nov 3rd, for construction of the O'Neil Drain.

Regina, Sask.
Plank sidewalks planned by City Council. City Engineer, F. McArthur. Tenders received until Oct. 31st, for construction of 34,200 lin. ft. of 4 ft. plank sidewalk, 10 16 ft. crossings, 54 24 ft. crossings, supply of 273,650 ft. B.M. of 2 in. x 8 in., 10 in. or 12 in., 12 ft or 16 ft. long, 20,400 ft. B.M. of 3 in. x 8 in., 16 ft. long, 75,800 ft. B.M. of 2 in. x 6 in., 16 ft. long, 31,000 ft. B.M. of 2 in. x 4 in. 12 ft. or 16 ft. long, 8,400 ft. B.M. of 4 in. x 4 in. 14 ft. long, 400 lbs. of 5 in. nails, 6,700 lbs. of 4 in. nails, 2,000 lbs. of 3½ in. nails.

Sudbury, Ont.
Extension to water mains, cost $5,000, planned by the Town Council. Clerk, George Elliott. Ratepayers will vote on by-law November 3rd.

Toronto, Ont.
Sewers. Argyle street storm sewer, Section No. 1. Balmy, Lyonde, Spruce Hill Rd., Willow, McLean, Pine, Cedar, Bloor W., Regal Rd., Balsam and Springmount. Board of Control, Mayor H. C. Hocken. Plans at Works Dept. Tenders close November 4th.

Sidewalks planned by the Board of Control. Mayor, H. C. Hocken. Plans at Works Dept. Tenders close November 4th. Concrete walks on Alton, Bain, Carlaw, Evelyn, Lee and Windeat.

Pavements planned by Board of Control. Board of Control. Mayor, H. C. Hocken. Plans at Works Dept. Tenders close November 4th. Asphalt on Coady, Cruickshank, Edith, Hickson, Standish and Theodore. Asphalt concrete on Givens. Bitulithic on Peel and Russell Hill Road. Brick block on Derby Lane. Grading Wheeler avenue. Concrete curbing on Derby Lane.

Tenders received until Nov. 18th for brass and bronze castings, brass work for house services, cast iron pipes, hydrants, iron valve and stop cock boxes, lead pipe, special castings, stop valves. Specifications, etc., at office of Works Dept., City Hall. Board of Control. Mayor, H. C. Hocken.

Tenders received until Nov. 18th for supplying and laying an 84 in. steel conduit from the Pure Water Reservoir on Toronto Island to the South Tunnel. Plans, etc., at Room 10, Works Dept., City Hall. Board of Control. Mayor, H. C. Hocken.

Vancouver, B.C.
Waterworks. Clerk, Wm. McQueen. Tenders received by Clerk till Oct. 29th, 1913, for construction of Point Grey Partnership Pipe Line.

Windsor, Ont.
Concrete and asphalt pavements on Howard, Lewis, Elm, Brant and Sandwich streets, planned by City Council. Mayor, Henry Clay. Clerk, Stephen Lusted. Engineer, Edward Brian. General contractor, Thos. Chick.

Winnipeg, Man.
Local improvements planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Avenue. Sewers on: Waverley St. from Colquhoun Ave. to 376 ft. S. Water mains: Burrows Ave. from McPhillips St. to 200 ft. W. Ethelbert St. from Wolseley to Ida Ave. Kent St. from McCalman to Talbot Ave. Wolfe St. from Windsor to Johnson Ave. Spruce St. from 50 ft. north of Lawn to 200 ft. north of Wolever Ave. Asphalt No. 2 pavement: McMillan Ave. from Lilac to Stafford St. Tenders received by Board until Oct. 31st. Specifications at office of Engineer.

CONTRACTS AWARDED

Edmonton, Alta.
Asphalt plant, cost $5,000, 29th. Owners, architects and builders, Worswick Paving Co., 1053 23rd St. Two storeys, 27 x 53, frame construction, concrete foundation. Foundations in.

Regina, Sask.
Pumping unit planned by City Council. City commissioner, L. A. Thornton. City Engineer, F. McArthur. It has been recommended that contract be awarded to Canada Fairbanks Morse Co., Ltd., 300 Princess St., Winnipeg, Man.

Toronto, Ont.
Sewer, cost $32,093, planned by Board of Control. Mayor, H. C. Hocken. Commissioner of Works, R. C. Harris. General contractors, Gawne Contracting Co. Danforth Ave. storm overflow sewer system Section No. 2.

Water mains planned by Weston Town Council. Clerk, J. H. Taylor. General contractor, G. B. Moogk, Main St. 600 ft. of 4 in. pipe on St. Johns Road and 2 in. pipe on Couron Place.

Sewers. Beech Ave. and Belsize Drive, M. H. Murphy, 84 Wells Hill Ave., Dominion St., $4,757, Danforth Ave., $68,800, Morrison Ave, $17,487, to Godson Contracting Co., Manning Chambers. Earlscourt Drainage System, $47,800, to John Maguire, 196 Spadina Road. Board of Control. Mayor, H. C. Hocken.

Pavements, etc. Asphalt on Sorauren, to Contracting & Paving Co., Confed. Life Bldg., $9,423; St. Nicholas St. and Russett Ave., to Godson Contracting Co., Manning Chmbrs., $4,150. Concrete pavement on Lane N. of Queen from Sherbourne, to Riverdale Concrete Paving Co., grading on Rockwell and Silverthorn Ave., to Britnell Contracting Co., Dupont St., $2,775. Board of Control. Mayor, H. C. Hocken.

Railroads, Bridges and Wharves

Cobourg, Ont.
C. L. O. & W. Ry. has been authorized to construct bridge across Sinclair St. by means of an undercrossing at mileage 20.6 and rescinding order No. 19093, April 19, 1913.

Central pier planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders to be called for shortly.

London, Ont.
Breakwater, cost $25,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. By-law for West London breakwater passed Oct. 22nd.

Hamilton Twp., Ont.
C. L. O. & W. Ry. has been authorized to construct bridge No. 21.29 across road allowance between lots 22 and 23. Con. A.

Huntsville, Ont.
G. T. R. has been authorized to reconstruct bridge No. 202 to carry its railway over Big East River, mileage 150.75 on 12th District near Huntsville.

Province of Quebec
C. N. O. Ry. Co. has approved location of station at Isle Jesus, Parish Ste. Dorothee, lot No. 85, mileage 38.95, Hawkesbury East, Co. Laval, Que.

Remi, Que.
C. N. O. Ry. has approved location of station at Remi, Parish Ste. Genevieve, Co. Jacques Cartier.

Seal Cove, N.S.
Breakwater planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders to be called for shortly.

CONTRACTS AWARDED

Brandon, Man.
Car barns, cost $20,000, 1st St. General contractors. The Beaver Constr. Co., Ltd., Princess Ave. Engineer, J. Antonisen. Tenders to be called shortly for 9 street cars.

Fredericton, N.B.
Freight sheds, cost $13,000 to $15,000, Lynch property, planned by Dom. Govt. Dept. of Railways & Canals (I. C. R.). Sec., L. K. Jones, Ottawa. General contractors, Messrs. McLaggan, McBean & Bell, Fredericton. Engineer, F. Condon. 300 ft. long, concrete foundation, frame construction, steam heating.

Malbaie, Que.
Pier, cost $43,000, planned by Dom. Govt. Dept. of Public Works. Sec., R.

C. Desrochers, Ottawa. General contractor, Jno. Burns, Malbaie.

Pictou County, N.S.
Culverts planned by Prov. Govt. Dept. of Public Works. Commr., Hon. E. H. Armstrong, Halifax. Contracts awarded to Jas. O. Kerr, Eureka, Pictou County, $708; F. W. Fordes, Trenton, Pictou County, $9,093; L. & W. Gammon, River John, Pictou County, $1,200.

Rougemont, Que.
Station for Montreal & Southern Counties Rly., Canadian Express Bldg., Montreal. General contractors, A. F. Byers & Co., 340 Unoversity, Montreal. Excavating started.

Salmon River, N.B.
Wharf, cost $10,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Island Dredging Co., Salmon River.

Tring Jct., Que.
Railroad station, cost $6,000, for Quebec Central Rly. Co. Manager, J. H. Walsh, Sherbrooke. Supt. of Rly. Bldgs., Jno. Farquhar, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. General contractor, W. C. Goff, Thetford Mines. Two storeys, 72 x 26.

Public Buildings, Churches, Schools, etc.

Edmonton, Alta.
Masonic temple contemplated. Architects, Magoon & MacDonald, Tegler Bldg. Eight storeys, 1st 2-storeys granite construction, upper storeys of mat glazed terra cotta. Contracts will not be let this year.

Grosse Isle, Que.
Hospital, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Foundation, J. B. Gallibois, Montmagny. Four storeys, 200 x 75.

Montreal, Que.
Church alterations, cost $25,000, for Congregation of St. Henry, St. James St., St. Henry. Architect, L. J. T. Decarie, New Birks Bldg., Montreal. Tenders to be called in January. Work to start April, 1914. Bouchard stone construction.

Recreation building, planned by Town Council of Verdun. Mayor, Mr. Allan, Verdun. Police Dept. have urged the need of this building, to include skating rink, toboggan slides, reading rooms and a billiard hall.

Theatre, cost $20,000, Park Ave. and Bernard, contemplated for Mr. Joly, 1205 St. Viateur, W. Architect, Z. Trudel, 238 St. Andre. Specifications not made yet, description of building later.

Hospital, contemplated by Royal Edward Institute. Sec., Dr. E. S. Harding, Belmont St., Montreal. Plans will be prepared.

Church, for St. Michael's Parish. Father L. Callaghan, Montreal. Site to be chosen by Archbishop of Montreal, and plans will be prepared.

Theatre contemplated for Mr. J. J. Shubert, c/o The Shubert Co., New York, N.Y., have secured an option of 24,000 ft. of land near the Princess Theatre, close to St. Catherine St. W.

Ottawa, Ont.
Government buildings, cost $5,000,000, Chief architect, D. Ewart. Time for reception of designs in the first competition for erection of Departmental and Court buildings is extended until April 2nd, 1914. Dom. Govt., Dept. Public Works, Secretary, R. C. Desrochers, Ottawa.

Church, cost $10,000, West End, contemplated for St. Francis D'Assiso Church. Father Superior, Hintonburg, Ottawa. Stone construction, seating capacity 700. Plans in progress.

Port Nelson, Man. (Hudsons Bay)
Grain elevator, planned by Dom. Govt. Dept. of Trade and Commerce. Deputy Minister, F. C. T. O'Hara, Ottawa. Tenders received until Nov. 5th. Capacity 1,500,000 bushels.

Regina, Sask.
Shelter, Alexandra Park, planned by City Council. City Commissioner, L. A. Thornton. Supt. of Parks and Boulevards Dept., J. Vanshe. 1½-storeys, brick construction, concrete foundation, metal tile roofing, concrete floors, galvanized ridge, 6 lavatories.

St. George East, Que.
Post office fittings. Tenders received by Sec., R. C. Desrochers, Ottawa., Dom. Govt. Dept. of Public Works, until Nov. 4th. Plans, etc., at office of Chas. Chapais, Post Office Quebec, Postmaster, St. George East, and at Dept., Ottawa.

St. John, N.B.
Alterations to St. John's Church, Carleton, planned. Rector, Rev. G. A. Kuhring, 80 Coburg St. Architect, Garnet Wilson, 50 Princess St. Re-arranging pulpit and chancel.

Tenders addressed to C. Johnston, Deputy Minister Marine and Fisheries, Ottawa, will be received until Dec. 20th for the construction of a wooden lighthouse and dwelling (combined), a boat house and oil shed, at St. Martin's Head, Bay of Fundy, St. John County. Plans, specifications, etc., at this Dept., Ottawa and St. John, and Post Offices St. Martin's, Salmon River, Rothesay and Sussex.

Toronto, Ont.
Church, contemplated for Jane street Methodists. Pastor, Rev. Gilbert Agar, 64 Indian Grove Ave. Plans in progress.

Church, cost $30,000, planned for Royce Ave. Presbyterians. Treas., Jos. Reid, 9 Hugo Ave. Work may start in spring 1914. Presbytery have given permission to raise above sum.

Church, planned for Roman Catholic Episcopal Corporation. Architect, Bishop Neil McNeil, Wellesley Place. Site purchased at 223 Jarvis St. for Syrian Roman Catholic Church.

Addition to Ryerson school planned by Board of Education. Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, until Oct. 31st, for several trades. Plans at office of Supt. of Bldgs.

Tenders received by Sec.-Treas., W. C. Wilkinson, City Hall, Board of Education, until Oct. 31st, for Fresh Air Class Room on roof of Hestor How School.

Tenders received by Board of Education, Sec.-Treas., W. C. Wilkinson, City Hall, until Oct. 31st, for heating, plumbing and electric wiring at Shirley, Parkdale and Kimberly schools.

Winnipeg, Man.
Church contemplated for St. Michaels and All Angels Anglican Congregation. Pastor, Rev. G. H. Broughall, 611 Mulvey Ave., looking for a site for new church and plans will be prepared.

Wingham, Ont.
Hall and hose tower, cost $3,200, contemplated by the Town Council. Architect to be selected. Further information from Ald. Geo. Spotton. White brick and frame construction, shingle roofing, electric lighting, maple floors.

CONTRACTS AWARDED

Berlin, Ont.
Alterations to theatre, King St., for Joe Zuber. Architect, G. M. Miller, 59 Yonge St., Toronto. General contractor, Adam Dengis, Berlin. Plumbing, J. Hainsworth, 14 Foundry St. N.

Theatre, cost $25,000, College and King Sts., for L. Longo. Architect, C. Cowan. Carpenter, B. Becker, 45 Courtland Ave. Preston Metal Co. supplying the metal for ceiling.

Edmonton, Alta.
Fire hall, cost $15,000, Inglewood. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox. Architect, A. Jeffers. General contractors, Nesbitt & Miller, Hart Blk. Two storeys, 45 x 80, brick construction, felt and gravel roofing. Foundations in.

Fredericton, N.B.
Central fire station, cost $21,550, King St., planned by City Council. Clerk, J. W. McCready. Architect, Kenneth M. Campbell. General contractor, Fred J. Ryan, Regent St. Three storeys, 91 ft. 6 in. x 31, freestone and tapestry, brick construction, felt and gravel roofing.

Frelighsburg, Que.
Convent, cost $12,000, planned for Rev. Sisters Precious Blood. General contractor, F. Robert. Three storeys, 55 ft. x 65 ft. Foundations in.

Hampton, N.B.
Post office, cost $10,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, H. H. Mott, 13 Germain St., St. John. General contractors, British American Construction Co., Ltd., Prince Wm. St., St. John.

Montreal, Que.
Fire and police station, cost $85,000, Bois de Boulogne, planned by Board of Commissioners. Secretary, L. N. Senecal. Architects, C. A. Reeves, 58 St. James St. General contractors, Picard & Balin, care architects.

Alterations and addition to Y. W. C. A., cost $25,000, 25 St. Famille St. Architects, Finley & Gagnon, New Birks Bldg., Montreal. General contractor, M. J. Aquin, Lachine. Heating, plumbing and electrical, Thos. O'Connell, Murray St., Montreal. Four storeys, 25 x 80.

Interior fittings, Postal Station "B," cost $6,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, The J. T. Schell Co., Alexandria, Ont.

Port Arthur, Ont.
Armouries, cost $200,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Tharle, Brown & Stewart, 309 Park Ave. Heating and plumbing, J. W. Barnes & Co. Electrical, Mahon Bros.

P. O. fittings, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, J. T. Schell Co., Alexandria, Ont.

Regina, Sask.
Lodge Hall, Retallach, for Sons of

England Institute. Sec.-Treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol St. Brick and stone construction, stone foundation. Foundations in.

Sault aux Recollet, Que.
Club and gymnasium, cost $25,000, for Club Canadien Champetre, Sault aux Recollet. Architect, C. A. Reeves, 58 St. James St., Montreal. General contractor, C. Durocher, Montreal East. Concrete foundation, waterproofing, frame construction.

St. John, N.B.
Sunday school building, cost $40,000, for Germain St. United Baptist Church. Pastor, F. S. Porter, Queen St. Architect, F. Neil Brodie, 42 Princess street. General contractor, R. A. Corbett, Douglas Ave.

Observatory, for Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Ltd., Prince William St.

Toronto, Ont.
Sunday School, cost $4,000, 64 Fern Ave., for Church of Christ. Pastor, Rev. Albert Brown, 26 Lynd Ave. Architect, J. F. Brown, Board of Trade Bldg. General contractor, J. Stewart, 627 Crawford St. One storey, 24 x 60, brick and steel construction, brick foundation.

Theatre and store, cost $15,000, Queen St. E. Owner and general contractor, A. B. Webster, 55 Spruce Hill Rd. Work not started, owner will sub-let. Three storeys, 40 x 110, steel and brick construction, brick foundation, felt and gravel roofing.

Theatre, cost $10,000, 780-2 Yonge St., for A. G. Robertson (in trust), 58 Colborne. Architect, N. G. Beggs, 12 Cosgrave Bldg. General contractors, Orr Bros., Queen St. E. Three storeys, 24 x 112, steel and brick construction, brick foundation, felt and gravel roofing, lime and sand plastering, metal lath, mosaic tiling, store fronts and fixtures, seating.

Winnipeg, Man.
Conservatory unit, cost $15,000, Assiniboine Park, planned by Park Board, 229 Chambers of Commerce. Sec., J. H. Blackwood. Architects and general contractors, Lord & Burnham, New York. To be erected in spring 1914.

Theatre, Market St., for Patterson & Cass, Canada Bldg. Architect, G. W. Northwood, Northern Crown Bank Bldg. General contractors and plastering, J. McDermott & Co., Canada Bldg. Electrical, Cowan & Levy, Portage Ave. Walls up.

Business Buildings and Industrial Plants

Berlin, Ont.
Twine factory, Galemans Place, contemplated for Arthur Forster, 123 King St. E. Site purchased and plans will be prepared.

Calgary, Alta.
Stores, cost $5,000, 17th Ave., for P. J. Crohan. Architects, Laing & Smith, 210 Beveridge Bldg. One storey, 50 x 70, hollow tile construction, concrete foundation, Carey roofing. Plans in progress.

Cowansville, Que.
Extension to carriage repair shop contemplated for Soules & Christie. One-storey, 50 x 21, concrete foundation. Plans will be prepared.

Fredericton, N.B.
Stores and apartments, cost $8,000, York and Charlotte Sts., for Geo. Cronkhill, Lower Southampton, York County. Plans in progress.

Guelph, Ont.
The Merchants Bank are contemplating making extensive alterations in near future.

London East, Ont.
Two stores, cost $25,000, for W. Heughan, 1004 Dundas St. Architects, Watt & Blackwell, Bank of Toronto Bldg. Two storeys, 60 x 75, tapestry brick construction, concrete and stone foundation, felt and gravel roofing, plate glass, store fronts and fixtures. Tenders in. Specifications at office of Architect.

Montreal, Que.
Addition to factory for Alaska Feather & Down Co., Ltd., 412 St. Ambroise St. Plans in progress.

Two stores and flats, cost $5,000, Papineau, planned for Mathien Beauchamp, 875 Delorimier. Three storeys, 30 x 60, concrete foundation, felt and gravel roofing. Permit issued.

Two stores and flats, cost $5,000, Beaubien, for Jos. E. Lamoureux, 449 Beaubien. Three storeys, 25 x 60, concrete foundation, felt and gravel roofing. Plans ready.

Garage and office building contemplated for the Automobile Club of Canada. Pres., H. Pillow. Sec., Geo. A. McNamee, 10 Cathcart. Architect will probably be chosen this month as money question is about settled.

Store and flats, cost $4,000, St. Hubert, for Dr. M. O. Belanger, 3452 St. Hubert. Three storeys, 28 x 52, concrete foundation, felt and gravel roofing. Plans ready.

Additions planned by Windsor Hotel Co. Manager, Hutchison, Windsor Hotel, Windsor St. Architect, H. C. Stone, 84 St. Francois Xavier St. Extensive improvements to interior of hotel are contemplated, including new marble work in bar and general overhauling.

Ottawa, Ont.
Store and residence, cost $6,000, Munroe, for J. Dathell, 38 Munroe St. Brick veneer construction, stone foundation. Plans in progress.

Niagara Falls, Ont.
Remodelling bank building, Erie Ave. and Park Street, for Royal Bank, local manager, E. R. Dewart. Address C. J. Doran.

Regina, Sask.
Warehouse, Cornwall and Dewdney, planned for Campbell, Wilson & Strathdell. Excavating, Andrew Gettselig, 1930 Halifax.

Warehouse and repair shop, for Emerson, Brantingham Implement Co., Headquarters, Rockford, Ill., U.S.A. President, C. S. Brantingham. Vice-President, E. T. Talbott. Plans in progress.

Store and flat, cost $10,000, Glengary. Tenders received by Architects, Atchison & Adams, till Oct. 30th. Two storeys, 38 x 60, brick veneer construction, brick foundation.

Winnipeg, Man.
The City Creamery, Pritchard Ave., are adding one-storey to pressent building, one storey, 24 x 40, brick construction, felt and gravel roofing,. maple floors Cost $15,000.

CONTRACTS AWARDED

Amherst, N.S.
Store, cost $5,000, Fifth Ave., for Chapman & Canfield. Architect, J. L. Allen. Carpentry, roofing and plastering, Jos. Baxter. Plumbing not let. 2-storeys, 35 x 65, comp. paper, birch floors, lime and sand plaster, plate glass store fronts and fixtures.

Berlin, Ont.
Shoe factory, cost $26,000, Kaiser St., for Gourlay & Fogelberg, Kaiser Street, Berlin. Architects and general contractors, Secord & Sons, Brantford. Walls up.

Fredericton, N.B.
Cold storage, cost $3,000, York and King, for Searle & Lamson, York St. General contractor, Chas. Hall. One storey, 55 x 25, stone foundation, stock brick construction.

Montreal, Que.
Factory alterations, cost $10,000, rear 50 Parthenais, for Dominion Oil Cloth Co., Ltd., 1192 St. Catherine E. Architects, Hutchison, Wood & Miller, Royal Insurance Bldg., Montreal. General contractor, Eusebe Meloche, 304 Eighth Ave., Rosemount. One storey addition, 54 x 116, felt and gravel roofing.

Niagara Falls, Ont.
Store and flats, cost $4,500, Queen St. Owner and general contractor, Roland Reed, Queen St. Two storeys, 50 x 21: Walls up.

Stanstead, Que.
Addition to business block planned for General Contractor, Jas. A. Gilmore. Two storeys, 39 x 32. Foundations in.

Toronto, Ont.
Store and residence, cost $4,000, Gerrard and Leslie. Owner and general contractor, J. J. Bradley, 1 Richard Ave. Two storeys, 20 x 56, brick and steel construction, concrete foundation, felt and gravel roofing. Store fronts and fixtures, plate glass.

Windsor, Ont.
Stores and offices, cost $40,000, Jasper Ave., for Captain Allen Palmer, England. Architects, Magoon & MacDonald, Tegler Bldg. General contractors, mason, carpenter, roofing and plastering, Dunlop Constr. Co., 204 Hart Block. Steel, Dominion Iron Works, Winnipeg. Electrical, Burnham Frith Electric Co., Rice and McDougall Ave. Three storeys, 53 x 95, brick construction, concrete foundation, felt and gravel roofing. Foundations started.

Offices and police quarters, cost $13,000, Grierson, for Royal North-West Mounted Police. Architect, A. M. Calderon, 259 Jasper Ave. General contractor, W. C. McArthur, 523 Sinclair St.

Stores and offices, cost $65,000, for Runnalls & Nickels, 140 Jasper Ave. Architect, E. C. Hopkins, 32 Jasper Ave. W. General contractors, Read, MacDonald & Brewster, Tegler Block. Painting, Chapman & Turner, Anderson Blk. Heating and plumbing, Kelly & Kakett, 120 Norwood Blvd. Elec., Penny & Newman. Three storeys, 53 x 100.

Hensall, Ont.
Repairs to business block, cost $10,000. Owner and architect, R. Bell. General

contractor, Alfred Taylor. Repairs to buildings recently damaged by fire. White brick construction, concrete and stone foundation, felt and gravel roofing, store fronts and fixtures.

Kingston, Ont.
Extension to stables, cost $18,600, planned by Dom. Govt. Dept. Militia & Defence. Deputy Minister, Eugene Fiset, Ottawa. General contractors, Campbell & Wright, Kingston. Piles and concrete foundation, red brick construction.

Magog, Que.
Business block planned for Miss A. Clomptors. Private plans prepared. Steel, MacKinnon, Holmes & Co., Sherbrooke. Two storeys, 30 x 0.

Montreal, Que.
Garage, cost $5,000, 240 Drummond, rear, for R. B. Angus, 240 Drummond St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq. General contractors, mason and carpenter, Reid, McGregor & Reid, 14 Guy Block. Steel, Structural Steel Co., New Birks Bldg. Other contracts to be given out shortly.

Stores and flats, cost $20,000, Outremont (Bernard St.), for Mr. Bessette, 97 St. James St., Montreal. Architect, J. A. Ouellette, 250 Amherst St., Montreal. Carpenter, Davis & Morisett, c/o Architect.

Garage, cost $15,000, St. Timothee, for P. T. Legare Ltd., 180 Amherst. General contractor, Henri Leoasseur, 116 Amherst. Two storeys, 42 x 75, concrete foundation, stone, steel and brick construction, felt and gravel roofing. Permit issued.

Ottawa, Ont.
Garage for W. J. Kennedy, 52 Cooper St. General contractor, I. B. Younghusband, 6 Spruce. Solid brick construction, concrete foundation.

Alterations to store and apartments, cost $4,000, Slater St., for C. B. Taggart, 341 McLeod. Architect, W. Herbert George, Castle Bldg., Queen St. Mason, T. C. James, 140 Flora St. Plumbing, J. R. McLennan, 240 Bank street.

Regina, Sask.
Addition to hotel, cost $12,000, S. Railway, for Palmer House, Ltd., S. Railway and Broad Sts. General contractors, McKay Construction Co., 1818 Scarth St. Two storeys, brick construction. Foundations in.

Warehouse, Dewdney and Cornwall, for Campbell, Wilson & Strathdale. Contractors for foundation Frid Lewis & Co., Ltd., Somerset Bldg., Winnipeg.

Stable, cost $23,900, Albert, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Two storeys, stone, brick and frame construction, corrugated iron roofing. Foundations in.

Addition to warehouse for Regina Plumbing & Heating Co., Ltd., Hamilton St. Architects, Storey & Van Egmond. General contractors, Minkley & Traub.

Stanbridge East, Que.
Tannery extension. Owners and general contractors, G. W. Sadler & Co. 100 x 64, concrete foundation, frame, fireproof and galvanized iron construction, asbestos roofing. Foundations in.

Sarnia, Ont.
Factory, cost $150,000, for Perfection Stove Co. Mech. Supt., Thos. Montgomery, 276 Brock St. General contractors, Imperial Oil Co. Will manufacture oil stoves and enamel ware. Three buildings, 100 x 200 each, brick, steel and glass construction. Day labor.

Waterloo, Ont.
Two stores, cost $12,000, King St. Owner, architect and general contractor, L. Wettlaufer, Sebringville. Two stys., 40 x 70, red pressed brick construction, concrete and stone foundation, 6 store fronts and fixtures. Excavating done.

Windsor, Ont.
Office building, cost $30,000, Quellette, for A. T. Currah. Architect, J. C. Pennington. Carpenter, Geo. Haugh. Three storeys, 52 x 90. Foundations in.

Winnipeg, Man.
Stores, cost $18,000, Broadway, for Dr. Peatman, 304 Main St. Architect, J. D. Atchison, Trust & Loan Bldg. General contractors, Lailey & Co., 367 Maryland. One storey, 66 x 75, brick construction, felt and gravel roofing. Excavating started.

Alterations to office building planned for Travellers Bldg. Assn. Sec.-Treas., F. J. C. Cox. Architects and builders, Jas. McDiarmid & Co., Canada Bldg. Alterations to club, billiard room and kitchen, also alterations to various offices.

Residences

London, Ont.
Apartment house, cost $15,000, Horton, for A. Hartmann, 300 Dundas St. Architects, McBride & Gilbert, Edge Block. Work may start this fall. Three stys., 50 x 80, white brick construction, concrete and stone foundation. Plans in progress.

Residence, cost $7,000, planned for Fred Henderson, c/o Robinson, Little Co. Tenders received by Architect, W. G. Murray, Dom. Savings Bldg. 2½-stys., 36 x 35, red brick construction, concrete foundation, slate or asbestos roofing.

Montreal, Que.
Six flats, cost $6,000, St. Ferdinand, for Louis Latulippe, 1098 St. Antoine. Three storeys, 40 x 35, concrete foundation, felt and gravel roofing. Plans in progress.

Flats, cost $9,000, rear 727-29 Pine Ave. W., for M. D. Baldwin, 194 Park Ave. Three storeys, 52 x 38, concrete foundation, pressed brick construction, felt and gravel and corrugated iron roofing. Plans ready.

12 flats, cost $6,000, 582 De Gaspe, for J. E. Lalonde, 1918 St. Denis. Three storeys, 25 x 48, stone foundation, felt and gravel roofing. Plans ready.

Residences, cost $8,000, Outremont (Querbes St.). Owner and architect, A. Lamontagne, 2561 Esplanade St., Montreal. Three storeys, 40 x 72, stone foundation, Columbus brick construction, felt and gravel roofing. Plans ready.

Flats, cost $8,000, for J. Foley, Pickering Ave. Architect, T. L. Hollingsworth, c/o Owner. Two storeys, concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Three flats, cost $6,000, St. Zotique, for Alf. Lalande, 288 St. Dominique. Three storeys, 25 x 61, concrete foundation, felt and gravel roofing. Plans ready.

Flats, cost $11,000, for J. White, Indian Road. 2½-storeys, concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Eight flats, cost $7,000, Chateaubriand, for Nap. D. Legar, 3361 St. Hubert. Three storeys, 50 x 51, concrete foundation, felt and gravel roofing. Plans ready.

Residence, cost $15,000, Outremont (Blvd. St. Joseph), for W. Duquette, 2668 Park Ave. Architect, A. St. Louis, 80 St. Gabriel St. Brick, T. Rochon, 1891 Esplanade. Tenders for all other trades are in but contracts will not be awarded for a couple of weeks. Two storeys, 36 x 57. Excavating started.

Regina, Sask.
Residence, cost $20,000, for F. Chapman Clemensha, Albert St. Plans ready.

Toronto, Ont.
Residence, cost $5,000, Riverdale, for F. W. J. Hill, 55 Woolfrey. Two stys., 22 x 52, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Apartments, cost $9,000, Gormaly, for B. A. Cumpston, care architect, S. B. Coons, 512 Temple Bldg. Two storeys, 36 x 56, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Residence, cost $9,000, Warren Road, planned for R. T. Brown, 197 St. George St. Architect, J. Hunt Stanford, Bloor and Ossington, is now ready to receive tenders on all trades except masonry and carpentry. Foundation in. 2½ storeys, 24 x 38, slate, felt and gravel roofing.

Winnipeg, Man.
Residence, cost $4,000, Sherburn. Owner and architect, W. W. Fleming, 97 Canora. 2½-storeys, 24 x 28, frame construction, stone foundation. Plans ready.

Residence, cost $5,500, Balfour Ave. Owner and architect, R. C. Mitchell, 312 Florence Ave. Two storeys, 28 x 28, frame construction, stone foundation. Plans ready.

Three residences, cost $12,000, Sherburn, for R. Robson, 284 Simcoe. Two storeys, 25 x 28, frame construction, stone foundation. Excavating started.

CONTRACTS AWARDED

Edmonton, Alta.
Residence, cost $8,000, for Mrs. Miller. Architect, W. D. Cromarty, 21 Dominion Block. General contractors, McSporran & Co., 715 2nd St. 2½-storeys, 44 x 46, frame construction, concrete foundation. Foundations started.

London, Ont.
Residence, cost $4,500, St. James St., for O. R. Moore, 478 Waterloo street. Architect, J. M. Moore, 425½ Richmond St. General contractor, J. Putherbough, 1002 Wellington. Two storeys, red pressed brick construction, stone and concrete foundation.

Residence, cost $15,000, for Henry Pocock, c/o London Concrete Machinery Co. Architects, Watt & Blackwell, Bank of Toronto Bldg. Mason, J. Evans & Sons, 905 Queens Ave. Other contracts will be let shortly. Two storeys, tapestry brick construction, concrete foundation. Excavating done.

Montreal, Que.
Residences, cost $16,000, Westmount (Mountain St.), for Ryan Tetley, 78 Crescent St., Montreal. Architects, Tetley & Dogerth, 78 Crescent St. General

(Continued on page 72)

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Lindsay, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Lindsay, Ont., and at this department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47381. 43-44

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Lakefield, Ont.," will be received until 4 p.m. on **Wednesday, November 5, 1913**, for the construction of a Public Building at Lakefield, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Lakefield, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—49240. 43-44

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,
Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition and Alteration to Public Building, Orillia, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 5, 1913**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Orillia, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C.DESROCHERS,
Secretary,

Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47491. 43-44

FOR SALE OR RENT

One ten-ton Ruston-Proctor Steam Roller, good as new.

RIGBY & ANDRUS,
43 St. Catharines, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913**, for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 16, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47820. 43-44

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Department of Railways and Canals, Canada

Trent Canal

Notice to Contractors

Nassau Dam

Sealed tenders, addressed to the undersigned and marked "Tender for Nassau Dam, Trent Canal," will be received at this office until 12 o'clock noon on **Friday, October 31st, 1913.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of Superintending Engineer, Trent Canal, Peterborough, Ont.

An accepted bank cheque for the sum of $10,000.00 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order.
L. K. JONES,

Asst. Deputy Minister and Secretary.
Department of Railways and Canals,

Ottawa, 13th October, 1913.

Newspapers inserting this advertisement with-authority from the Department will not be paid for it.—49189. 43-44

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Pile Protection Work, at Rainy River, Ont.," will be received at this office until 4 p.m., on **Monday, November 17, 1913**, for the construction of a Pile Protection Work, at Rainy River, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of F. Y. Harcourt, Esq., District Engineer, Port Arthur, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.; and on application to the Postmaster at Fort Frances, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48052. 43-44

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 4th, 1913**, for the construction of the following sewers:—

Balmy Ave. from Birch Ave. to East End;
Lyonde Cres. from Balsam Ave. to Beech Ave.;
Spruce Hill Ro. from Queen St. to Pine Ave.;
Willow Ave. from Queen St. to Balsam Ave.;

McLean Ave. from Queen St. to North End;
Pine Ave. from Balsam Ave. to Birch Ave.,
Cedar Ave. from Beech Ave. to Willow Ave.;
Bloor St. from old city limits to W. S. Dundas;
Regal Road from Northcliffe Blvd. to Springmount Ave.;

Argyle St. Storm Overflow Sewer, Sec. No. 1, from Shaw St. to Gladstone Ave.;

Balsam Road from Balsam Ave. to West End;
Division No. 2 West Toronto, Contract No. 3;
Outlet from Keele St. and Uttley Park to Quebec and Annette via Uttley Park, Hillsview Ave., Medland Cres., Humberside Ave. and Quebec Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 15th, 1913. 44

TENDERS

—for—

Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, November 18th, 1913**, for

Brass and Bronze Castings.
Brass Work for House Services.
Cast Iron Pipes.
Hydrants.
Iron Valve and Stop Cock Boxes.
Lead Pipe.
Special Castings.
Stop Valves.

Specification and tender form for any of the foregoing may be obtained upon application to the head office of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by city by-law, must be complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control
City Hall, Toronto, Oct. 21, 1913. 44

Notice to Contractors

Temporary Bridge

Sealed tenders addressed to the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Tuesday, November 4th, 1913**, for the erection of a temporary bridge over the Rideau River north of the present Billings Bridge.

Any tender received after the above stated date will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender. .

ARCHIBALD CURRIE,
City Engineer.
Ottawa, October 23rd, 1913. 44

Proposed Government Buildings Ottawa, Ont.

Extention of Time

Notice is hereby given that the time for the reception of designs in the first competition for the erection of Departmental and Courts Buildings, is extended for three months to **Thursday, April 2nd, 1914.**

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
—49657. Ottawa, October 23, 1913. 44-45

Sealed tenders addressed to the undersigned and endorsed "Tender for Construction of Wharfs at Victoria Harbour, B.C.," will be received at this office until 4 p.m., on **Tuesday, December 9, 1913**, for the construction of Wharfs at Victoria Harbour, B.C.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' offices at New Westminster, B.C., Victoria, B.C., Confederation Life Building, Toronto, Ont., Post Office Building, Montreal, P.Q., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45197. 44-45

Notice to Contractors

Intercepting Sewer

Sealed tenders addressed to the Chairman of the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Thursday, November 6th, 1913**, for the construction of the West End Intercepting sewer.

Any tender received after the above stated date will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, October 27th, 1913. 44

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour and River Improvements in the Mission River, Fort William, Ont.," will be received at this office until 4 p.m., on **Friday, November 21, 1913**, for the construction of the Harbour and River Improvements.

Plans, specification and forms of contract can be seen and forms of tender obtained at this Department and at the office of W. P. Merrick, Esq., District Engineer, Fort William, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office, Montreal, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46879. 44-45

Positions Wanted

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Residences

(Continued from page 73)

contractor, H. Strang, 4550 St. Catherine. Two storeys, 57 x 51, concrete foundation, brick construction, felt and gravel roofing.

Residence, cost $6,975, St. Lambert (Edison Ave.), for I. S. Inness. General contractors, Lording & Campbell. Carpenter not awarded, St. Lambert. Concrete foundation, frame and plastic brick construction.

Flats, cost $7,500, St. Lambert (Notre Dame Ave.), for S. David, Longueuil. General contractor, A. Gravel, St. Denis Ave., St. Lambert. Concrete foundation, encased brick construction, felt and gravel roofing. Excavating done.

Three flats, cost $9,000, Delorimier. Owner and general contractor, J. A. Duval, 1701 St. Lawrence. Architect, Z Trudel, 238 St. Andre. Work done by day labor. Three storeys, 25 x 105, concrete foundation, brick construction, felt and gravel and corrugated iron roofing.

Four flats, cost $6,000, Belgrave. Owner and general contractor, J. R. Lefebvre, 246 St. Antoine. Work done by day labor. Two storeys, 25 x 60, concrete foundation, felt and gravel roofing. Excavating done.

Flats, cost $25,000. Owner and general contractor, L. E.Kimpton, Birch Ave., St. Lambert. Concrete foundation, brick construction, felt and gravel roofing.

Flats, cost $7,000, St. Lambert. Owner and general contractor, J. K. Duncan, Notre Dame Ave., St. Lambert. Work done by day labor. Concrete foundation, frame and plastic brick construction, felt and gravel roofing. Foundations in.

Flats, cost $7,500, Outremont (Outremont Ave.). Owner and general contractor, Jos. Lecavalier, 1165 De St. Valier, Montreal. Work done by day labor. Three storeys, 28 x 75, stone foundation, brick construction, felt and gravel roofing.

24 tenements, cost $30,000, Notre Dame Des Grace (Western Ave.), for G. N. Clarmont, 97 St. James St., Montreal. Architect, J. A. Ouellette, 250 Amherst St., Montreal. Brick, M. Caille, 250 Amherst St., Montreal. Foundations in.

Ten flats, cost $5,000, 29 Forsythe, for Jos. Trudeau, Viauville. General contractor, Moise Trudeau, Fifth Ave., Viauville. Three storeys, 50 x 46, concrete foundation, felt and gravel roofing. Permit issued.

Four flats, cost $11,000, Belgrave Ave., for Isaac Collins, 207 Ash Ave. Architect and general contractor, P. Williams, Nicolet St. Two storeys, 50 x 60, concrete foundation, felt and gravel roofing. Permit issued.

Four flats, cost $10,000, Prudhomme, for Jno. Meyers, 158 Hillside ave. General contractor, Fred Jackson, 335 Hibernia. Two storeys, 40 x 86, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, cost $5,000, Madison Ave. Owner and general contractor, Jas. H. Smith, 1825 Esplanade. Architect, Chas. Bernier, St. James St. Work done by day labor. Three storeys, 25 x 42, concrete foundation, felt and gravel roofing.

Eight flats, cost $7,500, Cartier. Owner and general contractor, Alb. Brouillette, 191 Marquette. Work done by day labor. Three storeys, 42 x 42, concrete foundation, felt and gravel roofing.

Six flats, cost $15,000, 2013-15 Mance, for Christie McFarland, 2040 Esplanade. Architects and general contractors, E. Shaw & Son, Esplanade Ave. Work done by day labor. Three storeys, 42 x 85, concrete foundation, brick construction, felt and gravel and corrugated iron roofing.

Residence, cost $28,000, for O. Limoges, 479 Papineau Ave. Architect, Jos. Sawyer, 407 Guy St. General contractors, A. & D. Boileau, 343 Durocher St. Three storeys, 43 x 74, concrete foundation, stone and brick construction, felt and gravel roofing. Excavating done.

Residence, cost $6,000, Ballantyne ave., for Mrs. McRae, "The Mansions," Guy and St. Luke. Architects, Benoit & Girard, St. Catherine and Bleury streets. General contractors, Montreal West Contracting Co., Montreal West. Two stys., 27 x 31, concrete foundation, encased brick construction.

Montreal West, Que.

Residence, cost $6,000, Ballantyne Ave., for F. McLaren, St. Alexis St., Montreal. Architects and general contractors, Peden & McLaren, 20 St. Alexis St., Montreal. Brick construction. Foundations in.

Ottawa, Ont.

Residence, cost $7,000, Monkland, for E. I. Shuttleworth, 24 Euclid Ave. Architect, A. L. Weeks, Sparks St. General contractors, masonry and carpentry, Shuttleworth & Black, Journal Building, Queen St. Plastering and painting tenders to be called later. Electrical not let. Excavating done.

Residence, cost $6,000, Delaware Ave., for E. S. MacPhail, 127 Cartier. Architect, W. Herbert George, Castle B'dg, Queen St. Carpenter, I. Villeneuve. Painting, J. Store, 404 Bank St. Heating and plumbing, Coldrey & Chapman, 348 Rideau St. Foundations in.

Residence, cost $8,000, Monkland. Owner, architect and general contractor, Richard Hooper, 14 Monkland Ave. 2½-storeys, 30 x 36, brick veneer construction, stone foundation. Excavating started.

Port Arthur, Ont.

50 residences, cost $50,000, Algoma and Central, for The Canadian Resources & Development Co. Manager, Mr. Lloyd Owen. Work done by day labor. One storey, 25 x 28, frame construction. 12 of these houses are completed. A wooden toboggan slide to cost $1,000, will be erected on Company's property.

Quebec, Que.

Residence, cost $6,500, 56 Claire Fontaine, for Mrs. B. T. Gaudry, 69-71 4th ave., Limoilou. General contractor, Delphis Roy, 79 Claire Fontaine. Other trades not yet awarded. Three storeys, 25 x 28, concrete foundation, frame and Scotch brick construction, felt and gravel roofing. Lime and sand plaster.

Residence, cost $4,500, 12 Durochers, for Wilbrod Devaresne, 10 Durochers. General contractors, mason and plaster, Jos. Villeneuve & Son, 299 P. Edouard. Other contracts not yet awarded. Three storeys and basement, 29 ft. 8 in. x 32, stone foundation, red and Scotch brick construction. Excavating started.

Regina, Sask.

Addition to apartments, cost $9,000, for Victoria Court Apartment Co., Victoria and Relattack St. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. General contractors, McKay Construc-

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

tion Co., 1818 Scarth St. Brick construction, felt and gravel roofing. Foundations in.

St. Johns, Que.
Residence, cost $5,000. Owner and general contractor, Mr. Paradis, St. John, Que. Architect, L. J. T. Decarie, New Birks Bldg. Work done by day labor. Concrete foundation, brick construction, felt and gravel roofing.

Toronto, Ont.
One detached residence, cost $3,800, Annette St., for J. A. Duffin, 1676 Dundas St. General contractor, H. S. Chapple, 239 Evelyn, will sublet. Two storeys, 20 x 38, brick construction, stone foundation.

One detached residence, cost $7,000, Foxbar Road, for Mrs. Geo. Acheson, 56 St. Clair Ave. W. General contractor, Chas. Parker, 17 Boswell Ave. 2½-stys.. 24 x 33, brick construction, stone foundation.

10 attached residences, cost $22,000, Beverley and Grange. Owner and general contractor, Simon Robinowitz, 12 Henry St. Architect, Benj. Brown, 218½ Queen St. W. Mason and carpentry, day labor. Owner will sub-let plastering, painting, heating, plumbing and electric. 2½-storeys, 160 x 42, brick construction and foundation, slate, felt and gravel roofing.

One detached residence, cost $5,000, 317 Seaton St. Owner and general contractor, H. G. Baggs 395 Roxton Road Will sublet plastering, painting heating, plumbing and electrical. 2½-storeys, 22 x 40, brick construction and foundation, slate roofing.

One detached residence, cost $4,800, Oakwood. Owners and general contractors, Shaw Bros., 501 Manning Ave. 2½-storeys, 22 x 36, brick construction, stone foundation.

One pair residences, cost $8,000, 101-3 Balmoral. Owner and general contractor, G. V. Burgess, 105 Balmoral Ave., superintends construction, will sublet. Work not started. Two storeys, 42 x 48, brick construction and foundation.

One detached residence, cost $5,000, Wells Hill Road. Owner and general contractor, J. W. Brown, 229 Christie St. Will sublet. 2½-storeys, 20 x 38, brick construction, stone foundation.

Residence, cost $5,500, Indian Rd., for Salvation Army, 20 Albert St. General contractor, R. E. Awde, 1 Abbott Ave. 2½-storeys, 22 x 44, brick construction, stone foundation.

Four pairs residences, cost $28,000, Orchard View Ave. Owner and general contractor, L. C. Sheppard, 17 Adelaide St. E. Regular staff employed. Work not started. 2½-storeys, 36 x 40, brick construction and foundation, shingle, felt and gravel roofing.

One detached residence, cost $4,000, Howard Park Ave. Owner and general contractor, H. M. Bennett, 57 Concord. Two storeys, 30 x 32, brick construction, stone foundation. Excavating done.

Winnipeg, Man.
Two residences, cost $8,000, Fleet Ave. Owner and builder, J. Stoller, 562 Pritchard. Two storeys, 20 x 28, frame construction, stone foundation, shingle roofing. Owner to construct 8 more houses in spring.

Apartment house, cost $45,000, McMillan. Owner, architect and builder, W. W. Cross, 54 Yale Ave. Three storeys, 104 x 70, pressed brick construction, concrete foundation, felt and gravel roofing. Plans drawn.

Apartment house, cost $20,000, Westminster Ave. Owner, architect and builder, H. A. Walley, 811 Somerset Block. Three storeys, 38 x 39, pressed brick construction, concrete foundation.

Walkerville, Ont.
Residence, cost $14,000, Kildare Road, for Wm. Grant, c/o Parke, Davis & Co., Architects, McFarlane, Maul & Lantz, Wayne Bank Bldg., Detroit, Mich. Carpenter, Alfred Mapes, Walkerville. Two storeys, 58 x 54.

Welland, Ont.
46 residences, cost $1,500 each, planned. Owner, architect and builder, Robert E. Hysert. Homes for employees of the Empire Cotton Mills. Two storeys, brick and frame construction, cement foundation.

Power Plants, Electricity and Telephones

Brantford, Ont.
The Dominion Power & Transmission Co., Supt. Geo. E. Waller, Hamilton, are considering plan to develop 2,500 h.p. at Moohawk Lake.

Hamilton, Ont.
The Dominion Power & Transmission Co., Supt. Geo. E. Waller, plan a steam plant to be erected to generate 15,000 horsepower.

Kingsville, Ont.
Electric light plant, cost $7,000, for Edison Electric Light Co. General contractors, The Albrecht Co., Detroit, Mich. White brick construction, concrete foundation. Excavating done.

London, Ont.
Power house equipment, York St., for London Electric Light Co. Engineer, C. S. Spicer, 12 Adelaide St. E., Toronto. Dynamos, Corliss engines, etc., required. Specifications, etc., at office of Engineer.

Ottawa, Ont.
Standards and lamps, Bank, required by City Council, Electrical Department. Engineer, Supt. J. Brown. "White Way" system contemplated between Gladstone avenue and Bank St. Bridge, a distance of two miles, standards spaced approx. every 75 feet.

Souris, Man.
Electric light plant, cost $4,000, planned by Town Council. Sec-treas., J. W. Breakey. Town Engineer, Percy C. Smith. General contractors, Accumulator Lighting Co., Ltd., 259 Isabel Street, Winnipeg. Storage battery systems, ornamental light clusters.

South Bolton, Que.
M. Houldsworth contemplates putting steam power plant in his mill to supplement the water power.

Winnipeg, Man.
Power house, cost $158,000, Broadway, planned by Prov. Govt. of Manitoba. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, National Constr. Co., Donalda Bldg. Ground is being cleared.

Miscellaneous

St. John, N.B.
City Council has voted money for gasoline pumping engine, motor chemical and hose cart for fire apparatus. Commr. Public Safety, H. McLellan.

Business Notes

Kingston, Ont.
Laundry building of Kingston Penitentiary, burned. Loss $10,000.

Midland, Ont.
Sawmill boiler house, of Manley Chew, completely destroyed by explosion. Brick building, 130 x 40, 4 boilers.

Montreal, Que.
School, Bernard St., burned. Loss $7,000. Owned by R. C. Board of School Commrs., c/o U. Lafontaine, Com. Academy, 85 St. Catherine W. Covered by insurance.

St. Antaine R. Richelieu, Que.
Roman Catholic Church burned. Loss $100,000, partly covered by insurance. Will rebuild.

St. Denis R. Richelieu, Que.
Bakery and residence of Jos. Mathieu, burned. Loss $5,500, partly covered by insurance. Will rebuild.

St. Hilaire, Que.
Roman Catholic Church burned. Loss $40,000, covered by insurance. Will be rebuilt.

Sarnia, Ont.
School, Brock and Devine streets, burned. Loss $6,000. Seven rooms. Will be rebuilt.

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Send for our Catalogue of Asphalt Rollers and Mixers.

P. W. DIFTLY, Proprietor

"Our 20th Century Roller"

1303 Peach Street, - Erie, Pa.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

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Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

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McKinnon Electric-Welded Chain

has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16″ to 3/4″ inclusive.

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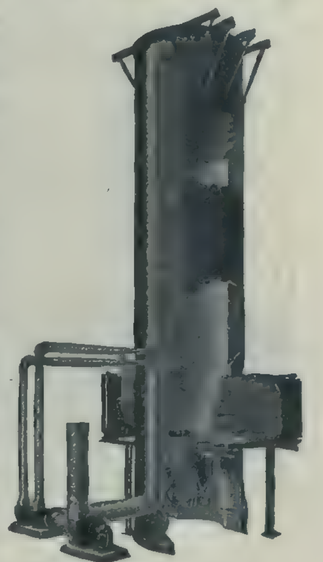

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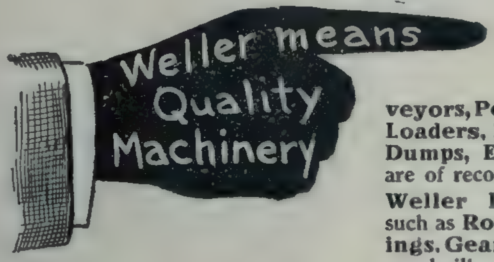

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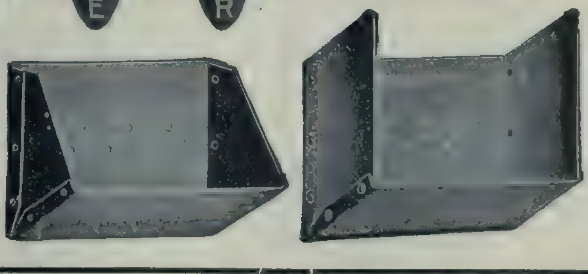

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ESTABLISHED 1886

Contract Record and Engineering Review

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Page 16

Vol. 27 November 5. 1913 **No. 45**

Status of the Engineering Profession

SOME interesting operations bearing upon the status of the engineering profession are recorded on another page in the report of an address delivered on October 15th by Mr. Walter J. Francis, C.E., of Montreal, before The Engineering Society of the University of Toronto.

One cannot read Mr. Francis' paper without agreeing with him at least in part. In recent years public recognition of the engineering profession has not been commensurate with its responsibilities. The man in the street is not disposed to regard the engineer favorably. This is due largely to the fact that the municipal engineer is often made the scape-goat for inefficient and blundering administration. The consulting engineer is regarded too often as a bird of prey holding aloof until the municipality is so exhausted (by aldermanic mismanagement) that he can swoop down and get a picking. This condition of affairs is not overdrawn or highly-colored in either case—as witness the number of changes that have taken place during recent years in the leading positions offered by municipal engineering in Canada; as witness, also, the experiences of a dozen prominent engineers who have been engaged in a consulting capacity during the same period.

Whether, as Mr. Francis says, the work of engineering is too great and too comprehensive to be confined within the narrow limits of a "profession" is a matter that affords room for considerable dispute. Certain it is that there yet remains to be done much that would educate the public to a higher appreciation of the important position that the engineer occupies in the community. Canada is essentially a country of engineering enterprise and no body of men, professional or otherwise, possesses one-half the opportunity of the engineer. The question is: what immediate steps, if any, can be taken to bring the public to their senses? Public estimation seems to accord the medical man a place of his own—and yet his responsibilities are those of individuals: he deals with lives singly while the engineer is responsible for public life wholesale. It was an engineering oversight in the design of the Quebec Bridge that carried scores of workmen to their graves in the St. Lawrence, and it was an engineering oversight at Ottawa that resulted in one of the most fatal outbreaks of typhoid in the history of the country. Has the engineering profession any desire to impress these things upon the public?

Perhaps the public is just as much in need of a higher standard as the engineer. We should say, more so.

However these things may be, there can be no mistake in the policy of a higher standard of attainment for the engineer. We are inclined to think that something might be accomplished by raising the requirements of the universities.

Mr. Francis cites a number of men who have distinguished themselves in engineering after graduating from the University of Toronto, but, after all, the proportion is very small. How many have not passed out into oblivion, or, at best, into some walk of life that has only the remotest connection with engineering?

And so, while we pay tribute to the excellent work of the engineer—while we extol him above those professions which the man in the street may deem of the "higher" order—we believe that there is an opportunity in engineering for higher standards.

The leading men—and the leading men only—in engineering circles can hold their own with any other profession. We leave it to the reader to decide for himself whether the rank and file of engineering has the education and attainment, technically or otherwise, that entitle it to the distinguishing part that it should play.

The Proposed Municipal Engineering Organization

WE are pleased to note that a representative provisional committee has been appointed to draft out the constitution of the proposed Canadian Institution of Municipal Engineers. The list comprises: Mr. J. Antonisen, Street Railway Superintendent, Brandon; Mr. M. H. Baker, City Engineer, Prince Albert; Mr. Willis Chipman, Consulting Engineer, Toronto; Mr. G. T. Clark, City Engineer, Saskatoon; Mr. G. W. Craig, City Engineer, Calgary; Mr. A. Currie, City Engineer, Ottawa; Mr. F. L. Fellowes, City Engineer, Vancouver; Mr. G. D. Mackie, Town Engineer, Swift Current; Mr. T. Aird Murray, Consulting Engineer, Toronto; Mr. F. McArthur, City Engineer, Regina; Mr. H. H. Phillips, Toronto; Mr. R. Potter, Town Engineer, Battleford; Mr. J. B. Stirling, City Engineer, North Battleford; Mr. L. A. Thornton, City Works Commissioner, Regina; Mr. R. O. Wynne-Roberts (Convenor), Consulting Engineer, Regina.

It is noteworthy that eight municipal engineers, prominent in the profession, have identified themselves with this movement, and it seems particularly appropriate that the City Engineer of the Federal Capital should be taking a part.

It were an odious procedure to dilate upon the qualifications of individual members of the committee, but several of the above-named gentlemen who have consented to act on the committee are men of high technical attainment and wide experience in society work, and the best results may be expected from their labours.

It is of interest to note that our London contemporary, "The Surveyor," supports the views advanced in the editorial published on page 41 of our issue of October 17. Those who are interested in the movement may find in the following extract from an editorial article in "The Surveyor" something worthy of consideration:—

"The Canadian Society of Civil Engineers appears to us unsuitable for the affiliation of a purely municipal engineering body, as compared with the advantages to be derived from connection with the Institution of Municipal and County Engineers. The constitution of this Institution is such as would render the formation of a colonial "district" a matter of comparatively easy achievement; or, if the new society desired greater independence, some less formal method of affiliation could, no doubt, be devised. Such an amalgamation would be of mutual benefit, inasmuch as it would secure to the new society the benefit of the Institution's experience, and at the same time the older body would gain by the extension of its influence."

An Extension of Time that Points a Moral

IT is gratifying to hear that the time for submitting competitive sketches for the new Government buildings at Ottawa has been extended to April 2nd, 1914. In an advertisement published in the "Tenders and For Sale Department" of our issue of September 3rd last, the closing date was given as January 2nd, 1914. This inadequate time allowance was the subject of a leading editorial article in the Contract Record of October 15th. The representations made would appear to have had some effect.

Here is a competition, of world-wide interest, for departmental buildings estimated to cost five million dollars. Surely the authorities are sufficiently alive to a sense of their responsibilities to give the people of this country the best brains that an undertaking of this magnitude will attract. The time extension given is none too great.

As we pointed out in the article, "'Open' or 'Closed' Competition?" published in our issue of October 15th, Old Country architects have two other important competitions before them and it is quite unlikely that they will be able to turn their attention to the Canadian undertaking before the New Year.

It might be argued that such a prolonged period was not necessary—even waste of time, and that in any case there would be sufficient competition to produce a satisfactory design. Fallacies of this kind have been responsible for some of the greatest disappointments in structural undertakings, as a single example of which might be cited the old Quebec Bridge, the collapse of which was undoubtedly due to inadequate attention given to the details of design.

The new concrete sewer system of San Francisco, which has been in progress since 1908 under a $4,000,000 bond issue, is now nearing completion. The mains are entirely of reinforced concrete, lined with paving brick, and the system is a perfect example of modern drainage engineering. The largest main, 8 feet in diameter, runs from the county line via Mission street, San Bruno road, Eighth street, Sansome street, etc., to the Embarcadero, emptying at the foot of Grant avenue. An interesting feature is the overhead sewer of the Ocean View branch, a 3 by 4-foot conduit raised on tall concrete trestles to pass a low spot of ground. The entire system is built on pile foundations, enabling it to resist possible movements of the soil.

Forfeiture of Deposits

THE Board of Education of the City of Toronto appears to have been permitting very loose practice in regard to the deposit cheques of contractors. It seems that contractors have not infrequently withdrawn their tenders after they have been opened by the Property Committee but before they have been finally passed by the Board. In this connection some interesting facts came to light at a special meeting of the Board of Education convened for the purpose of discussing the matter. The facts are such that we are entirely in sympathy with the suggestion to amend the by-law in such a way as to ensure the forfeiture of the deposit in the case of the withdrawal of the tender. We have often expressed disapproval of the exorbitant deposits required with tenders for public work, but that is another aspect of the question. Whatever the deposit required—if it be 50 per cent. of the amount of the tender—the conditions should be the same for all. The inequality of permitting a man to withdraw his bid after discovering—perhaps at the expense of a competitor—that he is too low, is apparent. If he be deemed sufficiently responsible to tender, the responsibility placed upon him, and which he assumes, should hold good throughout. If a man obviously made a mistake, an exception might be made by the authorities after a careful investigation of the case; but for the other conditions to obtain—conditions under which considerable malpractice is possible—is not in the best interests of the contracting community, even though it may enrich the few. The best way to improve contracting conditions throughout the country is to improve contracting ethics, wholesale.

Canadian Pacific Development

IN the west the C. P. R. has, all told, two thousand miles of new construction under way. Before the snow flies over one thousand of the total new mileage will be completed. The double-tracking continues with the greatest energy. The ultimate ambition of Sir Thomas Shaughnessy is to see the entire system double tracked, a task compared with which the labors of Hercules were as easy as snapping a woolen thread. But the vast design can be carried out. It will be realized—if not in the time of Sir Thomas, in that of his successor. Sir Thomas has put his hand to the work, however, and much of it will be completed before he lays down the reins of office. It is not remembered, perhaps, that much of the original road has been re-made, as part of the policy of consolidation for which Sir Thomas was responsible. New steel, new roadbed to give stability, new bridges—these features have been part of the programme. A vast outlay has been necessary, but the original system, hurried and spasmodic, has been almost wholly wiped out—replaced with modern features. To double track over four thousand miles of the main line would be an achievement worthy of the heroic ages. But it can and will be done within the next twelve or fifteen years.

The Application of Business Methods to Construction Work

THERE has been a great change in the methods used by successful contractors due to a change in conditions under which the work is now done. Successful contractors no longer "guess" the quantities, but study each contract and obtain complete data relative to it before submitting their bids. The following article has been abstracted from a discussion of this subject by James L. Stuart, Contracting Engineer, Pittsburgh, Pa., in the September issue of the Journal of the Cleveland Engineering Society.

Perhaps there is no business which responds more quickly to what is termed "business methods" than does the average piece of construction work. Certainly, there is no business with more diversified interests and trades connected with it than the modern structure, be it railroad terminal, factory, office building, hospital, or hotel.

It has not been more than twenty years, at most, since the construction of buildings was left entirely to practical men who had themselves worked up from positions as artisans or laborers to positions of leadership in constructional lines. Some of these leaders in the past were most talented and even brilliant, but they did not bring with them into the business, except in rare instances, the methods of the trained engineer or the progressive business man, their principal assets being nervous force, executive ability and practical knowledge of the building trades. However, as building construction became more complex and of greater magnitude, the necessity of trained men who understood the engineering problems and who appreciated the application of business methods necessary to bring "order out of chaos" became more apparent, and now both engineering knowledge and modern business methods are most necessary to get proper results as to economy and quality in all of the larger undertakings.

Methods and Organization

In order to successfully construct a building, it is necessary that one should anticipate each step in the progress of its development and outline the various steps from the time the drawings are received from the engineer or architect until the building is turned over completed to its owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery, and numerous smaller items. These estimates of cost were originally made up by the contractors themselves and were but approximations as compared with the present method of compiling them. In the latter method every advantage is taken of the prevailing market prices when the estimate is made, of the conditions of the labor market, the physical condition under which the work is to be done, and the season of the year. In a properly prepared estimate the unit prices should vary on each individual piece of work, whether figured at the same time or not.

After the estimate has been made of the total cost of the building—and I think an estimate should be made of every building whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule is based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project, and a familiarity with the estimate which, as I have said before, gives the quantities of the different kinds of material and assists in estimating the length of time required to complete the various stakes of the work.

After the estimate and the time schedule are completed and the contracts for material and labor have been entered into, the real work begins.

A dozen or more sets of drawings are procured from the architect or engineer, a copy of same placed on file in the main office of the builder, one copy sent to the job office and the others distributed among various sub-contractors who have to make up their shop drawings and prepare certain materials to be later installed in the building. A careful record must be kept of these drawings and to whom they are addressed and the date on which they are sent. While the various departments of the main office keep thoroughly in touch with the work in the field and the material in preparation, at this point, if the work is of sufficient magnitude, it is turned over to one particular member of the contractor's force, preferably a trained engineer, whose duty it is to keep in thorough and constant touch with all the drawings and all of the correspondence. He also has access to the files of the sub-contractors, contracts, contracts for materials, the original estimate and all other information pertaining to that particular piece of work. It is then his duty to follow up the sub-contractors in the preparation of their shop drawings, the submitting of the same to the architect for approval, the ordering of materials by the sub-contractors, and the progress being made through the fabricating shops and mills. This following-up process is part of his daily routine and from time to time reports are made to the superintendent in charge of the actual field work to enable him to know when the material is to be received, when the sub-contractors will have their men and material on the job, all of which enables him to shape up the field work so that certain portions of the building will be ready for certain sub-contractors at a fixed time. It is also his duty to keep track of the change orders and the changes made in the construction of the building, whether it be an addition or a subtraction. You can readily understand how necessary it is that all sub-contractors should be advised of changes, for often when they are conceived in the mind of the owner, their interference will be more far-reaching than he or anyone else anticipated.

A proper executive organization to do the field work is most important. It is far better to have too much assistance in the field than too little. First, there must be a superintendent who possesses rare abilities as an executive, who understands drawings and specifications thoroughly, who has had wide experience in building work and who has a knowledge of the different trades so as to be able to anticipate far in advance of his requirements. Above all, he should be able to create in those working under him, including the workmen employed in his department, and foremen and workmen of the different sub-contractors, an enthusiasm in their work, a desire to see it grow steadily, and to do it in the most substantial manner possible. If the work is of sufficient magnitude he should have an assistant superintendent, or possibly two or three of them, a large enough clerical force to do the timekeeping, and to keep an accurate cost record, and he should segregate the cost of the additional work which was not originally provided for. All of this work, if permitted to lag for even a day, becomes most complicated, and if not accurate, its value is entirely destroyed. In addition to this it is the duty of one of the clerks to send to the main office each day an accurate and concise report of what has been done during the day, the state of the weather, temperature, etc. As the building nears completion, work in the main office lessens, and it is usually an excellent idea to have the man in charge of the particular job in the main office to get in actual touch with the building and to assist the superintendent in picking up the loose ends in getting each trade completed as rapidly as the progress at the building will permit. This man (from the main office) is thoroughly familiar with each trade, knows just what changes have been made in the work, has a splendid knowledge as to how long it will take each trade to complete its work, knows the difficulties under which each has been laboring and can finish his "following-up process" from the field more intelligently than if he were to remain at the main office.

Cost

The cost of a piece of work is always of interest. The estimating department has access to the daily and weekly cost reports which are compiled in the accounting department, and from these they can compare and report to the proper person whether or not the work is being done each day or each week within the amount allowed for the same in the original estimate. If the work is not being done within this cost, and if the unit prices vary considerably from day to day, an investigation is at once made at the building to ascertain the reason for such fluctuations, to advise the superintendent of the discrepancy, and to see if ways and means cannot be found to bring the cost within its proper allowance—the estimate having been based on the cost of similar work under the same conditions, the proper average should not vary greatly from the amount allowed in the estimate.

The two following examples serve to illustrate the methods which were used in connection with the erection of a large manufacturing plant and a modern hotel building:

Construction of Large Manufacturing Plant Near Pittsburgh

Some time during the latter part of May, 1910, the manufacturing plant just referred to, covering approximately 15 acres, was almost totally destroyed by fire. All of the buildings were brick, some with wooden trusses and slate roofs, but the greater number were constructed with steel frames and cement tile roofs. The fire in and around these steel structures was so intense, however, that most of them collapsed of their own weight, and were only a mass of twisted steel, broken cement tile, brick and mortar, all of which it became necessary to remove in order to reconstruct the plant. We first received orders to clear the site, and subsequently were instructed to proceed with the reconstruction of the buildings. Fortunately, the power plant had not been greatly damaged, and, as a large portion of the plant had been electrically driven, we were able to get sufficient current of high voltage to use in cutting up, or, I should say, burning apart the collapsed steel frame, all of which was so badly damaged that it was loaded on cars and sold as junk.

After the site was cleared we began excavating for the new foundations, starting on the buildings which would be required first and those in which the greatest amount of machinery was to be installed. This scheme was followed so as to enable the entire plant to be completed at about the same time. It was the desire of the manufacturing company to commence manufacturing about the first of October, or earlier if possible. The key to this particular situation was to get the steel, of which there were about 4,800 tons. After consultation with the operating and executive departments of the manufacturing company, the order in which the different buildings were to be completed was decided on and the dates were fixed for the delivery of the steel for each building and were included in the schedule for the completed buildings. The structures were quite simple, similar to most of the modern factory buildings, but in order to live up to our schedule we knew we must keep continually in touch with the bridge company and see that nothing was permitted to lag or be left undone in order to make the deliveries as they promised. Our "expediter" was put in charge of the job at once and during the first month spent most of his time between the order department of the bridge company and the steel mills where the plain material was being rolled. After the last of the orders for the plain material had been sent to the rolling mills he devoted his time more particularly to the drawing room of the bridge company and reported daily just what progress was being made in designing, detailing and checking, the number of draughtsmen employed, and the progress made on each building. At times it was found that the checking department was overbalanced by the detailing department and that the designing department was not turning out sufficient work to keep the detailers and the checkers busy. This was adjusted by numerous meetings between the bridge company, the executive department, the manufacturing company, and ourselves. I might say, at this point, that the principal requisites of an expediter are, a thorough knowledge of the work to be performed, a pleasant personality, and the ability to interest the people who are actually doing the work—in this case, the men who made out the mill orders, the draughtsmen, the different foremen in charge of the rolling mill, and the foremen in the fabricating shop. All should be made to feel that their interests are parallel and that what is good for one is good for all. As soon as the drawings for one of the buildings were completed, we saw that this work was put in the shop at once, where someone had already attended to the delivery of the plain material, and that no time was lost in fabricating and shipping the same.

At times during the preparation of the drawings it was found necessary to urge the bridge company to employ additional men in all departments. This required considerable tact and force as, naturally, the heads of the different departments do not care to have their routine changed or, as they express it, "meddled with." This phase of the difficulty can be overcome only when it is possible to arouse sufficient interest in that particular piece of work. When the work was started our expediter received from the rolling mills, from which he knew the steel was to be furnished, a list of their daily rollings, and we saw to it that certain materials were gotten in on the dates at which the first rolling of that particular material was made. This saved considerable time, and we were able to get all of the plain material delivered before the shop drawings were entirely completed on the first building. The meetings between the heads of our department and the heads of the bridge company were most useful. Our expediter was usually on hand, and we were able to discuss the progress made since the last meeting, the condition of the work in the draughting room and in the shop, and to devise ways and means for overcoming any obstacles which had arisen, due either to lack of men or to want of materials.

The steel was erected as fast as the work was gotten out of the mill, fabricated, and delivered. We insisted on its being fabricated in sequence so that any materials delivered at the building could be immediately put in place. It had been previously decided at which end of the building the work would commence, and our superintendent in that field was advised of this fact and was also kept in thorough touch with the progress of the different stages of the steel. As the cars of steel were loaded and shipped out, they were put in the hands of the tracing department of the manufacturing company, and our own tracing department as well, and shipments were followed up until they were finally landed at the site. Our tracing department had, prior to this time, made the acquaintance of the different employees of the railroad through whom the records of the movement of the cars were to pass, as well as those who had direct charge at the transfer points. After the steel had been delivered the rest of the work was a mere question of brick, mortar, sand, gravel, cement, window frames, sash, roofing material, and sufficient workmen. Of course, there were large quantities of all these materials required and in order not to delay the work it was imperative that certain amounts of the same be delivered and put in place prior to the delivery of the steel.

Statler Hotel, Cleveland, Ohio

The same general method was applied to the construction of the Statler Hotel, except that the work was much more complicated and required many more details. There were approximately 90 sub-contractors and material men in and around the building from almost the day it was started until its completion, and it required a great deal of patience, perseverence and hard work to get the different trades to dovetail into each other throughout, so that those who did the preparatory work would finish and leave in time to permit the finished material to be erected in a proper and substantial manner. On the Statler Hotel we found it necessary from about the first of June until a few days before the building was turned over to Mr. Statler, to insist on daily meetings of all of the sub-contractors on the work, together with the architect's representative and others interested in the building. At these daily meetings each trade was taken up separately with the principal representative of that particular trade and the representatives of all the other trades present. He was questioned regarding the progress of his work and was told to state whether or not he was being retarded by any of the other trades. If it was found that his work was being hampered he was made to state explicitly and in detail to what extent and how.

The advantage of having all of the sub-contractors together at one time can readily be seen, as it eliminated innumerable quarrels between the foremen of the different trades and many misunderstandings which invariably arise due to the fact that the workmen and foremen are not always capable of expressing their troubles in an intelligent manner and, when they are busy, many times do not take the trouble to express themselves at all. It was rather hard to get them to continually attend these daily meetings, as they were held in the evening after they were supposed to be through with their work. We always tried to make the meetings as pleasant and as short as possible and never permitted ill-feeling to exist between the several trades arising from the discussions at the meetings. A typewritten report of each meeting was posted on the general bulletin board so that each of the sub-contractors would have access to the same during the following day.

The following points were brought out by Mr. Stuart in the discussion of the original paper:

Lump Sum or Percentage Basis for Contracts

If we can get contracts under reasonable competition, we much prefer to do work on the lump sum basis, as the work is then entirely in our hands and whatever we can save by any unusual attention or ingenuity is ours. However, if there is a chance that the competition will not be fair, and we are after the job pretty hard, we are glad to take it on a commission basis. A great deal depends on conditions. If the contractor is thoroughly honest, and when I say "thoroughly honest" I mean if he has real conscience, then it seems to me that a commission basis is the best on which to operate from the standpoint of the owner, because he gets exactly that for which he pays.

When we take work on a commission basis, and we do a great deal of that work in Pittsburgh, we make up an estimate of the actual cost of the work and tell the owner how much he is likely to expend. We do this for two reasons: One is that we do not want our organization to get into the habit of making any difference whether it is on a commission or a lump-sum basis. If you give the owner an estimate of his building, then it is everybody's purpose to keep within the estimate. The other reason is that we think it is only fair that the owner should know what the building is to cost, and we sometimes guarantee that the work will not exceed a certain maximum sum.

The owners should be satisfied even though it may be a little more expensive to have the work done on a commission basis, as it saves them in other ways. For example, it gives the owner a chance to make changes and to have the work done in just the way he wishes, so as not to interfere with his business. Personally, I do not think it costs any more to do the work on a commission basis, especially if the contract covers several buildings or a long period of time. We now have three contracts on a commission basis which are yearly contracts, that is, unless they are cancelled before the close of the year they carry over to the next year.

I think the principal objection to percentage work is that the owners do not sufficiently trust the contractors. I know many honest contractors, but just as in other business there are some who are not honest. This is not generally true of engineers, as statistics show that in the army and navy corps few engineers have proved dishonest.

We sometimes let some of the work to sub-contractors on a commission basis, but never when the work is of such character that it must be prepared away from the building, such as mill work, steel work, ornamental iron, etc. We have done our own plastering work, but we do not find it very advantageous, because most sub-contractors look after the work themselves as foremen. Fireproofing, painting and other trades are usually sub-let. Most people agree that to get some one who knows how to do it is worth the profit they pay to the contractor.

Value of Creating Interest

It is essential that sub-contractors and all others connected with a piece of work shall take interest in facilitating the work. Little progress can be made unless everyone is doing his part. We sometimes go so far as to stimulate interest among those furnishing the materials. For example, some one may be sent out to meet the superintendent of the brick plant, from whom the bricks were bought. In fact, our representative may meet the man who writes out the bills and also the man who loads the cars. To be more specific, during the construction of the Statler Hotel we had a man at the stone quarry who saw that the stone was shipped just as we needed it; he stayed there two or three months. The lower courses were shipped first, but even then we paid a large demurrage.

Detailed Estimates

Estimating is becoming more and more standardized. A great many estimators figure work on the same basis. The estimating in Europe is done by professional estimators, or surveyors, as they are called. In England one surveyor will make an estimate and give it to the different contractors. I think it has been attempted here a number of times, but it does not seem to be satisfactory.

In making our estimates we obtain the price of cement delivered; we get the cost of the aggregate; we obtain from the specifications the amount of cement required and the ratio of the concrete mixture; we figure minutely just what the material is going to cost; and we then add the cost of the labor. For the reinforcement, we get the prices per pound, and then compute the amount of reinforcement required for the entire job. The principal element of variation in reinforced concrete is with the wooden forms. We figure the number of feet of lumber which will be required for the framework for the entire job. We do not try to compute the formwork at so much per yard, as it will vary on different buildings, depending on the thickness of the slab, and on other details which vary with every job. It ought, theoretically, to vary almost every day.—Engineering & Contracting.

The Port Moody Sand and Gravel Company's Plant near Vancouver, B. C.

By S. A. Lake

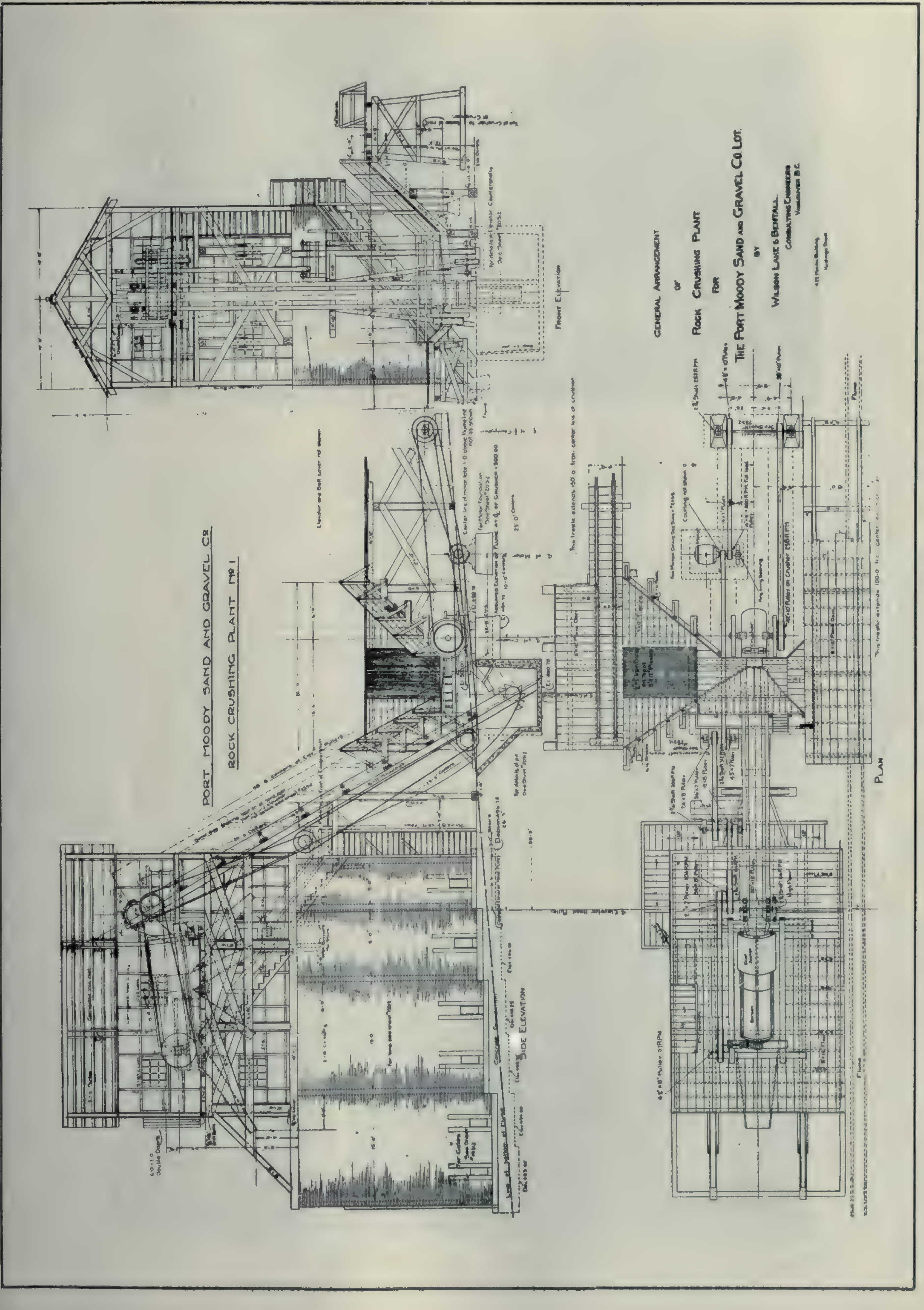
THE gravel pit and plant of the Port Moody Sand & Gravel Company are situated on the north shore of Burrard Inlet, about ten miles from the city of Vancouver and close to Port Moody. The property comprises about seventy acres, situated 3,500 feet from the beach and about 300 feet above sea level, and the company has acquired a right of way 66 feet wide from the pit to the beach, where the screening plant and storage bunkers are located.

The water from a creek above the pit is utilized for excavating and conveying the gravel to the beach, the right to take 250 miners inches from the creek having been acquired by the company. The fact that this amount is not available in dry summer weather made it necessary to investigate other sources of water supply, a reservoir site was located close to the property and the preliminary work for building a dam carried out. After consideration this scheme was abandoned, the determining factors being the uncertainty of water supply and the loss from evaporation in a reservoir having a large surface area compared with its capacity. It was ultimately decided to use sea water, a multistage turbine pump being installed at sea level for that purpose.

The material in the pit contains many boulders from six inches to between two and three feet in diameter which it was impossible to convey to the beach by means of the flume, so a plant was installed at the pit to reduce these. This plant consists of a rock crusher, with storage bins arranged so that the product can be discharged into the flume and conveyed to the beach. The storage bins are emptied at night, in order that the gravel sluicing shall not be interfered with. A derrick in the pit handles the larger stones, delivering them to a bunker from which they are carried to the crusher in dump cars. Stones from six to ten inches in diameter descend in the flume until the crusher is reached and are there separated by means of a grizzly from the smaller gravel, which continues its course to the washing and screening plant at the beach.

Flume.—There is about 3,500 feet of flume on a 7½ per cent. grade. The flume is constructed of lumber in the usual manner, 18 in. wide and 18 in. deep, blocks end grain on and 6 in. thick being used to take the wear. Before reaching the beach the flume crosses the tracks of the Canadian Pacific Railway (which here run through a cut) by means of a timber truss bridge. A second bridge at this point takes care of the 16 in. woodstave pipe from the pumphouse.

Screening Plant.—The screening plant is arranged with duplicate screens and the flume is divided just before reaching the plant so as to turn half the water and gravel into each set of screens. At the first screens all material over two inches in diameter is rejected to a storage bin, which feeds direct into the crusher of a second crushing plant built alongside the screening plant. The product is elevated to a screen afterwards being stored in bins below for shipment. Subsequent screens separate the two-inch and one-inch gravel, and the water and sand then pass to two automatic dumping tanks, which separate the coarse sand. The overflow from these tanks passes through a sedimentation tank where the finer sand is deposited. Thus two grades of gravel and two of sand are obtained in the


PORT MOODY SAND AND GRAVEL Co
ROCK CRUSHING PLANT No 1
FRONT ELEVATION
SIDE ELEVATION
PLAN
GENERAL ARRANGEMENT
OF
ROCK CRUSHING PLANT
FOR
THE PORT MOODY SAND AND GRAVEL CO. LTD.
BY
WILSON LAKE & BENTALL.
CONSULTING ENGINEERS
VANCOUVER B.C.
This trestle extends 150 0 from center line of crusher
This trestle extends 100-0 fr. center line of crusher

General view of screening plant from discharge end of conveyor belt.

following proportions. Fine sand 20 per cent., coarse sand 40 per cent., one-inch gravel 25 per cent., and 2-inch gravel 15 per cent.

The storage bunkers, on top of which the screens are placed, have a capacity of 4,000 cubic yards for all sizes, and the discharge openings are arranged above a belt conveyor running at a speed of 300 feet per minute and with a capacity of 180 cubic yards per hour. A short conveyor is run under the rock bunkers and connected across by another to the main loading conveyor, running out rom under the gravel bins. This latter conveyor is 427 feet, centre to centre, and discharges through an adjustable spout into scows at the end of the wharf.

Pumping Plant.—The pump house is situated at the end of a pier some 300 feet from the shore, constructed for the purpose of carrying the pipe out to deep water. The house contains a multistage turbine pump, manufactured by Allen & Sons, of Bedford, England. This is direct connected to a Westinghouse motor 450 h.p., three-phase, 2,200 volt, running at 850 revolutions per minute, as well as the necessary switchboard, valves, by-passes and priming jet. The pump is guaranteed to deliver 7.5 cubic feet per second against a pressure of 165 pounds per square inch.

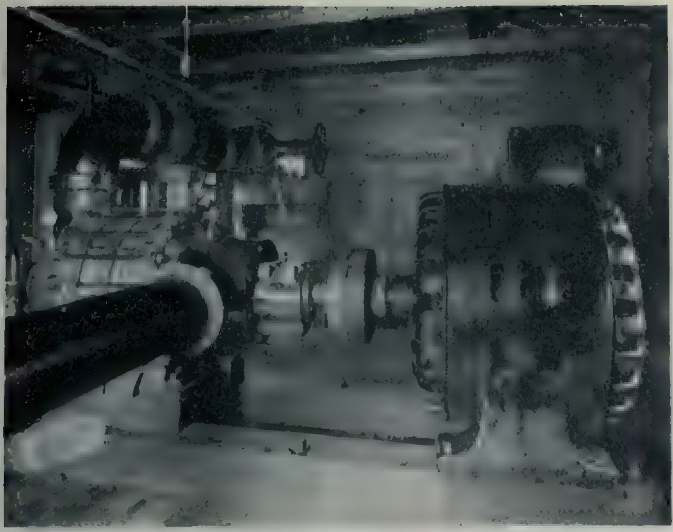
Electrical energy is supplied by the Western Canada Power Company, which has erected a sub-station on the site of the plant. The motors used on the plant are as follows: 450 h.p., 2,200 volt; 40, 35, 25 and two 10 h.p., all 220 volt, three-phase induction type.

This plant has a capacity of 500 yards of gravel and sand and 320 yards of crushed stone per 10-hour day. The crushers are Hadfield's Jaw type. The gravel screening machinery was supplied by Meese & Gottfried, the conveyors by the B. C. Equipment Company, of Vancouver, and the conveyor belting by the Canada Rubber Company.

The work was done partly by contract and partly by day labor employed by the owners. The consulting engineers were Wilson & Lake, 221 Pender Street W., Vancouver.

Great care is used to get a clean product by con-

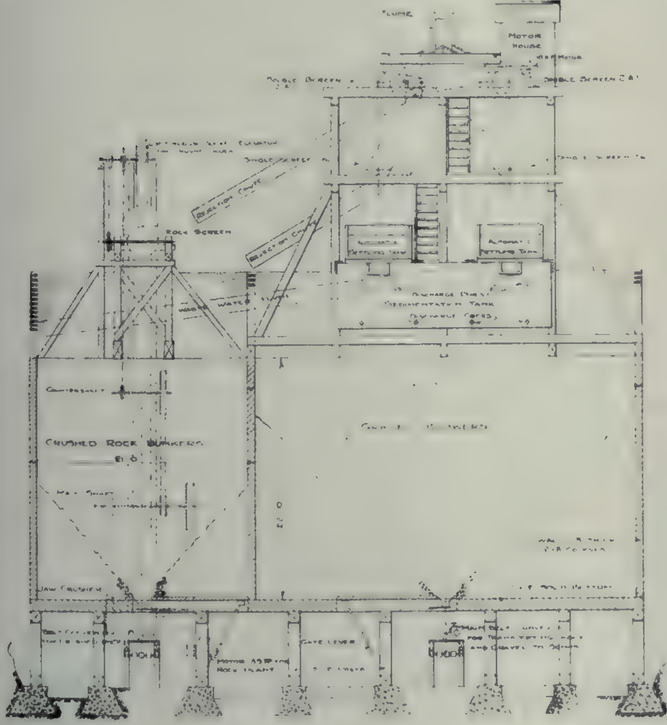
View of screening plant looking towards the water.



Interior of pump house.

siderable washing in the pit before sluicing the gravel into the flume.

Some trouble was met with in the settling tanks, as the sand formed a hard bed during each stop and required digging out before starting up. This was overcome by arranging tipping beams to the tanks so that they can be completely emptied by one man at the end of each run. The use of the automatic tanks in combination with the sedimentation tank has proved a success in obtaining a coarse sand for concrete and fine sand for plastering, etc.



Cross section through screening and No. 2 crushing plants.

The general design and arrangement of plants can be understood by reference to the accompanying cuts and drawings.

A record in boring the Mount Royal tunnel of the C. N. R. has been made. The men have bored 418 feet per month, which, says Mr. T. S. Brown, the chief engineer, is two feet more than has been previously done.

Brick Paving Construction in Baltimore*

THE first rick pavement laid in Baltimore was constructed about 1892 on St. Paul Street between Biddle and Preston. It was laid on a 4-inch base of concrete and a sand cushion anywhere from ½-inch to 3-inch in thickness. The brick was about the same size as the ordinary building brick, wire-cut, with straight edges, and of red shale. Instead of laying the courses at right angles to the curb, they were laid herringbone fashion, the most expensive way to lay a pavement. Sand was used as a filler. After giving 21 years' service, one half of the block was removed; the other half is still in fairly good shape. I cite this to show that even in the early stages of brick construction good work was sometimes accomplished.

We next used re-pressed brick, with lugs; in 1911 23 miles of vitrified block—some of poor construction, some fair and some excellent—had been laid. From January 1, 1912, to September 1, 1913, we have put under contract about 243,000 square yards and have completed 182,000 square yards. Some of this work is on very heavy traffic streets, most of it withstands medium traffic, while a small portion of it is alley work. Probably 5 per cent. of our brick so far is on a 4-inch base, with 95 per cent. of it on a 6-inch base.

Present Principles of Laying Brick Pavements

While we do not use a template in finishing our concrete, the contractor is required to make it of such consistency and to ram it in such a way that it presents an even and smooth surface. On a 6-inch concrete base stone passing a 2½-inch screen, and on a 4-inch base stone passing a 1½-inch screen is allowed to the extent of 20 per cent. of the total mass; but in no instance must the longest dimension of any stone be more than one-half the thickness of the concrete base.

Our specifications first required a compressed sand cushion 2 inches thick, but, to overcome a tendency to exceed this on the part of the contractor's foreman and the city's inspector, we finally reduced our cushion to 1½-inch, and, owing to the smoothness of our concrete, there is very little variation from this depth. We find that the thinner layer is more easily compacted, an important detail in the proper construction of vitrified block pavements. When the sand cushion is not compact and firm the grouting is more apt to break and jump out, due to the vibration of the brick under traffic. Furthermore, the rumbling sound so frequently noticed from teams passing over a brick pavement is due in a large measure to this lack of compactness. I recommend a loamy sand preferably with 10 or 15 per cent. of loam, rather than a perfectly clean material.

The most practical way to determine whether or not the sand cushion is sufficiently firm is to step on it evenly but firmly, gradually throwing the entire weight on it. If there is a decided imprint, the cushion should be re-rolled.

Brick should be hard (not so hard as to be brittle, however), well and uniformly burned, and free from warps, fire-cracks and other defects. Uniformity is extremely important. A street composed of uniform brick will wear evenly and will always present a good appearance if otherwise well constructed. The breaking of joints is another important item and when cutting brick to fit in next to the curb the cut end should be placed away from the curb rather than against it to give a better finish.

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* Abstract of Discussion by R. Keith Compton, Chairman, Consulting Engineer, Baltimore Paving Commission, before the Third American Road Congress at Detroit.

In my judgment it is a great mistake to lay the brick too close, just as it is to have too loose paving. If laid too close it is impossible to obtain a sufficient amount of grout in the end joints. If laid too loose, however, while rolling the brick will rock and the sand is apt to come up into the joints. This latter fault is a very common item and should be guarded against to the limit. While the brick are being rolled the inspector should carefully follow the procedure, and if the sand cushion is coming up the brick should be immediately removed and the sand cushion re-struck; if necessary, re-rolled. The appearance of more than ¾ inch depth of sand in the joints seriously obstructs the admission of the cement grout.

Application of Cement Filler

I am a firm believer in a cement-filled joint rather than a bituminous-filled joint for brick pavements. Cemented joints protect the edges of the brick and give a monolithic construction, while bituminous-filled joints are deficient in these respects. Two years ago I saw bituminous-filled streets completed in the most workmanlike manner and the streets left with a good even surface. Today the brick have rounded on the edges, and the surface has become decidedly uneven, the brick having shifted and floated on account of the bituminous-filled joint.

Some years ago we tried a cement filler mixed two of cement and one of sand but found this too brittle and returned to the 1:1 mix. If this filler is mixed and applied as outlined in Mr. McCleary's paper (see abstract Contract Record, p. 55, October 22, 1913), no trouble should be experienced, but it is imperative that the minutest detail of the selection of the sand and cement, the mixing, the application, and the covering with sand after the filler is otherwise completed, be complied with. The slightest deviation from one of these details is more than likely to cause trouble.

It is bad practice to follow too closely the application of the filler with the sand cover. The sand cover can only be used to protect the cement filler from the hot rays of the sun or from frost. It is very important that two or three hours should elapse between the time that the filler is completed and the time when the sand cover is applied, as a too early application of sand will not only cover up slack joints but may seriously weaken the cement filler.

As is well known, only the side joints next to the curb are necessary. Every precaution should be taken to have these joints free of foreign matter so that the pavements will have the full advantage of a clear joint filled from the top to the bottom with either a good bituminous filler or the patented "Elastic" joint.

The following thicknesses of joints next the curb are recommended: On streets between 30 feet and 50 feet in width, 1¾ inches; on streets between 20 feet and 30 feet 1 inch; on streets between 10 feet and 20 feet, ¾ inch.

If all of these details are strictly complied with, there will result a street possessing durability, ease of traction and a pleasing appearance; further, it will have a sanitary surface and will necessitate only a moderate maintenance cost.—Engineering Record.

Revew of Concrete as a Fire-Resistant

IN a paper recently read before the Boston meeting of the American Society of Mechanical Engineers, G. E. Fisher, Engineer of the Arkwright Mutual Fire Insurance Company, Boston, gives some interesting experiences with concrete in fire. He prefaces his remarks with the following general statement:

The fact that a building is of concrete construction seems to carry with it the idea that it is fireproof, regardless of occupancy. This word fireproof is a misnomer when applied to any kind of a building and it is gradually being displaced by the word fire-resistive, which includes not only concrete construction, but also the type now so common involving steel frame work protected with tile, concrete or brick. No building is absolutely fire-resistive, for the resistance offered to fire is one of degree only, and if the heat be sufficiently intense and prolonged, nothing can resist it.

At high temperatures the surface of concrete is easily injured and spalls badly when water is thrown on it, and both actual fires and experiments have proved that where these temperatures run from 1,400 deg. to 1,900 deg. F., the surface of the concrete may be injured to a depth of ½ in. to ¾ in., or even 1 in, but the body of the concrete is not affected. Excellent heat insulation is afforded by concrete, but to obtain the best results a sufficient thickness must be applied, depending largely upon the occupancy of the building under consideration. Experience has shown that 2 in. of concrete will protect an I-beam with good assurance of safety. Obviously a building having combustible occupancy should have a heavier protection of concrete over reinforcing members than one having non-combustible occupancy.

The best fire-resistive materials are usually considered to be first-class Portland cement with quartz sand and broken trap rock. Limestone aggregate will not stand the heat so well as trap and the particles of gravel are more easily loosened by extreme heat. Cinders make a good aggregate for fire resistance, but the concrete made with them is not so strong as the rock concrete and cannot be used where high compressive values are necessary. Considered from an insurance point of view, cinder concrete is not so desirable as that made of trap rock on account of the porous quality of cinders; the insurance companies have learned that with cinder concrete they are called upon to pay losses on account of damage from water used at times of fire, which percolates through the small interstices of the cinders, which the cement mixture cannot reach, to the floors below.

The behavior of concrete in the great fires in Baltimore and San Francisco as reported in the various scientific publications at the time of these conflagrations is again offered by the writer, who sums up the general investigations in both fires to the effect that concrete stood well in both cases, even though the material used in San Francisco was of inferior grade and much of it flimsy material stiffened with light metal which had been passed as reinforced concrete. Coming down to a more recent period he says:

Reports from fires in other sections of the country furnish further interesting information. At the Dayton Motor Car Works, Dayton, O., and Huyler's building,

N. Y. C., the fires were so hot as to destroy all inflammable material and yet the buildings themselves were damaged to a very slight extent only; the burned-out floors were occupied within two days after each fire. Another example is that of a two-storey building of reinforced concrete construction used for drying purposes; this building was considerably exposed by frame buildings burned, one part of the concrete structure was subjected to severe heat from a burning boiler house and grease-extracting building. The heat melted the wire glass in the windows and burned up all combustible materials in the finish of the building, but the damage to the concrete walls and floors was very slight. Still another case is that of a reinforced concrete building, four storeys in height, in which the heat from a fire was so intense that it fused a piece of cast iron into a shapeless mass, but the only damage resulting was that in several places throughout the building the concrete was split off to a depth of ¼ in. to 1 in.

In the case of an extremely hot fire in a pulp and paper mill, the principal effect of the heat observed was to expand the floor and to cause a movement of the columns. On the morning after the fire, while the concrete was still hot, the end wall of the mill was noticeably out of plumb; later on, as the wall cooled, it drew back to the perpendicular. There were several minor breaks in the concrete and some parts of it were spalled off to a depth of about 2 ins. Where the concrete was rich in mortar there was less damage than where it was stony, the mortar acting as a protection to the aggregate. Where the fire was hottest the concrete was softened for an average of 1 in., so that it could easily be knocked off with an ordinary hammer.

Referring to the requirements of the Mutual fire insurance companies that sprinklers be installed in all manufacturing buildings having combustible material either in their construction or occupancy, he states that the use of these sprinklers has proven very effective. Instancing a case of this kind, he says:

Some interesting information was furnished in one of these fire-resistive buildings, which did not have sprinklers, by a fire that destroyed the contents. The building, which was occupied for general office purposes and had the usual fittings and trimmings of a modern office, was three storeys in height with 17-in. walls of brick and had tile and reinforced concrete posts and beams on all floors. On account of its superior construction and safe occupancy, sprinklers were thought not absolutely necessary. The intense heat generated by the burning of the hardwood overlay on the floors and the hardwood office fittings affected the brick walls, the concrete windowsills, and the concrete belt extending around the building at the third floor level. It is thought that most of the spalling of the concrete work was due to cold water from hose streams on the hot material. The structural strength of the concrete columns appeared to be very much reduced by the fire, and to determine whether or not it was necessary to replace them and the beams damaged in the fire, shores were placed under a third floor beam ½ in. clean at the top, to take the weight, should it settle when loaded. Careful measurements were taken of the distance between the underside of beam and top of floor below. A load of 16 tons of iron was placed on the third floor over the beams to be tested, and the deflection was 7/64 in. in the center of beam. This occurred at once when the load was applied, and did not increase when the test continued, namely, 3 hrs. For comparison, the same load was then placed over an uninjured beam elsewhere, and the same measurements taken, showing a deflection of 6/64 in., or practically the same as found in the damaged beam. No settling could be detected around any of the damaged posts when the load was applied.

In repairing this building a cement mixture was made and the beams and columns built out with it wherever spalling had taken place. It is doubtful that anyone examining the building to-day could detect any traces of this fire. It has been equipped with automatic sprinklers, and as a further precaution against another fire the new office furniture is all metal so far as could be obtained. From the writer's own experience, however, he would not consider this last precaution necessary, for in a building well protected with sprinklers the chance of a fire getting outside the area of two or three sprinklers is remote.

Cleaning Stone Work

A builder in Virginia had a contract involving the use of brick work with granite trimmings and he found it necessary to clean the stone work. He made the attempt with dilute acid, but it did not give satisfaction, although the stock brick around the trimmings cleaned up very nicely. The granite, however, still showed the streaks of dirt. He stated his case in a recent issue of The Painter's Magazine and the suggested remedy was as follows:

Builders' acid, which is equal parts of muriatic acid and water, will remove spots of mortar on brick or stone work, but is not the right material for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fiber brush, a strong solution of caustic soda or pearl ash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this will not be effective enough, scrub the stone with a stiff fiber brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove the cleansing material. Protect your hands with rubber gloves.

A unique engineering problem is the construction of sufficient houses to quarter the men employed on the task of constructing the gigantic tunnel through the Selkirk range of the Rocky Mountains at Glacier, B.C. One of the problems the contractor had to face was the drifting snow in winter, which made it well nigh impossible to proceed with the work in a satisfactory manner, so they conceived the plan of building a village on stilts. The proposition was placed in the hands of a well-known architect and he was asked to draw up plans which, when finished, will cost $50,000. The floors of the houses, which will be of substantial construction, are to be eight feet above the ground. The streets will have no sidewalks, but will have a walk in the centre, also eight feet above the ground level and connected with the doors of the houses by little bridges.

It has been computed that there were used in the buildings erected in New York City last year 1,019,250,000 bricks, which is an increase of 93,187,000 bricks over the number needed for building operations in 1911. The cost of the brick used in last year's operations amounted to $5,858,770, as against $4,717,633, the cost of the pile used during the previous year.

Winter Fair Building, Regina, under construction.

Regina—A City in the Building

REGINA is rapidly becoming one of the live constructional centres of western Canada. Nearly every week one of our western correspondents sends us new information appertaining to building or engineering development and the list of stories apparently is far from being exhausted. Reproduced herewith are exterior and interior views of the new Winter Fair building, which is being erected for the city of Regina by the Parsons Construction and Engineering Company, Limited, at a cost of $133,000. The building has a steel frame with solid brick walls and its dimensions are 332 ft. by 191 ft. 6 ins. In the centre there is an oblong arena 220 ft. long and 85 ft. wide. The building has the regulation promenade and stalls for spectators. It is hoped to complete the structure by March 1st in time for the first Winter Fair and Horse Show which is taking place at Regina on March 6th.

The Canadian Bank of Commerce has recently erected an up-to-date bank building at Regina and the offices in this city have now been transferred to the new quarters. The building is elaborately finished throughout, marble, stone and ornamental plaster being used. Messrs. Clemesha & Portnal, architects, Regina, supervised the work.

The excavation for the new Sherwood $1,000,000 departmental store at Regina has been completed and a start made on the erection of the steel work. The contract for the steel work has been awarded to Charles D. Oliver, Canadian representative of the "M" System. It is claimed that the Sherwood store is the first building in Canada to be erected by this system. The girders and beams used in the building are composed of structural steel, and are so arranged that they take up all the tensile stresses, while the concrete which surrounds the steel members takes up the stresses of compression. The buildings erected on this plan differ from the usual run of buildings in that the steel is reinforced with concrete, rather than concrete reinforced with steel. It is proposed to use this new class of construction in the two buildings to be erected for the Hudson's Bay Company, one to be at Victoria, costing $800,000, and the other to be at Winnipeg, costing $3,500,000.

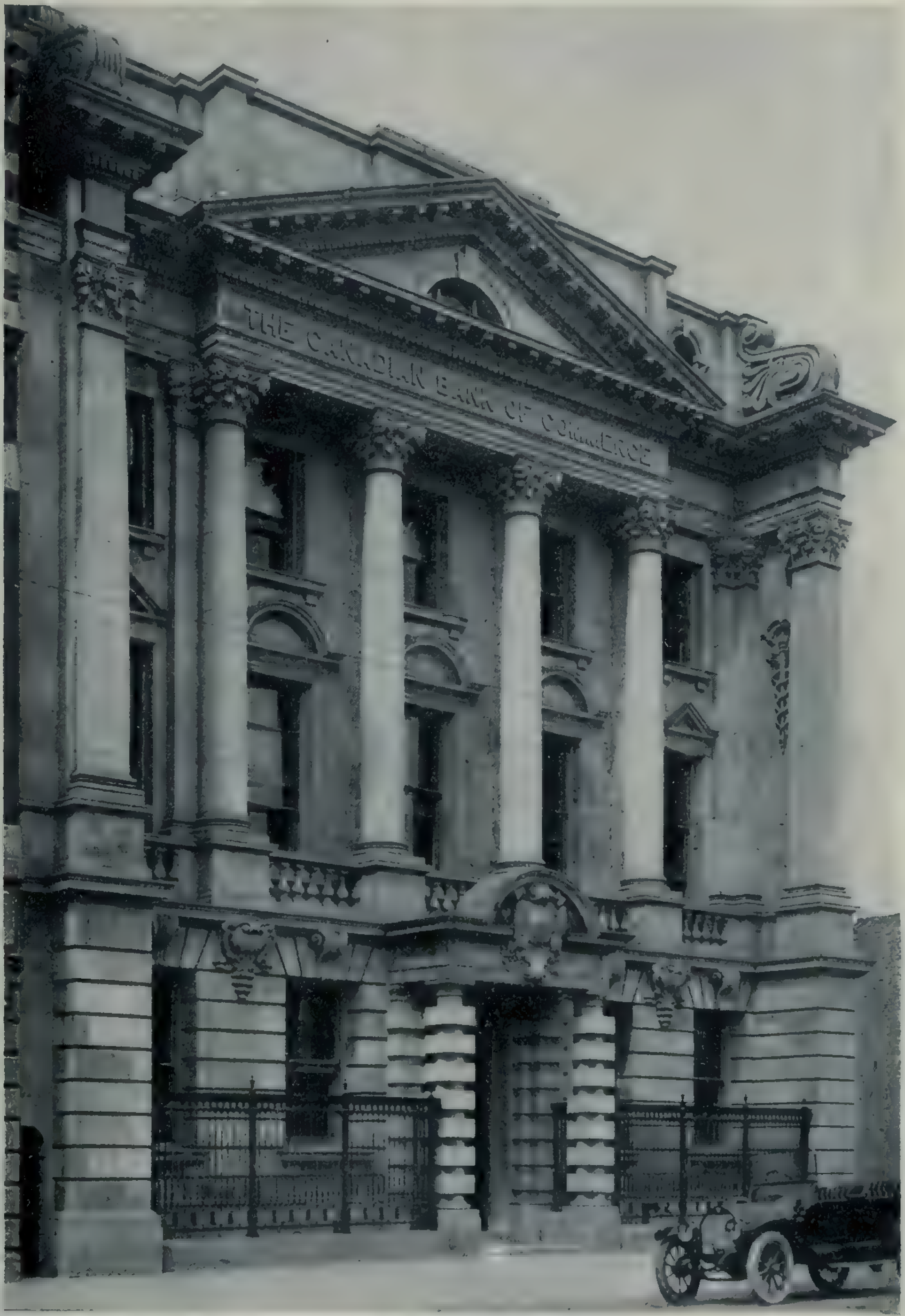
Regina's new building code, upon which Mr. R. O. Wynne-Roberts and the building inspector, Mr. A. Falls, have been engaged for some time, is in the final stages of preparation. Local constructional interests are awaiting its appearance with much interest, it being understood that it provides for a number of interesting departures in construction.

The Broad street subway, for which the Parsons Construction and Engineering Company were the contractors, is nearing completion. Twenty-three sets of track cross this subway and a double track of the street railway runs through it.

Arrangement of tellers' quarters and ledger desks.

Main entrance, vault and tellers' cage.

The Canadian Bank of Commerce, Regina.



The Canadian Bank of Commerce, Regina

Architects: Messrs. Clemesha & Portnall.

The Testing of Materials Used in Road Construction

By James G. Ross*

WITH the present era of good road building, increasing attention is being directed to the quality of the materials used in the construction of roads. To many people a rock is a rock, and any stone that happens to be convenient is used, regardless of its suitability. Too often its lack of wearing qualities is determined only by time, and a short time at that. Careful examination and testing of the material available will determine what is best suited to the conditions. The same remark applies to binders used, paving blocks, paving bricks, and various patented pavements.

A description of the methods employed in a commercial testing laboratory indicates that where roads are properly constructed, materials are selected only after careful testing. A thorough study having been made of the traffic conditions, the style of road best suited to give satisfactory wear at a reasonable price is decided on. If a rural district, a macadamized road will answer the purpose. An examination of the district is made to ascertain the available material. Should gravel be abundant, this should be inspected to see that it contains the requisite binding agent,—if in a rock district, the various points where rock can be quarried should be examined with a view to selecting the rock that will give the most satisfactory service. An examination by an engineer will disclose the most economical place for opening a quarry from which a uniform and satisfactory rock can be obtained. Should no rock be available in the vicinity, tests should be carefully made of the stone offered on the market to secure that best adapted to the conditions. Where field stone is used from old fences or farmers' stone piles, a few tests will show which rocks should be used for foundation and which reserved for top dressing. If, instead of a water-bound macadam road, one bound with oil, or bituminous substance is decided on, it is good economy to have these binding agents tested. Where brick or stone block is to be laid, the various makes of brick and block from different quarries are carefully tested and a decision arrived at as to which is the best to use. Cement is, of course, tested for all building purposes and should be tested for use in road foundations, gutters, culverts and bridges.

In France and Portugal, an elaborate system of testing various stones in service was carried out by digging up sections of the roadways and observing the wear on the stone, careful observations being also made of the traffic. These agreed so well with simultaneous laboratory tests that now all stone in these countries is selected as the result of laboratory tests. As early as the middle of the last century compression tests were made on rocks in the endeavor to determine their road building quality. The systematic testing of road materials may be said, however, to have begun during the decade opening with 1870, in France, where it has been developed steadily ever since. In recent years laboratories equipped with appliances for testing road materials have been installed by various State Geological Survey Departments in the United States and also at many colleges. The methods and results of tests of the Department of Public Roads at Washington, D.C., have been published in a series of reports which contain much valuable information. This has been used freely in the preparation of this article. No single material or class of materials will suit all conditions of climate and traffic. To get the best results it is necessary that the material selected, as well as the methods of construction, should be adapted to the special conditions of the road that is to be built or maintained. This is not always practicable and often impossible. Much can be done to determine which of the available materials is best suited for use.

An error in the selection of a material means an inferior road and occasionally complete failure. Such an error may cause a great loss of money to the community in which it occurs.

To obtain the best results on a macadam road, that rock should be selected which will resist the wear of the traffic to which it is subjected to such a degree as to supply just the sufficient amount of binding material to cement the road. Too much, or too little wear are alike injurious. When a road is first constructed a sufficient amount of binding material must be supplied to cause it to "come down" under the roller or traffic.

The values of a rock for road building purposes depends on its physical properties, per cent. of wear, toughness, hardness, specific gravity, and cementing value. These are determined by various tests.

Percentage of wear represents the amount of material under 0.16 Cm. in diameter lost by abrasion from a weighed quantity of rock fragments of definite size. This well-known test is similar in almost all respects to the Deval abrasion test of the French School of Roads and Bridges. It has been used since 1878, and is entirely satisfactory for the purpose for which it was designed. It is carried out in a machine called a Rattler and the specifications of the American Society for Testing Materials is as follows:

> "The machine shall consist of one or more hollow iron cylinders; closed at one end and furnished with a tightly fitting iron cover at the other; the cylinders to be 20 c.m. in diameter and 34 cm. in depth inside. These cylinders are to be mounted on a shaft at an angle of 30 degrees with the axis of rotation of the shaft.
>
> At least 30 lbs. of coarsely broken stone shall be available for a test. The rock to be tested shall be broken in pieces as nearly uniform as possible, and as nearly fifty pieces as possible shall constitute a test sample. The total weight of rock in a test shall be within 10 grams of 5 kilograms. All test pieces shall be washed and thoroughly dried before weighing. Ten thousand revolutions, at the rate of between 30 and 33 to the minute, shall constitute a test. Only the percentage of material worn off which will pass through a 0.16 cm. (1-16 in.) mesh sieve shall be considered in determining the amount of wear. This may be expressed either as the percentage of the 5 kilograms used in the test, or the French coefficient which is in more general use, may be given."

Toughness is here understood as the power possessed by a material to resist fracture under impact.

In testing macadam rocks under impact it has been found best to apply a number of blows of successively increasing energy and note the blow causing failure.

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* Engineer Milton Hersey Company, Limited, Montreal.

The following test involving this principle is, therefore, recommended by the A.S.T.M. for determining the toughness of rock for macadam road building:—

> "Test pieces may be either cylinders or cubes, 25 mm. in diameter, and 25 mm. in height cut perpendicular to the cleavage of the rock. Cylinders are recommended as they are cheaper and more easily made.
>
> The testing machine shall consist of an anvil of 50 kilograms weight, and placed on a concrete foundation. The hammer shall be of 2 kilograms weight, and dropped upon an intervening plunger of 1 kilogram weight, which rests on the test piece. The lower or bearing surface of this plunger shall be of spherical shape, having a radius of 1 cm. This plunger shall be made of hardened steel, and pressed firmly upon the test piece by suitable springs. The test piece shall be adjusted, so that the center of its upper surface is tangent to the spherical end of the plunger.
>
> The test shall consist of a 1 cm. fall of the hammer for the first blow, and an increased fall of 1 cm. for each succeeding blow until failure of the test piece occurs. The number of blows necessary to destroy the test piece is used to represent the toughness, or the centimeter grams of energy applied may be used."

With heterogeneous materials like most of the rocks used in road building, toughness depends on a number of factors,—among these may be mentioned interlocking of the crystals, the nature of the crystals themselves, and in some cases the nature of the cementing or binding agent.

Hardness is the resistance which a material offers to the displacement of its particles by friction, and varies inversely as the loss in weight by grinding with a standard abrasive agent. The test is made in the following manner:—the test piece in the form of a cylinder about 3 inches in length by 1 inch in diameter is prepared by an annular core drill and placed in the grinding machine in such a manner that the base of the cylinder rests on the upper surface of a circular grinding disk of cast iron, which is rotated in a horizontal plane by a crank movement. The specimen is weighted so as to exert a pressure of 250 lbs. per square centimeter against the disk, which is rotated in a horizontal plane by a crank movement. The specimen is weighted so as to exert a pressure of 250 lbs. per square centimeter against the disk, which is fed from a funnel with sand about 1½ m.m. in diameter. After 1,000 revolutions the loss in weight of the sample is determined and the coefficient of wear obtained by deducting one-third of this loss from 20.

The binding power, or as it has come to be called, the cementing value, of a road material is the property possessed by rock dust or other finely divided material found in nature to act as a cement on the coarser fragments composing crushed stone or gravel roads. This property varies enormously, not only with different kinds of rocks but also with those that are practically identical in classification and chemical composition. The absence of cementing power is so pronounced in some varieties of rock that they can never be made to compact with the road roller or under traffic. As the binder surface of a macadam or gravel road is most exposed to the action of wind and rain, as well as the wear and tear of traffic, it can be seen that the presence of this property is most essential to good results. Further than this, the hardness and toughness of the binder surface, more than the rock itself, constitutes the hardness and toughness of the road, for if a load be sufficient to destroy the bond of cementation of the upper surface of a road, the stones below are soon loosened and forced out of place. Moreover, it is a matter of common observation that a good surface which binds well is less dusty and less muddy.

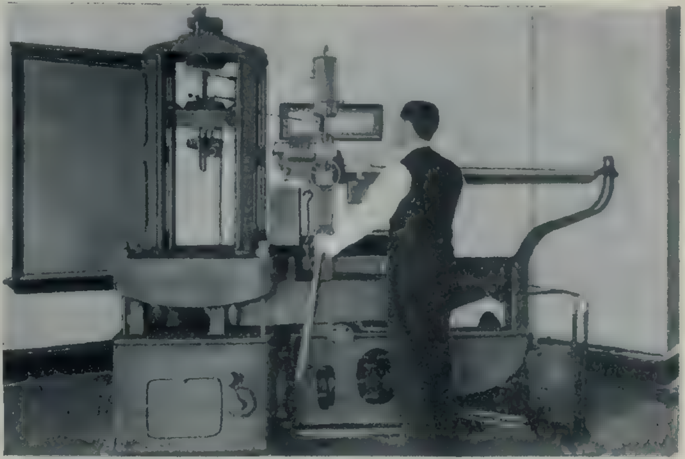
The specific gravity is the weight of the material compared with that of an equal volume of water, and is obtained by dividing the weight in air of a rock fragment by the difference of its weight in air and water. Given the specific gravity, the weight per cubic foot is found by multiplying this value by 62.5 pounds, the weight of a cubic foot of water.

Upon receipt of a rock sample, which should weigh not less than thirty pounds and be collected with care, according to specifications for sampling which may be had on application, to represent as nearly as possible an average of the whole exposure, it is examined in a general way to determine the proper method of analysis.

Rocks consisting essentially of the carbonates of lime and magnesia (limestones, dolomites, etc.) as well as fine-grained shales and unconsolidated sedimentary deposits, such as clays, sands, gravels, etc., are analyzed chemically when necessary, whereas all other materials are prepared for microscopic examination or determined microscopically.

The mineral composition of a rock, may, under favorable conditions, be estimated with considerable accuracy by a miscroscopic examination, yet for exact quantitative results the aid of a polarizing macroscope

Standard impact machine for road work.



Autographic testing machine. Capacity 150,000 pounds.

and transparent thin sections of the rock are essential.

The macroscopic form of analysis can be applied only to coarse-grained rock, in which the various mineral components are easily detected with the unaided eye.

For microscopic examination thin transparent sections are made so that the various minerals comprising the rock may be identified. In connection with the work carried on in the chemical laboratory it has been frequently found of importance to determine the chemical composition of a rock from the volumetric proportions of its mineral constituents as determined by the microscope.

Rocks belonging to the same species, and having the same name, but coming from different localities, vary from each other in their physical road-building properties almost as much as they do from rocks of distinct species. Wide variation also occurs in the mineral composition of rocks of the same species, as well as in the size and arrangement of their crystals. It is impossible, therefore, to classify rocks for road building by simply giving their specific names. It can be said, however, that certain species of rocks possess in common some road building properties,—for instance, the trap rocks as a class stand heavy traffic well, as they are hard, tough, usually have binding power, and are therefore frequently spoken of as the best rocks for road building. This, however, is not always true, for examples have shown that some trap rocks having these properties in the highest degree, have failed to give good results on light traffic roads. The granite are generally brittle and many of them do not bind well but there are a great many which when used under proper conditions, make excellent roads. The felsites are usually very hard and brittle, and many have excellent binding power, some varieties being suitable for the heaviest macadam traffic. Limestones vary greatly but generally bind well; they are soft and frequently improve under traffic. Quartzites are almost always very hard, brittle, and have low binding power. The slates are usually soft, brittle, and lack binding power.

Standard rattler for abrasion tests of paving bricks.

There are, undoubtedly, practical road builders whose judgment on the road building quality of rock is excellent, but experience with materials of construction in general has proved that it is wise and economical to test the physical properties before entering on the expenditure of large sums of money.

There is another class of road materials whose toughness is due to a combination of properties not considered under the definition as applied to rocks. It includes those materials capable of considerable deformation without rupture when stressed beyond the elastic limit. Asphaltum and tar practically constitute this class. Bituminous compounds, bitumens, and dead oils distilled from tars under various trade names, are also used as binders.

The standard method for the determination of the loss on heating of oil and asphaltic compounds is specified by the A. S. T. M. as follows:—

> "The loss on heating of oil and asphaltic compounds shall be determined in the following manner:—twenty grams of the water-free material shall be placed in a circular tin box with vertical sides, measuring about 2 cm. in depth by 6 cm. in diameter, internal measurement. The penetration of the material to be examined shall, if possible, be determined at 25 deg. C., and the exact weight of the sample ascertained. The sample in the tin box shall then be placed in a hot-air oven (New York Testing Laboratory oven without fan) heated to 163 deg. C. (325 deg. F.) and kept at this temperature 5 hours. At no time shall the temperature of this oven vary more than 2 deg. C. from 163 deg. C. When the sample is cooled to normal temperature, it shall be weighed and the percentage of loss by volatilization reported. The penetration of the residue shall then, if possible, be determined at 25 deg. C., as upon the original material, and the loss in penetration found by subtracting this penetration from the penetration before heating. In preparing the residue for the penetration test it shall first be heated and thoroughly stirred while cooling."

The method for the determination of the penetration of bitumen as specified by the A. S. T. M. is as follows:—

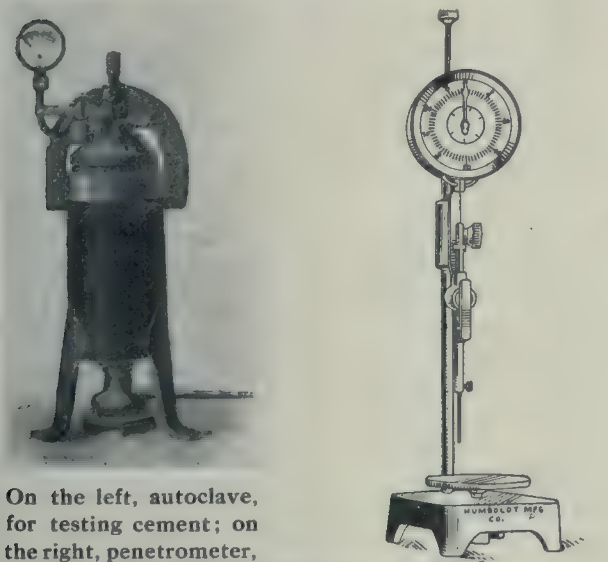
> "The penetration of bitumen shall be the distance expressed in hundredths of a centimeter that a No. 2 needle will penetrate into it vertically without friction at 25 deg. C. under a stated weight applied for a stated length of time, the factors of weight and time being determined as follows:—
>
> The material shall first be tested for five seconds under a weight of 100 grams. If this result is less than 10, the penetration shall be determined under a weight of 200 grams applied for one minute, if between 10 and 300, the penetration shall be determined under a weight of 100 grams applied for five seconds; if greater than 300, the penetration shall be determined under a weight of 50 grams applied for 5 seconds. In every case the factor of weight and time shall be stated when reporting the penetration, and whenever possible to obtain both readings, the penetration under a 100-gram weight for 5 seconds and under the modified weight and time shall both be reported. When testing material softer than 100 penetration, a containing receptacle not less than 1¼ inches in diameter shall be used.
>
> It is recommended that the penetration may be determined at 0 deg. C. (32 deg. F.) and 46 deg. C. (114 deg. F.) in addition to the 25 deg. C. (77 deg. F.) test."

When paving blocks or paving brick are submitted, they are tested for absorption, tensile strength, hardness, toughness and specific gravity.

The blocks are examined macroscopically, for a block made of gneiss or foliated granite would develop planes of weakness. Hardness, toughness and specific gravity are determined, as in the case of rock for macadam road, except that in the test for hardness the Rattler is loaded with cast iron blocks or shot.

> "The machine for conducting this test consists essentially of a rotation drum partially filled with large

and small cast iron blocks or shot. The wearing quality of paving brick is judged by the loss sustained after a sample has been subjected in this drum for one hour to the impact and abrasion of these cast iron shot. For the first 600 rotations the loss is mainly due to a chipping action which develops the brittleness of the brick; between 1200 and 1800 rotations the loss is mainly due to an abrasive action which develops the softness of the brick. During the test any defects of structure, such as planes of separation, will probably result in rupture. The Rattler is 28 inches in diameter and 20 inches long and has 14 steel slats. It is run at a speed of 30 rotations per minute for 1800 revolutions. The charge to be placed in the rattler consists of nine paving blocks or twelve dry bricks, together with 300 pounds of shot made of ordinary machine cast iron. The shot are of two sizes. The larger (2½ by 4½) weigh 7.5 pounds each and have slightly rounded edges; the smaller shot (1.5 inch cubes) weigh about seven-eighths of a pound each. The charge is composed of 75 lbs. of the larger and 225 pounds of the smaller size. The individual shot are replaced by new ones when they have lost about one-tenth of their original weight. The loss in weight undergone by a sample of brick under test at the end of 1800 revolutions is found by comparing the original weight of the brick with its weight after test. The loss in per cent. of the original weight is the factor determining the quality of the brick. For the best paving brick this loss should not be in excess of 18 per cent. The above conditions are those demanded in the standard specifications recommended by the National Brick Manufacturer's Association."



On the left, autoclave, for testing cement; on the right, penetrometer, for determining the consistence of asphalt.

Paving brick and paving blocks are sometimes tested for compressive strength. This is done in a testing machine which has two screws so that tests may be made for both compressive and tensile strength. The bricks are tested either in the same position as in service or on the flat, being bedded in sheets of lead or plaster of paris. The maximum compression of this machine is 200,000 pounds per square inch.

Cement is tested according to the methods of the A. S. T. M. and should conform to the following specifications:—

Specific Gravity.—The specific gravity of cement shall not be less than 3.10. Should the test of cement as received, fall below this requirement, a second test may be made upon a sample ignited at a low red heat. The loss in weight of the ignited cement shall not exceed four per cent.

Fineness.—It shall leave by weight a residue of not more than 8 per cent. on the No. 100 and not more than 25 per cent. on the No. 200 sieve.

Time of Setting.—It shall not develop initial set in less than thirty minutes; and must develop hard set in not less than one hour, nor more than ten hours.

Tensile Strength.—The minimum requirements for tensile strength for briquettes one square inch in cross section shall be as follows, and the cement shall show no retrogression in strength within the periods specified:—

NEAT CEMENT

Age	Strength
7 days (1 day in moist air, 6 days in water)	500 lbs.
24 hours in moist air	175 lbs.
28 days (1 day in moist air, 27 days in water)	600 lbs.

ONE PART CEMENT, THREE PARTS STANDARD OTTAWA SAND

Age	Strength
7 days (1 day in moist air, 6 days in water)	200 lbs.
28 days (1 day in moist air, 27 days in water)	275 lbs.

Constancy of Volume.—Pats of neat cement about three inches in diameter, one-half inch thick at the centre, and tapering to a thin edge, shall be kept in moist air for a period of twenty-four hours.

(a) A pat is then kept in air at normal temperature and observed at intervals for at least 28 days.

(b) Another pat is kept in water maintained as near 70 deg. Fahrenheit as practicable, and observed at intervals for at least 28 days.

(c) A third pat is exposed in any convenient way in an atmosphere of steam, above boiling water, in a loosely closed vessel for 5 hours.

These pats, to satisfactorily pass the requirements, shall remain firm and hard, and show no signs of destortion, checking, cracking, or disintegrating.

A more rapid determination is made by the autoclave, which detects unsoundness that might not be shown by the above test.

Sulphuric Acid and Magnesia.—The cement shall not contain more than 1.75 per cent. of anhydrous sulphuric acid (SO_3), nor more than 4 per cent. of magnesia (MgO).

Wood block, creosoted wood, tile piping for drains, and reinforcing iron for bridge floors are also tested.

THE APPLICATION OF LABORATORY RESULTS TO PRACTICE

The proper interpretation and application of the results obtained in the laboratory are quite as important as the general accuracy and appropriateness of the tests themselves. It is probable that many engineers and others interested in the subject of road building who have found time to examine the question only superficially have not understood the bearing and value of road material testing. In all cases the results obtained in testing materials of construction are of relative rather than absolute value. Even a large variation in the results yielded by different test pieces of the same sample should not condemn the practical value of the figures if they are properly applied and interpreted. The necessary qualities of road material have to be considered from the double standpoint of furnishing a strong unyielding, well-drained road foundation and a hard coherent binder surface. In road building the attempt should be made to get a perfectly smooth surface, neither too hard, too slippery, nor too noisy, and as free as possible from mud and dust, these results to be attained and maintained as cheaply as possible. Such results, however, can be achieved only by selecting the material and methods of construction best suited to the conditions.

Given a number of materials for laboratory examination, it is not pretended that an actual grade of excellence can be established. On the other hand, if more than one material is available, it is quite possible for the laboratory to point out which one would yield the best results, both as to immediate excellence and length of life under known conditions of climate and traffic. Undoubtedly in many cases, large sums of money have been wasted in building roads from unsuitable material, which might have been saved by referring the materials to the laboratory.

A road material cannot be selected, irrespective of the volume and character of traffic and the climatic conditions to which it is to be subjected, without the risk of failure. When the very great cost of even rural highways is considered, it is evident that it is gross negligence not to use every preliminary precaution to guard against expensive mistakes.

Design of Steel Mill Buildings—Part I.*

Review and Discussion of Practical Considerations Governing Their General Features, Proportioning and Detailing

By R. J. Fleming †

THE purpose of this article is to call attention to some practical points that enter into the design of steel mill buildings. Articles written from the professor's chair are sometimes purely academic. The assumptions made, and upon which conclusions are based, are often found in actual practice to be incorrect. A thorough knowledge of the theoretical treatment of the various phases of mill building design given in the text books is necessary but will not in itself confer the ability to design a mill building that is economical or adapted to practical needs. This knowledge should be supplemented by one's individual experience as well as by the experience of others.

The engineer having a building to design will usually consider the different features of his work in the order followed below.

At the very outset he should possess himself of all available data. For what use is the building intended, and what are the probable uses to which it may be put? Upon these two questions largely depend the loads to be assumed for floors, the kind of covering for the roof, the amount of light, heat and ventilation required. The geographical location will decide the snow load. Sometimes the proposed building is within the limits of a city having a building code. A copy of this should be procured. Incidentally, a design based on sound engineering principles should be affected only in minor details by a building code, provided the code represents sound engineering principles. Local conditions may govern the selection of material to be furnished. As a matter of course, attention must be given to the preference of the owner.

If the building is to be used for manufacturing purposes, a lay-out of the machinery should be obtained from the mechanical engineer. This is necessary to locate interior columns to the best advantage. In these days of specialization we have also the heating and ventilating engineer, the illuminating engineer, the sanitary engineer, and others, engaged on the structure. The order of precedence may be as follows: Mechanical engineer, structural engineer, architect, other engineers.

When the steelwork is but a comparatively unimportant part of the structure the work of the architect precedes that of the structural engineer. When the steelwork predominates, the structural engineer should take the lead, while in the design of many mill buildings he is both engineer and architect.

It is seldom the good fortune of the engineer to be called upon to design an industrial plant from the start on a new site. Generally the proposed building is an addition to another building or a building added to a group of buildings. Most large manufacturing establishments are a growth from humble beginnings. Buildings are enlarged or new ones built to meet the exigencies of the time without much thought of future requirements. This growth will in most cases continue, and in designing new buildings provision should be made for their future extension. The conditions of the present work should be thoroughly understood.

In many cases data to the extent outlined can not be obtained. In work for export the inquiry is often very crude, little more than the uses to which the building is to be put and the approximate dimensions being given. Recourse must then be had to plants previously built for the same kind of work. A knowledge of buildings similar to those which the engineer is called upon to design is always valuable. The files of the technical papers for the past 10 to 20 years are rich in plans and descriptions which can be studied with profit.

Lighting

The demand of the industrial world to-day is for greater efficiency. To meet this demand in mill buildings attention should be given both to the machine and to the man. Better means of handling material will increase the output and lessen cost. Given a more favorable environment in the way of light, heat, and ventilation, the workman is more efficient, resulting in a larger and better output. In late years the question of proper lighting and its economic value has been widely discussed.

The United States Census of 1910 gives for the year 1909 the number of manufacturing establishments as 268,000, engaging 7,678,000 persons, of whom 6,615,000 were wage earners. The value of the products during the year was over twenty billion dollars, of which the portion added by manufacture (value of products less cost of materials) was over eight billion dollars. Assuming that the value of the output could be increased 1½ per cent., a low estimate, if better illuminating methods were used, we have an annual saving for all industries of $315,000,000.

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* Courtesy of the Engineering Record.

† Designing Engineer, American Bridge Company, New York City.

Out of an average 24-hour day we have 11¾ hours of darkness, 4½ hours of cloudy or foggy atmosphere and only 7¾ hours of sunshine. Hence manufacturing plants must operate for part of the time by artificial light. We now have the illuminating engineer to deal with this feature.

The structural engineer, however, should, if it is possible, design his building to admit all the natural light needed during the day. This is generally done by using windows in the sides and, for the portion of the building the windows fail to light, skylights in the roof. The windows should be low, if there are benches along the wall or if light is needed near the sides, and they must be high to light the central portion of the room. A good plan is to have them begin 3 ft. from the floor and extend as high as possible. When balanced sash can be used, the expense of counterweights is saved.

A monitor, the purpose of which is to light or ventilate the building, is often built on the ridge of the roof, running from end to end, or stopping one panel from each end, with swing or sliding sash in the sides. The sash give ventilation as well as light. For the best results the monitor should have a width about one-fourth that of the roof on which it rests. Skylights in the roof are expensive, are liable to breakage, are a frequent cause of leaks, and when covered with snow do not admit light. Their use should be restricted to a minimum.

The proper proportion of glass surface to the side and roof areas of a building varies widely according to its uses. Fowler's "Specifications for Steel Roofs and Buildings" says as to this point:

"Windows shall be provided in the sides and clerestory or ventilator of a surface equal to not less than 10 per cent. of the entire exterior surface of the building, in mill buildings, and of not less than 20 per cent. in machine shops or similar buildings.

"At least half of the lighting specified shall preferably be in the form of skylights, of some form of construction, which shall entirely prohibit leaking."

This proportion is small for the sides and large for the roof. The East Side Machine Shop at Pencoyd, which is an unusually well lighted building, has one-eighth of the roof surface and one-half of the side and end surfaces covered with glass. Steel frame buildings having narrow concrete pilasters around the columns, and belt courses, also of concrete, at the floor and eave levels, with the balance of the sides filled with steel sash, are illustrated in the catalogues of the leading manufacturers of steel sash. With this construction almost the entire sides and ends are of glass. It might be noted here that the greater the expanse of glass the greater is the cost of heating and danger of breakage.

For large areas covered by one-storey buildings, where a great amount of light is needed, what is known as "saw-tooth" roof construction has come into great favor. It is a series of trusses with one side vertical or slightly inclined and glazed, and the other side covered with roofing. Ketchum in his "Steel Mill Buildings" devotes a dozen pages to this style of roof construction. It should not seem necessary to admonish the designer that the glazed portion of such roof should face the north.

The question of heating is not within the province of this article. Suffice it to say that there are many systems of heating—a common one being the forcing of fresh air over heated pipes in a cast iron case and from thence distributed through conductors into various parts of the building. This system has the advantage of combing ventilation with heating.

Ventilation

The design of the building should provide for proper ventilation. The ventilating area required varies from ½ to 8 sq. ft. for every 100 sq. ft. of floor area, according to the uses of the building. When ventilation is the prime factor, little or no light being required, swinging shutters or fixed louvres, generally made of sheet metal, are used in the sides of the monitor in place of sash. Continuous rows of sash or shutters are sometimes placed in the sides of buildings, but more commonly ventilation from the sides is secured by the windows.

The steel sash people make their sash so that certain portions can swing on pivots. An operating device will enable the whole system of pivoted sash, whether in the sides of the monitor or in the sides of the building, to be easily controlled from the floor. A number of makes of tubular ventilators of galvanized steel are on the market. They give excellent service and can be placed on the roof where needed—the ridge being naturally the appropriate place. Ventilation is also secured artificially by forcing air through conductors by means of fans and blowers.

Important points to be considered in the choice of a roof covering are the uses to which the building is to be put, the roof pitch, the possibility of fire, the climatic conditions, the presence of gases, the appearance of the finished building, permanence and cost. The list of roof coverings is a long one; sheet metal, slate, tar and gravel on plank, tile, hyrib, tin, together with composition roofing of many kinds, are all familiar forms. Each has advantages for certain conditions.

Corrugated steel, either painted or galvanized, is a cheap covering and can easily be renewed when necessary. It is much used for sheds, car barns, rolling mills, and similar structures. It is laid on channel or angle purlins spaced to fit the sheets. The sheets most in use are 7, 8 and 9 ft. long. When laid each sheet should be supported at the centre as well as at the ends by a purlin. The standard laps are 6 in. for the ends of sheets and one and one-half corrugations for the sides. The best pitch for a corrugated steel roof is 6 in. to the foot. Five inches to the foot will answer, but when less than 4 in. the roof is liable to leak during a shower accompanied by a high wind, the water being pushed up between the end laps of the covering. A greater lap than 6 in. will partly remedy this trouble but will not do away with it altogether.

Preventing Condensation

When the temperature of the room inside is considerably higher than that of the air outside, condensation will take place on the under side of the corrugated steel and drip on the floor below. In such cases other covering should be used or sheathing placed under the corrugated steel. An "anti-condensation" lining under the sheets is sometimes used; it is made of one or two layers of asbestos paper and one or two layers of tar paper, resting upon galvanized wire netting attached to one eave purlin and stretched over the ridge to the other eave purlin.

In buildings for export to warm climate there is a feeling against the use of corrugated steel. In a tropical climate its deterioration is rapid. This may be retarded by galvanizing but can not be prevented entirely. It is much the same when subject to the action of certain gases. For this reason corrugated iron may be called for, although it is more expensive and often difficult to procure. In a copper refining plant near Bayonne, N.J., the corrugated steel roof and sides of a building had to be renewed 18 months after it was finished. Another building near by, erected at the same time and subject to the same uses, with roof and siding of corrugated iron, is still doing good service after eight years of use.

Slate laid on plank is a favorite covering. Its first cost is high, but it is lasting, is not affected by gases, and seldom needs repairs. A normal pitch is 7 in. to the foot, though 6 in. is frequently used. For low pitches—4 in. or less to the foot—the same trouble with leaks as with corrugated steel will be experienced, but it will be intensified by the greater number of laps. Slaters' cement for the laps is a salve, not a cure.

Tar and gravel on plank sheathing have been used for many years when the pitch is from ½ to 2 in. to the foot. For a greater pitch than this the covering will wash off during a hard rain with the result that the roof will leak.

The fire-resisting qualities of reinforced concrete are causing it to come more and more into favor. It can be used for any pitch and adapted to any waterproof covering.

It is highly important that the choice of covering be adapted to the pitch of the roof or vice versa. The lack of this adaptation is a prolific cause of leaky roofs, and a leaky roof not only entails expense for repairs but, what is sometimes more serious, damage to stock or machinery.

Sides

The siding for mill buildings varies, though not through as wide a range as the roofing. If corrugated steel is used for the roof, the sides are often made of the same material, though of lighter weight. If No. 20 gage is used for the roof, No. 22 can be used for the sides. Less than No. 22 should not be used for roofs nor less than No. 24 for siding.

To the common construction of brick walls between steel columns but little objection can be raised. There should be steel lintels over window and door openings unless the openings are narrow, when brick arches will answer. If the sides are thin curtain walls, the lintels should extend from column to column and be designed to carry the wall above. They thus act as struts between the columns as well as beams. In the buildings of the Ambridge plant of the American Bridge Company, the side walls throughout are of concrete 8 to 12 in. thick. The walls are carried by the steel columns.

No one kind of floor is adapted for universal use. For rolling mills, forge shops or foundries, which have only a ground floor, earth well tamped will generally answer. Sometimes the ground floor is made of brick or cement. For the floors of machine shops, mills and factories a common practice is to use yellow pine planks with a wearing surface of 1 in. hard maple. Buckle plates covered with concrete with a cement finish, steel trough floors, corrugated steel arches and concrete, checkered steel plates, reinforced concrete, and a number of patented floors are all in more or less use, though mostly for upper floors.

Roof Loads

The loads for which the steel portion of a roof is ordinarily designed are the weight of the structure itself, called the dead load, the snow load and the wind load. The dead load includes the weight of the steel truss, the purlins, roof covering, bracing, and any other loads which are permanently a part of the roof. This load varies from 5 or 6 lb. per square foot for the lightest kind of corrugated steel roofs to 30 or 40 lb. per square foot for concrete roofs. The snow load varies according to locality. Fresh fallen snow weighs from 5 to 12 lb. per cubic foot. A load of 20 lb. per square foot is ample provision for snow load on roofs in the latitude of New York.

The wind load may be assumed equivalent to a pressure of 20 lb. per square foot. It is good practice, though not universally adopted, to assume for roof trusses a combined dead, snow, and wind load per square foot of exposed surface, applied vertically. Schneider's "General Specifications for Structural Work of Buildings" follows this method and recommends that for ordinary roofs up to 80-ft. span, in climates corresponding to that of New York, the following loads per square foot be used:

	Lb.
Gravel or composition roofing on boards, flat slope, 1 to 6, or less	50
Gravel or composition roofing on boards, steep slope, more than 1 to 6	45
Gravel or composition roofing on 3-in. flat tile or cinder concrete	60
Corrugated sheeting on boards or purlins	40
Slate on boards or purlins	50
Slate on 3-in. flat tile or cinder concrete	65
Tile on steel purlins	55
Glass	45

In tropical climates, where there is no snow, the above loads may be reduced 10 lb. In some parts of New England and the Northwest where there are unusually heavy snows the loads should be increased. The reader acquainted with the text books and taught that the wind acts normal to the roof surface and that the stresses in members differ according to their location on the windward or leeward side will at once question the right to consider the wind acting vertically along with the dead and snow loads. The answer is that the error, if there be any, is negligible.

It is needless to make a separate calculation for each kind of load and each case of wind loading. The reader can easily prove this for himself. Assume a wall-bearing roof truss of the Fink type, say of 60-ft. span, a pitch of 6 in. to the foot, and trusses 16 ft. apart. Of the 40-lb. per square foot load, let 20 lb. be the wind load and 20 lb. the dead and snow load. Using the graphical method proceed as follows:

Graphical Method

(1) Make a stress diagram for the 20-lb. dead and snow load, the loads being concentrated at panel points of the top chord and acting vertically;

(2) Make a stress diagram for a wind pressure of 20 lb. on one side and normal to the surface, the loads being concentrated at the top chord panel points of one side and the truss considered to have both ends fixed;

(3) Make a stress diagram for the same wind pressure, considering the end on the truss on the windward side to be fixed and the end of the leeward side to be free or on rollers;

(4) Make a stress diagram for the same wind pressure, considering the windward side of the truss to have a roller end and the leeward side a fixed end;

(5) Show on a diagram of the truss the stresses due to a vertical load of 40 lb. per square foot of ex-

posed surface. These stresses are double those found in (1).

By a comparison of the algebraic sum of stresses found under (1) and either (2), (3) or (4) with (5) it will readily be seen that the differences do not affect the size of a single member.

Shafting is sometimes carried by the lower chords of the roof trusses. This causes stresses indeterminate in amount, but if the shafting is light a stiff lower chord made of two channels or plates and angles will provide for it. If the shafting is heavy the whole truss should be strengthened by adding 10 lb. per square foot to the assumed roof load and using a stiff lower chord. Sometimes a given load is to be lifted from any point of the lower chord, or it is to carry a monorail or light crane. These loads are all definite in amount and stresses due to them can be easily calculated.

Floor Loads

The dead load of the floor, consisting of the weight of the steel supports and the materials composing the floor proper, varies between wide limits—from 20 lb. per square foot to 80 lb. and more, according to the floor construction. The live load which should be used varies, according to the uses of the room, from 60 lb. per square foot for the floors of pattern and template shops to 600 or even 1,000 lb. per square foot for the charging floors of cupola rooms. Machine shop floors, owing to vibration of machines and the liability of concentrated loads, should be calculated to carry from 150 lb. per square foot when the machinery is light to 300 lb. per square foot when it is heavy.

For floors of factory buildings, with machines as close together as they can be placed, the live load should seldom be assumed less than 200 lb. per square foot. For heavy work it may be more. The weights of particularly heavy machines should be determined, and ample provision made for carrying them. Note should be made if stock or materials are to be heaped upon the floor in any considerable quantity. In speaking of floor loads the non-technical man generally means the live load and not the combined live and dead. There should be no misunderstanding with the owner on this point.

Crane and Special Loads

The travelling crane is an important feature of the modern mill building. Hand power cranes are occosionally used, but the vast majority of travelling cranes are electrically driven. Travelling cranes vary in their lifting capacity from 3 to 5 tons, used in light machine shops, to 150 and 175 tons, used in locomotive shops and steel-furnace buildings. Probably more cranes of 10-ton than of any other capacity are used. Up to about 60 tons capacity they are generally carried on a two-wheel truck at each end with a wheel base of 8 to 12 feet.

Cranes of 60 to 120 tons capacity should be carried on a four-wheel truck at each end, while the trucks for 150-ton cranes should have eight wheels. It is difficult to procure rails or design girders that will properly withstand the great concentrated loads that come from too few wheels. For this reason preference should be given to the crane having the greater number of wheels under the trucks. The maximum loads that can come upon the wheels should be obtained from the crane maker. If the make of crane has not been decided upon, the loads given in published tables may be used. The wheel bases and maximum wheel loads of standard cranes, with the exception of those of one maker, vary but little. It is the custom to add 25 per cent. to the maximum wheel loads for impact, as the crane is a moving load and is liable to be started quickly or brought to a sudden stop.

In addition to the vertical loads the girders or runway of a travelling crane should be designed for lateral stiffness. The neglect of this has been the cause of failure of more than one crane runway. The lateral load may be assumed to be 20 per cent. of the transverse moving load—one-half at each end of the crane divided equally between the truck wheels. This assumes that double flange wheels are used on one side. The owner may request that a crane runway be designed to carry a heavy load for a given distance from one end and a lighter load for the remaining portion. A design of this kind should not be drawn, or, either through ignorance or intention, the heavy load will sometimes be brought on the portion designed for the light load. The blame for any disaster invariably falls upon the designer.

Jib cranes are attached to roof trusses, to floor beams, and to columns. The horizontal force in any position of the boom should be analyzed. In a power plant the question of coal storage should be taken into consideration and bunkers or bins designed where required. Heavy economizers may be carried on the floor of the boiler room, and dynamos on the floor of the engine room. Many buildings carry special loads peculiar to the trade for which they are built—in cement mills are storage bins and in smelting plants are ore bins. The character of loading should be obtained.

Unit Stresses

With the external loads given, the internal stresses in the supporting members of a structure can generally be determined. Some members have direct stresses, others bending stresses, and others a combination of both. In proportioning members the following may be assumed as unit or working stresses in pounds per square inch for open hearth medium steel generally used for mill buildings:

Tension, net section	16,000
Bending on extreme fibers of rolled shapes and riveted girders	16,000
Shear on plate girder webs (net section)	10,000
Shear on rivets (shop)	12,000
Shear on rivets (field) and bolts	10,000
Bearing pressure on rivets (shop)	24,000
Bearing pressure on rivets (field) and bolts	20,000

(To be concluded)

Mr. Chas. S. Cobb has been awarded first prize in the competition for the design for the new registry office building at Toronto. Mr. Cobb will receive $1,000 as winner of the first prize and the terms of the competition provide for his inspection of the erection of the building. Second and third prizes of $600 and $400 respectively go to Messrs. Chapman & McGiffin and Messrs. Symonds & Rae. The assessors were Messrs. A. R. Denison, C. H. C. Wright and R. H. Bowes.

Over two million concrete blocks have been used so far in the new $10,000,000 plant of the Minnesota Steel Company, at New Duluth, Minn. The company is now about to start the construction of two hundred concrete block houses and sixty-five apartment buildings, each to accommodate six families. The plans, which have been prepared by Dean & Dean, architects, Chicago, call for block walls and monolithic floors.

Railroad Practice in the Construction of Sewers and Drains

Committee Report, American Railway and Bridge Association

AT the twenty-third annual convention of the American Railway and Bridge Association, held in Montreal last month and reported in our issue of October 29th, a number of valuable reports were presented by the various committees. Perhaps the most interesting of these, from the viewpoint of many readers of this journal, was that relating to sewers and drains. This contained much excellent information likely to be of value in practice. Following is the report:—

Report of Committee

Sewers, as referred to in this subject, are intended to carry the excremated matter from railroad buildings to the main sewer, stream or cess-pool. The necessity for prompt and complete removal of sewage from the building and its disposal in a way the least offensive and injurious to health is a matter well worth consideration.

Drains are used in connection with railroads for carrying off surplus water from buildings and pits, and are simpler in construction than sewers. Ordinarily they do not require tight joints and traps, and they are often built of wood or common drain tile; but the larger sizes are usually built of sewer tile.

In order to enable the committee to submit a report on this subject, letters of inquiry were sent to several officials of the various railroads throughout the country and answers were received to about twenty per cent. of the letters, which indicates quite a bit of interest on the part of our members to assist in our work, for which we take this opportunity to thank all contributors.

After careful consideration as to the practice, experience and opinions of our contributors, we offer the following as a progress report, hoping that the few points touched upon in this paper will bring forth sufficient written matter and oral discussion to make the subject worthy of publication in our proceedings.

Material.—For sewers cast iron pipe or vitrified sewer tile is recommended, as the conditions may require. Cast iron soil pipe should be of standard weight free from flaws, cracks, air bubbles or other imperfections, and it should be tested to 50 lbs. water pressure previous to tarring.

Vitrified sewer tile should be of standard thickness, good quality, salt glazed and well burnt throughout its thickness; impervious to moisture, smooth and well glazed on exterior and interior surfaces, free from cracks, flaws, blisters, fire checks and other imperfections.

For drains, cast iron soil pipe or common sewer tile may be used, according to the local conditions.

General Considerations.—Sewers and drains should be carefully studied, surveyed and mapped out, both for greater accuracy of work and for location of the line afterwards. Particular stress is laid upon the importance of the grades, to avoid dips or depressions in the line which might work mischief with the system.

The area of the trunk or main sewer should be equal to the area of all intermediate connections, allowing for difference in velocity of flow. The following table will give the approximate carrying capacity of different sizes of drain pipe, in U. S. gallons per minute, for grades varying from one inch to 36 inches fall in 100 ft.

Fall per 100 ft.		Diameter of pipe in inches								
Inches		3	4	6	9	10	12	15	18	24
1	Gals.	13	27	75	205	267	422	740	1,168	2,396
2	"	19	38	105	290	378	596	1,021	1,651	3,387
3	"	23	47	129	355	463	730	1,282	2,022	4,152
6	"	32	66	183	503	655	1,033	1,818	2,860	5,871
9	"	40	81	224	617	803	1,273	2,224	3,508	7,202
12	"	46	93	258	711	926	1,468	2,464	4,045	8,303
24	"	64	131	364	1,006	1,310	2,076	3,617	5,704	11,744
36	"	79	163	450	1,240	1,543	2,554	4,467	7,047	14,466

Angles in sewers and drains should never be used where it is practicable to do without them. Under ordinary conditions, where it is absolutely necessary to make an angle in a pipe line, long radius bends should be used, on account of less interruption to the flow. Where it is necessary to provide cleanout basins in a pipe line they may be made to act as the turn. Where the angle is greater than 45 degrees, brick or concrete turns, with a cleanout basin, should be used.

Where necessary, traps should be placed in the pipe line and a hand hold should be provided in the pipe line near each trap, so that the trap can be cleaned or raked. The trap alone offers some resistance to the flow, and where a hand hole is made in the trap it adds another probability of obstruction.

Drains should be provided with a screen or grating at the inlet to keep sticks and rubbish from entering. Where dirt, sand, boiler washings and other sediments are liable to enter, a large catch basin should be constructed as near as possible to the inlet end. In this materials may settle and may be removed, from time to time. If the water carries a fine silt and the drain is of considerable length, other smaller catch basins should be placed in the line, for the same purpose as the larger one. The large basin should have a depth of at least three feet and the smaller ones two feet, below the line of the drain.

When a pipe line is laid in soft earth or in a marsh, it is often necessary to provide a foundation to keep the pipe from settling. We find various methods used, namely: the use of piling, cinders, a concrete base, timbers cross laid, wooden trestles, wooden cradles, and concrete cradles, all of which can be used advantageously. Matters of this kind are decided largely with respect to the material locally obtainable.

Where a drain or sewer is laid by contract, frequent inspection of the work should be made during construction to see that specifications are being carried out, and, where necessary, a regular inspector should be assigned to the work. It is a very difficult and expensive matter to locate a defect in a pipe line after it has been laid and covered.

Where water pressure is obtainable pipe lines may be given a pressure test after laying and before they are covered up. A pipe line may also be tested with air or smoke.

Laying.—Where sewer pipe is laid under buildings or under granatoid or cement sidewalks or platforms, or under tracks, it should be of cast iron; otherwise it might be of best quality, salt-glazed, vitreous terra cotta. All cast iron pipes should be neatly and snugly fitted together, the joints being well caulked with picked oakum and molten soft pig lead, using 12 oz. of lead for each inch of diameter of pipe in which joints are made. No cement or putty joints should be permitted, and wherever connections are made they must be laid with "Y" branches, long curves and one-eighth bends.

Vitrified sewer tile should be laid with joints closely fitted together in such manner that there will be no shoulder or lack of uniformity of surface on the interior of the drain. Each joint should be wiped clean of mortar on the inside before another joint of pipe is laid. The joints should be well cemented together with a mixture of one part Portland tested cement and two parts of clean sharp sand. The cement should be pressed into the space between the socket and spigot so as to fill it completely. After cementing the joints together care must be taken not to disturb the pipe.

In laying common sewer tile for drains we recommend cementing the joints the same as in laying sewer pipe.

APPENDIX

We submit herewith a copy of the circular letter of inquiry sent out, together with extracts from some of the replies received, omitting such matter from some of the replies received as would repeat data or information contained in others.

Circular Letter of Inquiry

1. Do you recommend the use of sewer tile, or cast iron soil pipe?

2. Where possible to obtain the desired fall, what grade do you give the pipe per 100 ft. in length

3. Do you make any allowance in the size of sewers or drains to take care of intermediate connections?

4. Where you have angles in the sewer or drain, do you recommended or use elbows, long bends, increasing bends, crosses or brick turns? If so, state reasons for use of recommendations.

5. Where it is necessary to have trap in pipe line, do you use or recommend the use of clean-out traps? If so please give reasons.

6. In laying drain where foreign matter is likely to enter and choke the pipe, do you make any provision to guard against such? What are your methods?

7. Where you lay drain or sewer tile in soft earth or marsh, what method do you use to prevent pipe from settling and forming pockets in the line?

8. Where sewer or drain pipe is laid by contract, do you place an inspector on the work during construction, or make inspection after the line is completed?

9. After laying a sewer or drain, do you make a test of any sort to locate defects in the line? If so, give your method of testing.

10. In laying cast iron sewer or drain, do you find it necessary to completely fill the bell joint with packing and lead?

11. What do you use for packing pipe joints before leading?

12. What portion of the bell joint of the pipe do you fill with packing?

EXTRACTS FROM LETTERS RECEIVED

E. B. Ashby, Chief Engineer, Lehigh Valley R. R.:

1. Cast iron where subject to heavy pressure; elsewhere sewer tile.
2. Grade not less than six inches in 100 feet.
3. We make allowance for intermediate connections.
4. Long bends to prevent reduction of flow.
5. Yes.
6. Frequently use large wire mesh at entrance.
7. Sometimes lay on planks or make cradles of stone.
8. Try to inspect as work progresses.
9. Not unless flow is restricted.
10. No.
11. Usually use a clay if anything.
12. Generally none.

J. Dupree, Superintendent Water Department, Chicago, Terre Haute & South-Eastern Ry.:

1. In soft earth I use cast iron pipe; elsewhere sewer tile.

2. I increase size of main at intermediate connections.

3. Grade 2½ to 3 inches per 100 feet.

4. Where practicable I use brick turns. My reasons are that I can start at any angle from a brick turn, and use this turn as a catch basin. Elbows and long bends will stop up.

5. Where necessary to use trap in pipe line, I always use cleanout trap.

6. Where an unusual amount of foreign matter exists I make use of catch basin; also use a screen and clean out the catch basin when necessary.

9. I hardly believe it necessary to make a test if the line is laid according to specifications.

10. In laying cast iron sewer or drain it is not necessary to completely fill bell joints with lead and packing where there is a good foundation. With sewer tile I fill the joints with cement or mortar.

12. The bell joints of soil pipe are about 3 inches deep, and if the earth or marsh is very soft I use 1½ inches of lead. Where I have clay or solid earth for the line I use only one inch of lead and caulk. Care must be taken in caulking cast iron soil pipe, as it is very easily broken.

C. R. Knowles, General Foreman Water Works, Illinois Central R. R.:

1. Specifications for sewer tile should specify tile to be constructed of standard thickness, good quality of vitrified pipe, salt glazed and well burned throughout its thickness, impervious to moisture, of smooth and well glazed exterior and interior surfaces, free from cracks, flaws, blisters, fire checks, and other imperfactions. Pipe to be laid in trenches fifteen feet deep, or deeper should be extra strong.

2. Area of trunk or main sewer should be equal to the area of all intermediate connections, of course allowing for difference in velocity of flow.

3. Pipe should be allowed a minimum fall of two inches per 100 feet.

4. Long bends are more desirable on account of less interruptions to flow, than elbows or right angle short bends, except where a brick turn is made, which may be made to act as a cleanout basin.

7. In laying a drain or sewer in soft earth or marsh, the bottom of the trench should be floored and the trenches should be kept free from water. No sewer should be laid in water.

10. If conditions are severe enough to justify the use of cast iron pipe, the joints should be entirely filled with jute and lead and caulked as in laying water pipe.

11. Jute or oakum for cast iron pipe.

12. Joints should be filled in the same manner as in laying water pipe, when cast iron pipe is used, leaving 1½ inches for the lead.

Cement for Joints.—A good mortar for cementing the joints of sewer pipe should be made of a mixture of one part Portland cement and two parts clean sand. This will also answer for cementing joints in cast iron pipe when not subject to pressure or strain.

Joints.—The cement should be pressed into the space between the socket and spigot so as to fill it completely, and a level joint at the end of socket should be made. After a joint is completed care should be taken not to disturb the pipe.

Moses Burpee, Chief Engineer, Bangor & Aroostook R. R.:

1. Either sewer tile or cast iron pipe, according to circumstances.

2. I think not less than 1 per cent.; more is better.

7. I recommend in soft ground to lay cast iron pipe with the ends resting on posts driven firmly into the subsoil, if not too deep. If the latter, wrought iron pipe laid on a cradle or planks.

8. I think inspection after laying and a severe test, with guarantee of contractor, the best.

I. O. Walker, Assistant Engineer, Nashville, Chattanooga & St. Louis Ry.:

6. Where sewers drain turntables and engine pits, my personal practice is to put some kind of netting over the inlet so that only the very finest matter can pass into the drain. This is very necessary at such places, because engine wipers invariably drop waste, which, I believe, is the worst thing that can get into a drain.

A. M. Griffin, Architect, Nashville, Chattanooga & St. Louis Railway:

6. I construct catch basins with removable cast iron top at intermediate points, with the bottom about 12 inches below the flow line of the sewer.

7. We use cinders on a concrete base.

8. Where the ditch can be left open we usually make inspection after completion, but otherwise use an inspector.

9. We use a water test of 25 lbs. on cast or wrought pipe work, but on sewer tile we make no test.

R. J. Bruce, Superintendent of Buildings, Missouri Pacific Ry.:

7. I would prevent pipe from settling and forming pockets in the line by either removing the sand or marshy earth or by putting timber under the line to hold it in surface.

10. Where cast iron pipe is laid I would use lead the same as for water pressure.

11. Would jute to bell then lead.

12. Jute to lead recess.

Where a pipe line comes near the surface of a driveway cast iron pipe should be used to avoid breakage. It is good practice in installing a sewer line 12 inches in diameter and up, to provide manholes at all points where change in direction is more than 45 degrees. The character of sewage that is to be taken care of should regulate the distance between manholes, and where much paper or rubbish finds its way into the sewer the outlet pipe at the manhole should be provided with a suitable strainer.

C. H. Fake, Chief Engineer, Mississippi River & Bonne Terre Railway:

7. Have not had any experience in such places, but think I would try laying the pipe on a bed of cinders.

8. An inspector on the job, and he must not be off or get off of it while the men are at work.

9. No, unless city ordinance requires a test and then it is made to conform to ordinance.

W. H. Courtenay, Chief Engineer, Louisville & Nashville R. R.:

1. We ordinarily use cast iron pipe under buildings, platforms, and other places where the pipe would be difficult of access in case of breakage or other trouble.

7. Wooden trestles, wooden cradles, concrete cradles.

8. Generally an inspector, sometimes an inspector and final inspection.

9. Not ordinarily. In buildings we usually specify that the drain shall be stopped at the lower end and filled with water to the roof line.

C. A. Lichty, Inspector, Chicago & Northwestern Ry.:

1. With perhaps few exceptions, ordinary vitrified bell jointed sewer pipe with cemented joints will answer for railroad sewers, unless the sewage has to be disposed of under pressure to a higher level, in which case cast iron pipe might have to be employed.

2. Sewers should have no less than two and one-half inches fall per 100 ft., and more if it can be obtained.

4. Where a bend or sharp turn occurs in the line, a manhole should be constructed; this will permit of the free use of sewer rods or chains when it becomes necessary.

7. Where pipes are laid in soft ground or marshes it is often necessary to support them on a layer of boards or planks and in special cases it may become necessary to support this layer of wood on posts or cross-timbers.

8. To insure good results sewer work should receive careful inspection during construction.

9. It is poor policy to try to correct defects after a sewer has been built, and careful inspection of the work should be insisted upon during construction.

Extensive Improvements at London, Ont.

At London, Ont., the citizens have authorized the issue of debentures for an amount of $400,000 for storm-water drainage construction, also $25,000 for a length of reinforced concrete faced river embankment.

Plans for these proposals are in skeleton form and working plans will be completed during the winter months with a view to letting contracts and starting construction at the beginning of next spring. The storm-water proposals will probably be spread over four years, with an annual expenditure in the vicinity of $100,000. This also means the commencement of an extensive paving programme for the city, which is badly needed.

Proposals are now in hand for starting the laying of two and one-half miles of asphalt paving, to be carried out next season. Several sections of brick paving will also be laid.

A $75,000 extension of the existing sanitary system with a disposal plant for the eastern district, where extensive factories are locating, will be considered this winter and work commenced next year.

Mr. Willis Chipman, of Toronto, is the consulting engineer for the above work, which will be carried out under the supervision of Mr. W. N. Ashplant, the City Engineer.

In all probability tenders for the supply of ironwork, gulley gratings, manhole covers, etc., in quantity, will be called for early in the year.

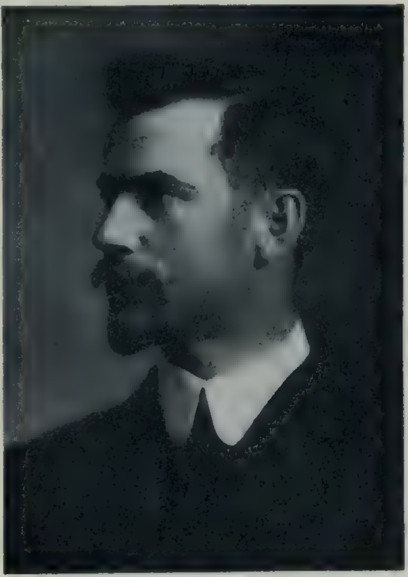
Montreal Builders' Exchange

The opening luncheon in connection with the Montreal Builders' Exchange was held in Cooper's Restaurant on October 29, with Mr. W. Rutherford as chairman. The Quebec Provincial Lien Law was discussed, Mr. J. L. Perron, K.C., M.P.P., being the principal speaker. Messrs. M. Beullac, Gilday, Stinson, T. P. Howard, Col. Smart, and J. Ballantyne took part in the discussion. Complaint was made that, to secure the benefit of the law, supply houses had to notify the proprietors of their having supplied goods to contractors. The result was that firms were placed in a very delicate position, and the law was practically in abeyance. This had resulted in losses to the supply firms. An amendment of the law was said to be urgently needed, and it was suggested that the proprietors should be held responsible for the supplies to a contractor, or that a contractor should take out a guarantee with a company guaranteeing the payment of the account. The discussion was adjourned.

Engineering as a Profession

An Address by Walter J. Francis, of Montreal, before the Engineering Society of the University of Toronto

ENGINEERING is so material, so practical, and so engrossing that it is very difficult to talk about it in the abstract. Moreover, the engineer is known as a man who does things—and one who is doing things is too busy to talk. You will therefore appreciate the greater difficulty experienced by one who is supposed to be an engineer talking in the abstract on such a subject as engineering.



Mr. Walter J. Francis*

In order that we may have some appreciation of the subject it is necessary for us to arrive at some definite understanding of the two words "engineering" and "profession," although I cannot promise you that these definitions will entirely sweep away the mist. We all have our ideas what a profession is and yet it might be very difficult for us to name many professions, and, having named them, to state the reasons why they are professions. Probably the first professions that would come to our mind would be law, medicine and theology. Later we should add pedagogy, dentistry, architecture, and surveying. Some even might go so far as to add engineering. The predominating characteristic of all these callings is their protection by law and their recognition as lawfully constituted bodies by the powers that be and by the people themselves. The distinguishing feature of a profession is that it requires its members to have special training and to perform mental rather than physical labor. Custom has decreed that an individual member must earn his livelihood by his chosen profession. The representative society or societies of each profession have a written or an unwritten code of ethics. This code requires, amongst other things, that the remuneration received by a member for his services shall not be in any way contingent upon the result of his work; in other words, the professional man may not share in the profits. Thus, a lawyer may not, theoretically at least, accept a case on the understanding that he will be recompensed only in event of a victory over the opposing party, or a doctor may not perform an operation on the understanding that his fee will be greater if his patient should live than it would be if he should die. Further, the law recognises, more or less, certain fees that must be paid in court for the services of certain professional men—the surveyor, for example. You will doubtless be pleased to learn that the law allows a surveyor six dollars a day for attendance at court, while engineers and other ordinary mortals receive one-dollar-and-a-quarter as an emolument for such service. The standing of the professions in the popular mind is due largely to the character, ability and dignity of the men engaged therein. The societies representing the professions are the result of the interest that the leaders of the professions have taken in order that the professions may be recognised as such by the world at large.

Generally speaking, a man is no longer considered a member of a profession when he ceases to earn his livelihood by the practice of the profession. A dentist leaving his calling to become a vendor of real estate is no longer considered a dentist, although he has had his training and may still be holding his diploma. A doctor may have received all his degrees and may have practised for decades, but let him devote his energies to commercially exploiting, say, some well-tried prescription and the medical profession no longer recognises him as a member. And so we see that the connection of earning that which is needful to purchase food, clothing and the necessities of life is intimately connected with the recognition of a person as a member of a profession. So much for the meaning of the word profession. Later I shall return to the application of the term to engineering as a calling.

It is much more difficult to define engineering. What is an engineer? I confess I have been trying for twenty-five years to find out—and I am still trying. I remember two boys, now both on the list of graduates of this University, arguing about whether a civil engineer should know all about a locomotive or not. One thought he should. I didn't know. The other fellow is now practising surveying. Once I heard a judge of the Supreme Court of the United States struggle with the definition of an engineer in a brilliant twenty-minute speech, and he wound up by concluding that he didn't know anything definite about engineers excepting that they were jolly good fellows. In the daily press we often read of engineers, but before we get through the description we are fully aware that the person referred to drove locomotive No. 522 between two given stations at seventy miles an hour, or that he was the man who turned the throttle valve of the engine in the hold of the excursion boat.

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*Mr. Walter J. Francis, C.E., Montreal, was born at Toronto in 1872 and is an honour graduate of the School of Practical Science. One of the earliest positions that he held was assistant engineer in charge of the design and construction of the Toronto Union Station, which cost seven million dollars. He was engaged by the Department of Railways and Canals to design the 65-foot hydraulic lift lock on the Trent Canal at Peterborough, a position which developed into that of principal assistant to the chief engineer of the Canal and included the design and construction of the Kirkfield lift locks. For a description of the hydraulic lift locks Mr. Francis was awarded, in 1906, the Gzowski medal of the Canadian Society of Civil Engineers. In 1907, after carrying out many important enterprises, Mr. Francis went into consulting practice. Since then he has been identified with many important engineering works throughout the country. In 1908 he was engineer to the Royal Commission of enquiry into the Quebec Bridge disaster. In 1909, among other things he made a report on a two-million-dollar hydro-electric proposition on the North Saskatchewan River, near Edmonton. In 1910 he reported on the public utilities of the city of Edmonton, Alta., and made examinations and reports in connection with the Herald Building disaster (Montreal) and other important matters. One of his most recent undertakings is the Moose Jaw water supply. He has been engaged on the water supply problems of the city of Winnipeg and has made an exhaustive report on hydro-electric development on the Ottawa River. He represented the Canadian Society of Civil Engineers on the committee which undertook the revision of the Montreal building code. Mr. Francis is a member of The Canadian Society of Civil Engineers, The Institution of Civil Engineers (England) and other professional bodies.

The term "engineer" is very much overworked. It is not surprising that the great public gets confused in the multiplicity of engineers that are sometimes referred to. There engineer, the publicity engineer, the mining engineer, the chemical engineer, the structural engineer, the bridge engineer, the elevator engineer, the harbour engineer, the stationary engineer, the government engineer, the city engineer, the town engineer, the tunnel engineer, the county engineer, the marine engineer, the railway engineer and the consulting engineer.

Mr. Dunn, President of the American Institute of Electrical Engineers, in Boston, last year, referred to twenty-seven recognised classes of engineers, and I understand that someone of a statistical turn of mind has succeeded in isolating over one hundred and ten separate and distinct varieties of the bacterium, "engineericus universalis." Is it any wonder the public gets confused?

The Engineer in the Background

Compared with the professional men of law, medicine and theology, the engineer never comes to the attention of the public as a learned man doing things. Let a man be a member of one of the other professions and as soon as he begins to accomplish things he will be heard of. Let the geologist make a speech on his chosen subject and the newspapers of the land will blaze forth with startling headlines that Professor Geologus has unlocked the great secrets which Mother Earth has hidden in her bosom for millions of years. Professor Haultain accounts for this by the fact that the geologist takes time to tell the people what he is doing and what he thinks he has discovered. Let the lawyer defend some celebrity, whether famous or notorious, and before many hours the whole world will know it and will be gazing upon indifferent pictures of that lawyer. I think I am safe in saying that the engineer may devote his life to the service of the world, and die doing his duty, and yet never be heard of during his career, unless he unfortunately makes an error in judgment. I venture to suggest that the Quebec Bridge was more widely known by its failure than it or any other bridge will be in its success. I do not know that the engineer cares particularly about publicity, for he is too busy doing things. I am referring now only to the recognition or non-recognition of his professional existence by the great public. Anyway, he is too busy doing things to stop for the sake of publicity. One of the powers that the engineer under-rates is the power of the press. Summing up, it would appear that the public has, at the best, a very hazy idea of what engineering is. Every engine-runner of the country is an engineer, no matter whether he operate a locomotive or a threshing engine. Even the plumbers try to play on the title and have in our own country succeeded in getting an association incorporated under the name of The Canadian Society of Sanitary Engineers. All respect to the man who can wipe joints and collect his bills of world-famous magnitude, but it looks very much like trespassing on the dignity of the name of the great recognised engineering body of Canada, The Canadian Society of Civil Engineers. It is, indeed, a most fortunate thing that the motorman does not term himself a street car engineer, that the chauffeur does not call himself an automobile engineer, and that the aviator does not wish to be known as a monoplane or biplane engineer. I was just wondering, if the analogy were carried on, what the man would call himself who runs a wheel-barrow.

In every country there are recognised engineering societies having for their object the betterment of the profession and the uplifting of its members, all of whom are required to have certain pre-requisites of training and experience. In Canada there is The Canadian Society of Civil Engineers; in Great Britain, The Institution of Civil Engineers. In the United States The American Society of Civil Engineers takes a corresponding place, with, however, the addition of very strong societies known as the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers. We have in Canada, also, The Mining Institute of Canada. In the constitution of The Canadian Society of Civil Engineers and of The Institution of Civil Engineers the art of engineering is defined, but so far as I know, no definition is given by the other bodies I have named. The definition used by The Institution is that devised by Tredgold, well nigh a century ago. He calls engineering "the art of directing the great sources of power in nature for the use and convenience of man." The Canadian Society of Civil Engineers has based its definition on the same formula in the words "the profession whereby the great sources of power in nature are converted, adopted and applied for the use and convenience of man." With definitions such as these given us by two of the leading English-speaking engineering organisations, it is not surprising that the public has some difficulty in comprehending what an engineer really is, that is, assuming that these definitions ever reached the public. I think it may fairly be said that you could not be considered much of an engineer when you first learned to overcome the law of gravity and stood on end to direct that great source of power in nature to your use and convenience. It has truly been said that the greatest source of power in nature is the tongue of woman, nevertheless, to your engineering ability could not be applied any other definition than that of "contriving" when you succeeded in getting your mother to persuade your father to buy your first rubber boots. We are told that this definition of Tredgold was primarily intended to distinguish the military engineer from the civil engineer. I think there might be some difficulty in endeavoring to apply Tredgold's definition of a civil engineer to the military engineer because that military engineer would not find it easy to convince his enemy that the cannon balls were for the use and convenience of the said enemy, even if there were any enemy left to argue with. Maybe my lack of soldier enthusiasm prompts the remark. The conflicts for the necessities of life are surely serious enough without adding other struggles blazing with uniforms, glittering with cold steel and reeking with blood. But we must not forget that in the olden days much of what is now known as "public work" was done under the direction of the military authorities who possessed the only complete organization of the time.

"Engineering" Defined

Professor Swain has given, perhaps unconsciously, a definition which, it seems to me, excels all others, where he calls engineering "the application of the laws of nature, the principles of mechanics and materials of construction to the business of the world." It seems to me that in these words we have a definition of engineering in its broadest sense.

This definition brings me right up to the present moment, speaking to you as a body of young men who have entered one of the great engineering schools to learn something of how to apply "the laws of nature, the principles of mechanics, and the materials of construction to the business of the world." You have, I repeat, come to a great institution. Its graduates are to be found everywhere making good. Go from Tyrrell on the north to Laschinger on the south, start with

Lash in Java and encircle the world, and you will find the alumni of Toronto. I myself am proud to be on the same list as Duggan, Stern, Thomson, Wright, Ross, Deacon, Mitchell, Fairbairn, Speller, Angus, Chalmers—I should not have started to name them personally, because I want to name them by the hundreds—an honour list of which everyone should be proud. It has been said of Sir Christopher Wren in St. Paul's, "If you would see his monument look around you." I say to you—and I say it with pleasure in his hearing—if you would see the monument of John Galbraith just look around the world at the engineering alumni of Toronto.

The definition necessarily implies broad-mindedness. You cannot be a good engineer and be narrow-minded. So do not forget that this broad Dominion has other universities, older ones in the Old East and newer ones in the New West. Queens and McGill are great universities. There are many great universities in the States. England has a great number of the highest engineering schools in the world. So has France. Germany was well advanced with engineering training before some of the other countries began to be serious about it.

But your university training will not make you an engineer. It will equip you to become an engineer—if the engineering spirit were born in you. By hard work and the application of the training you will here receive you will, I trust, all become engineers.

Now I have discussed professional standing, and I have discussed engineering, and I have discussed university training. You are now doubtless realizing the difficulties surrounding "engineering as a profession." If you eliminate all those engineers who share in the profits of their labours, you will see that you come down to a comparatively small number of men—small as compared with the number composing the profession of law or medicine. Yet you cannot say that those you have eliminated are not engineers. On the contrary they are engineers in every sense of the word and they are so recognized by all the great national engineering organizations. Many of the leading ship-builders, bridge-builders and contractors are amongst the best engineers of the world and they are occupying the topmost positions of honour in the engineering world.

The idea of a part of the engineers taking a stand shoulder to shoulder with the other professions is growing fast. Already a powerful movement is taking place in this direction, and it is interesting to note here that the indefatigable secretary of the only really professional organization of engineers was a member of the class of 1884. I refer to Eugene W. Stern, Secretary of the American Institute of Consulting Engineers.

Let me, in passing, call your attention to the pre-requisites of membership with these professional engineers. A member must be at least thirty-five years of age, he must be actively engaged in the independent practice of the profession, he must be a full member of one of the great recognized engineering bodies, he must have a high character, he must have attained a degree of eminence in the profession, and he must not be engaged in contracting.

When you come to realize the requirements for admission to any of the great recognized engineering bodies and add to them all the other stipulations I have named, you will see that the standard set up by the American Institute of Consulting Engineers is one of which the engineering world should be proud. The membership is jealously guarded, and, of course, it is not great in numbers. At present I think there are less than seventy. You will be especially interested to know that of these one of every sixteen is a graduate of Toronto. This organization illustrates to some extent the difficulties surrounding "engineering as a profession." One is forced to conclude that "engineering" is too great and too comprehensive ever to be confined within the narrow limits of a "profession" in the same way as law and medicine. As it looks at present we should associate ourselves with the recognized engineering bodies first and, later, if our choice take us in that direction, with the Institute of Consulting Engineers. In the meantime study the work that the Canadian Society of Civil Engineers is doing.

The Engineer a Producer

As I look at the whole question, there are, in this world, two classes of people: the producer and the non-producer, and you will see before I get through that I am somewhat of an optimist. At the bottom of the non-producers I place the real estate men and the speculators. At the top of the producers I place the agriculturist and the engineer. Between these extremes live all the other callings and I shall leave you, each for himself, to place them according as they may in your judgment be producers or non-producers. Under our present social system the agriculturist must come first, because we must have food and clothing. Next in order in the world's progress is the engineer. The Indian in his native state, the Arab with his caravan,—these have no need of the engineer. The farther we get from the primitive the greater the need of those who are able to apply to our use and convenience the great sources of power in nature. The marvellous advance of the last century are engineering advances. The other professions are older than engineering. Art is centuries old, yet it is a question if the art of today is on the same plane as that of Greece and Rome centuries ago. The greatest examples of the work of modern architects are based on the ancient orders, and the advances of architecture in modern times are due to the engineer in introducing steel skeletons and reinforced concrete. In surgery wonderful progress has been made within a lifetime, but the skill of noted surgeons was developed only through the medium of the engineer's handiwork in fine instruments and electrical appliances. The physician heals the sick and deals with individuals, while the engineer holds in his hand the health of towns, cities and nations. The preacher has no particular use for the engineer excepting as illustrations in sermons. The lawyer lives on the engineer's quarrels and on the relations which by its ingenuity he has set up between others. The teacher helps to prepare the embryo engineer for his admission into a cold-blooded world and promptly forgets him in the further pursuit of embryology.

It is the engineer who harnesses the Niagaras of the world to transform the night of our cities into noon-day and to turn the wheels of commerce. It is the engineer who develops the mining and furnishes the metal with which he builds machines that by their ingenuity compel us to stand in awe and admiration. It is the engineer who produces the steel that forms a network of highways over our continents and that makes possible the myriads of floating palaces on our oceans. It is the engineer who has abolished famine and pestilence. It is the engineer who has annihilated distance with his telegraph and his telephone. It is the engineer who has made possible the conquest of the air. It is the engineer who places in the hand of the president of a nation the power whereby he is able with a touch to remove from a point thousands of miles away a barrier of nature separating two oceans. It is the engineer who furnishes the worker in the golden west with the machines whereby millions of bushels of wheat are each year made ready to enter the hopper that the engineer has constructed. It is the engineer who has made the Canada of today what she is.

Mather & Platt turbine pumps, for which The Canadian Allis-Chalmers Company, Toronto, have the exclusive manufacturing rights for Canada, are described in a catalogue, a copy of which has just reached us. These pumps are adapted to widely diverse conditions and are in successful operation in many departments of municipal and industrial use. The applications of the pumps are well illustrated in the catalogue.

Mainly Constructional

The News in Brief—From Coast to Coast

Mr. Le Marquand, president of Starland, Limited, Winnipeg, has concluded an arrangement with P. Turner Bone, of Calgary, involving the erection of a theatre building on a lot at Eighth Ave. and First Street East in Calgary, to cost about $500,000.

Owing to the difficult nature of the foundations for a pumping station for the city of Montreal, the contractor notified his desire to be relieved of further responsibility, and the controllers thereupon arranged with the Foundation Company, Limited, Montreal, to complete the work.

The Ritchie Contracting & Supply Company, Limited, have been awarded a contract to furnish two submarine drill boats of the "Sullivan Type, S V 14" required for deep sea drilling in the proposed government dock excavating at Vancouver under contract to Messrs. MacAfee, Henry & McDonald.

The Barnett, McQueen Company, Limited, of Winnipeg and Fort William, have been awarded contracts for the international storage elevators to be erected at Saskatoon and Fort William, to cost almost one million dollars each. The Barnett McQueen Company was the lowest of four tenderers by nearly three thousand dollars.

Without asking for tenders, the Montreal Board of Control have decided to accept an offer of the Elder Elbano Asphalt Company to supply all the asphalt required for 1914. This will allow the city to start paving work early in the spring. The price is $26 per ton, and in the opinion of the controllers the offer is the best ever made.

Contracts have been given by the Federal Government for the construction of a revetment wall and the building of a stretch of roadway to connect the river road near Laprairie with the new stretch of the King Edward Highway. When this work is done the highway will be complete from St. Lambert to the boundary beyond Lacolle.

Seventy new cottages are in course of construction and will be completed this fall on what is known as inter-city property owned by the Canadian Resources Company, Limited, between Fort William and Port Arthur. The dwellings are being rented as soon as completed at a nominal charge of $15.00 a month; many of them have been spoken for weeks in advance.

In the article relating to constructional operations at Regina published in our issue of October 15th, Messrs. Cotter Bros. were erroneously given as the contractors for the Connaught School. We are informed that the general contractors are The Parsons Construction & Engineering Company, Limited, and that Messrs. Cotter Bros. are the contractors for the plumbing and heating.

Representatives from almost every municipality in the Ottawa Valley attended the first meeting of the Ontario Good Roads Commission held last week at Ottawa. There was general agreement as to the necessity of having a permanent government commission to supervise all road construction, and to investigate and apply successful new methods. The Commission is made up of Mr. C. A. Magrath, chairman; Mr. A. M. Rankin and Mr. W. A. MacLean.

The plans for the new Jubilee Hospital at Victoria, B.C., which had been amended in several particulars by the architect, Mr. Loring P. Rixford, have been finally passed by the directors. The estimated cost, on a basis of 28c per cubic foot of building, and including architect's fees, is $399,840. The new structure will include the following buildings: Administration building, two public ward biuldings, laundry and power house, and service building.

The Thor Iron Works, Limited, of Toronto, have been awarded the contract for the standpipe at Timmins, Ont., by The Canadian Mining and Finance Company, Limited. The standpipe will be 20 feet in diameter and 95 feet high, with a total capacity of 225,000 gallons. Of this capacity, 50,000 gallons will be held as a reserve for fire protection purposes at the top of the standpipe by installing a hemispherical bottom about fifteen feet from the top. The standpipe will be erected before the severe weather begins.

The Amalgamated Engineering Company is reported to be arranging to start work on the drydock and ship-building yards project at North Vancouver within thirty days. They will occupy the eighteen hundred feet of waterfront lying between Fell and McKay avenues. The Amalgamated Engineering Company will be assisted by the Dominion Government by a guarantee of its bonds. The cost of the proposed works is estimated at four million dollars, 99 per cent. of which expenditure will be made in North Vancouver.

Mr. J. D. McArthur, contractor for the Hudson Bay Railway, denies the statement that the railway will not be completed until 1916. He stated that the rails would be laid to Fort Nelson in 1915 and that the line would be in operation by the end of that year. Track-laying this year had proceeded slowly owing to the shortage of ties, but the rails would be laid on the first division this year and 200 miles thereby completed. With regard to the Edmonton, Dunvegan and B. C. Railway, Mr. McArthur said two hundred miles of grading had been accomplished and over one hundred miles of steel laid.

The city council of Victoria, B.C., recently considered a final report on awarding the contracts for various phases of the Sooke waterworks system. The contract for the rivetted steel pipe was tentatively awarded to MacDonald Godson Company, of Vancouver, at $440,000, and it is now understood that Jones & Rant, of Victoria, are preparing to oppose this award. The latter firm's tender was originally $398,000, but this did not comply with the specifications and was rejected. For the concrete flow line the Graff Construction Company, at $308,000, was the lowest, with the Pacific Lock Joint Company next lowest, at $329,000.

The Vancouver ferry subway, for which proposals are invited, will cost about $35,000. The subway will be 25 feet wide, and will have nine feet clearance, with a ramp leading down from Alexander street and another leading up to the wharf. The retaining walls of the ramps will be of reinforced concrete, while immediately under the tracks there will be a steel roof. The supporting walls of this will be of solid concrete. The steel roof of the subway will be located about three feet six inches beneath the tracks of the C. P. R. The floor of the subway will consist of solid concrete reinforced by steel rods, and 18 inches thick.

To members of the Prince Albert Board of Trade was recently outlined plans for a large undertaking already launched upon by the National Iron and Steel Corporation, which, according to Mr. Jas. Kreis, of Chicago, consulting engineer for several large United States corporations, inside of four years will be employing fully five thousand men. The plant is located in the west end of the city, where the work of erecting the factories has already been commenced. A twenty-inch bar mill and horseshoe factory, which are the first two units, are already under way. Later a sheet mill galvanizing plant, a foundry for steel castings and a tube factory will be added. Mr. Kreis estimated that by then the corporation will be using at least 4,200 horsepower from the new city power plant now in course of erection at Lacolle Falls.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Listowel, Ont.

Water mains planned by the Town Council on Wells, Erie, Wellington, John and Ross Streets. Mayor, Wm. Climie.

London, Ont.

Sewers planned by City Council on Ridout St., Cove Rd. and Regent St. Mayor, C. M. R. Graham. Engineer in charge, W. N. Ashplant.

Sewers, cost $400,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Working plans to be completed during winter with a view to letting contracts and starting construction in spring. Work will likely be carried out under supervision of Engineers Dept. Tenders for supply of iron work, gulley gratings, manhole covers, etc., in quantity, will be called for early in 1914.

Extension to sanitary sewer system, cost $75,000, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting Engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Matter to be considered this winter and work commenced next year. Extension to system with disposal plant for the Eastern District.

Ottawa, Ont.

Sewer, intercepting, cost $75,000, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Tenders close November 6th. Quantities: Earth excavation 12,000 cu. yds. Rock excavation 3,092 cu. yds., brick and concrete sewer 3,985 lin. ft., tile pipe underdrain 3,935 lin. ft., 6-in. drain connections 100, 9-in. drain connections 20, both to include stoppers, 12-in. connections for sewers 10, manholes 12, connection chamber 1.

Sewer, cost $2,500, Queen St., planned by City Council. Mayor, J. A. Ellis. City Engineer, Archibald Currie.

Sewer, cost $50,000 to $80,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders will be received by Sec. Board of Control until 4 p.m. Nov. 6th, for construction of the West End Intercepting Sewer. Specifications, etc., at office of City Engineer.

Quebec, Que.

Street improvements, cost $600,000, planned. Mayor, Nap. Drouin. City will be authorized to ask Legislature to borrow the above sum for the paving of streets, new ornamental posts, etc., in Montcalmville.

Regina, Sask.

Tenders received until Nov. 10th for steel roof for filter bed at Sewage Disposal Works. Engineer, F. McArthur. City Commissioner, L. A. Thornton.

Stamford Twp., Ont.

Waterworks, cost $30,000, planned. Clerk, Carleton Munroe, Southend. Engineer in charge, Carl Gardner, Niagara Falls. Council will receive tenders on Duplex pumps, capacity 300 gallons per minute, automatic controls, pipe, valves and standpipe to hold about 180,000 gals.

Sarnia, Ont.

Waterworks and sewer system, cost $16,000, planned by Town Council. Mayor, Dr. Bell. By-law carried by ratepayers Oct. 24th.

Toronto, Ont.

Commr. of Works, R. C. Harris, recommends sidewalks on Benlamond, Heath, Elmer, Renhold and Ritchie. Estimated cost $8,192. Asphalt pavements on Cornwall and Renholt, cost $4,927. Brick on lane off Dovercourt, north of Dundas, $5,905.

Commr. of Works, R. C. Harris, recommends asphalt pavements, Hugo Ave. $2,374, Agnes $17,442, Seymour $8,558, Armoury $4,837, Tyrrel $17,413. Brick block on St. Clair W. $13,802.

Pavements planned by Board of Control. Asphalt on Dunn Ave. and Wolseley, to Constructing & Paving Co., Confederation Life Bldg., $11,501; Beaumont, Bellair, Browning, Carlaw, Cumberland and Elliott Sts., to Godson Contracting Co., Manning Chambers, $41,847.

Commr. of Works, R. C. Harris, recommends construction of tile pipe sewers in number of lanes. Estimated cost $5,330.

Winnipeg, Man.

Pavement, St. Charles. Owner, Rural Municipality of Assiniboia. Tenders received by Clerk, Frank Ness, Kirkfield Park, P.O., till November 25th, for asphalt pavement on Portage Road in Lot 113. Approximately 7¼ miles, the first 1¼ miles to be 24 ft. wide, the balance 16 ft. wide. Plans and specifications at office of Engineer, Municipal Hall.

Watermains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. Dunfra ave., McGregor to 300 ft. of Copp St. McGregor St., Armetta to Dunfra Ave. Armetta Ave., McGregor to Copp St. Specifications, etc., at office of engineer. Tenders received till November 4th.

Tenders received by Board of Control till Nov. 1st for water mains in Cameron St. from Talbot to Reach Ave., Beach Ave. from Molson Bridge C. P. R. to Green St., Talbot Ave. from Cameron to Kent St. Specifications at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Regina, Sask.

Additional filter bed, cost $14,700. at sewage disposal works, planned by City Council. Engineer, F. McArthur. City Commr., L. A. Thornton. General contractor, O. W. Smith, Peart Block.

Three Rivers, Que.

Paving planned by the Municipal Council. General contractors, Cote & Michaud, Quebec, Que. 20,000 yards.

Timmins, Ont.

Standpipe for Canadian Mining & Finance Co., Ltd. Engineer, Company's staff. General contractors, Thor Iron Works, Ltd., Foot of Bathurst St., Toronto. 95 ft. high, 20 ft. in diameter, with total capacity of 225,000 gallons. To be erected this year.

Toronto, Ont.

Concrete curbings. General contractors, Constructing & Paving Co., Confed. Life Bldg., Wolseley St., at 41c per ft. General contractors, Godson Contracting Co., Beaumont, Bellair and St. Nicholas St., at 41c. General contractors, National Contracting Co., 9 Garnock Ave., Avondale Rd., at 40c.

Cast iron pipe required by Board of Control. Mayor, H. C. Hocken. 36 in. pipe. General contractors, National Iron Works of Toronto, at $7,325 per length for delivery in Section "A," Can. Allis-Chalmers Ltd., at $7,320 per length for delivery in Sections B and C. 20 in. pipe. General contractors, National Iron Works of Toronto, at $4,080 per length.

Street grading planned by Board of Control. Mayor, H. C. Hocken. Howick and Rosethorn to Grant Constructing Co., Front St. E., $2,465. Tennis Cres. to Routley & Summers, Benlamond Ave., $2,922.

Asphalt pavements planned by Board of Control. Butternut and Jackman Ave., to Contracting & Paving Co., $18,296; Dufferin, Huron and Knox, to Godson Contracting Co., $13,489; Homewood Ave., to Commr. of Works, day labor, $9,417.

Winnipeg, Man.

General contractors, Thos. Jackson & Son, 370 Colony St., for sewer pipe and specials, cost $30,183. Board of Control. Sec., M. Peterson. Engineer, H N Ruttan, 223 James Ave.

Hydrants planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractors, Rensselaer Valve Co., Troy, N.Y. 150 6 in. hydrants each $37.50.

Water mains planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Sewer in Sargent Ave., $2,274.50; water mains in Kent St., $99.20; Sargent Ave., $176; Wall St., $275.75; Sherburn St., $291.44.

Railroads, Bridges and Wharves

Province of Alberta

G. T. P. Rly. has been authorized to construct spur and sidings for Pembina

Coal Co., Ltd., in Sections 19 and 30-53-7 W.5.M. Alta.

Bassano, Alta.
C. P. R. has been authorized to construct spur for Imperial Oil Co., Lot 1, Block A, of Bassano & Calgary Brewing & Malting Co., Ltd., Lot 2, Block A of Bassano.

Beeton, Ont.
G. T. R. has been authorized to reconstruct bridge No. 278 at mileage 73.75 13th Dist., over Nottawasaga River, near Beeton.

Province of B. C.
C. P. R. has been authorized to construct bridge No. 117.42 Shuswap Sub. Div., B. C. Division.

Calgary, Alta.
C. P. R. has been authorized to construct spur for Calgary Stock Yards Co., Ltd., in N.E. ½ Sec. 11-24-1 W.5.M., Alberta.

Fitzroy Harbour, Ont.
C. N. O. Rly. has authorized construction of bridge to carry railway across Ottawa River at Fitzroy Harbour, Twp. Fitzroy and Onslow Cos., Carlton and Pontiac, Provinces of Ontario and Quebec, mileage 37.32 west of Ottawa.

Fort William, Ont.
Quay wall, etc., Mission River, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders close Nov. 21st. Plans, etc., at office of Dept. and W. P. Merrick, Fort William, J. G. Sing, Esq., Toronto, J. L. Michaud, Montreal. Quay wall 2,646 ft. long, sq. timber cribwork filled with earth and stone, concrete superstructure, British Columbia fir, spruce, hemlock, white or red pine, approximate quantity of materials: lumber 4,822,900 ft. B. M.; drift bolts 319.629 lbs.; screws, bolts, etc. 152,261 lbs.; lift rings 12,336 lbs.

Halton, Ont.
G. T. R. has been authorized to construct siding into premises of Canada Brick & Fireproofing Co., Ltd., on part of Lot 27, Con. 11, Twp. Esquesing Co., Halton, Ont.

Islington, Ont.
C. P. Rly. has been authorized to construct siding into premises of D. L. Streight, Lot 7, Con. A., Twp. Etobicoke, Co. York.

London, Ont.
Breakwater, cost $25,000, West, planned by City Council. Mayor, C. M. R. Graham. Engineer, W. N. Ashplant. Consulting engineer, Mr. Willis Chipman, Mail Bldg., Toronto. Plans to be completed during winter with view to letting contracts and starting work early in spring.

Musquash, N.B.
C. P. Rly. has approved of station at Musquash, Parish of Musquash Co.. St. John, N.B., mileage 66.41 on Co.'s Shore Line Sub. Div., Atlantic Dist. No. 1.

North Sydney, N.S.
Tenders received by Sec., L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, up to and including Nov. 10th, for the construction of a line of railway from North Sydney to Leitches Creek. Plans, etc., at office of Station Master, North Sydney, Resident Engineer, New Glasgow, office of Chief Engineer, Moncton, N.B., and at Dept., Ottawa.

Province of Ont.
C. L. O. & W. Rly. has been authorized to construct bridge over Smithfield Creek, near mileage 93.7 Ont. (Murray-Brighton Road Div).

C. P. Rly. has approved of station on Pt. McNicoll Sub. Div., Ont. Dist. 1, Lot 28, Con. 3, Twp. Ops. Co. Victoria, Ont. Cambray mileage 22.78 and 2 at Franklin mileage 6.3, Lot 22, Con. 12, Twp. Manvers, Co. Durham.

C. N. O. Rly. have approved of stations as follows:—Master, mileage 111.05 from Ottawa, Twp. of Master and Kathmore, mileage 115.3 from Ottawa, Twp. of Master.

Ottawa, Ont.
Temporary bridge, cost $15,000, Bank St., planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Tenders received by Chairman Board of Control until Nov. 4th for bridge over Rideau River, north of present Billings Bridge.

Pelee Island, Ont.
Repairs to docks, cost $3,500, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Engineer in charge, H. B. R. Craig, Windsor, Ont. Plans in progress.

Twp. Pentland, Ont.
Bridge. C. N. O. Rly. has been authorized to construct bridge across Kiosh-Koqui Lake, Twp. Pentland, Nipissing Dist., at mileage 186.6 from Ottawa.

Regina, Sask.
C. P. R. has been authorized to construct spur for J. K. McInnis.

Addition to car barns, cost $20,000, Albert, planned by City Council (Street Rly. Dept.). City Commr., L. A. Thornton. Architect, H. Doughty, Supt. of St. Rly. Dept. Brick construction and foundation, corrugated iron roofing.

Subway, cost $50,000, Winnipeg, planned by City Council, under C. P. R. tracks. Engineer, F. McArthur. City Commr., L. A. Thornton.

Richmond Hill, Ont.
C. N. O. Rly. has been authorized to construct spur to the property of J. H. Dunlop, Lot 24, Con. 1, Twp. Markham, Ont.

St. Catharines, Ont.
Welland canal, cost $3,000,000, Section No. 5. Tenders will be received by Dominion Govt., Dept. of Railways & Canals. Secretary, L. K. Joies, Ottawa, until noon, November 18th. Plans, specifications, etc., at office of Chief Engineer of above Department, Ottawa, and with engineer in charge, St. Catharines, Ont. Section No. 5 consists of three mile division, extending from a point in Port Robinson to a point in about the centre of Allenburg. Comparatively little rock-cutting to be done.

St. Gregor, Sask.
C. N. Rly. Co. has been authorized to erect 3rd class station. Work to be completed not later than July 31st, 1914.

Sudbury, Ont.
C. N. O. Rly. has been authorized to construct spur to mills of Laberge & Sons, from station 4158.7 on connecting track between its line and Algoma Eastern Rly. and across Wilma St.

Twp. Tilbury West, Ont.
Michigan Central Rly. Co. has approved of bridge to be constructed under M. C. R. tracks at mileage 32.98, Little Creek Drain.

Tilsonburg, Ont.
C. P. Rly. has been authorized to construct spur for Tilsonburg Elec. Car Co., Ltd., across King St. and 6th St., at mileage 15.4, Port Burwell Sub. Div.

Toronto, Ont.
High level bridge planned by Twp. of York, over Don River, connecting Leaside and Donlands, near corner of Eglinton and Leslie Sts. Plans not yet approved by Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, Adelaide St. E.

CONTRACTS AWARDED

Cardigan River, P.E.I.
Extension and reconstruction of wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Annandale Lumber Co., Annandale, via Georgetown, P.E.I.

North River Bridge, P.E.I.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jos. Hughes, Charlottetown.

Ottawa, Ont.
Railway planned for Morrisburg & Ottawa Elec. Rly., Can. Life Bldg. Sec., R. S. Bishop, Canada Life Bldg. General contractors, R. J. Tierney Co., Ottawa. Eight miles of line completed.

Pinette Bay, P.E.I. (McAuley's Shore)
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Annandale Lumber Co., Ltd., and T. W. McDonald, Annandale, via Georgetown, P.E.I. 675 ft. long.

Public Buildings, Churches, Schools, etc.

Amherst, N.S.
Police headquarters, cost $5,000, La Planche, planned by Municipal Council. Mayor, J. N. Fage. Clerk, W. J. Donkin. Police Commrs., P. Gordon, H. R. McCully. Two storeys, 40 x 40, stone foundation, brick construction, shingle roofing, electric lighting. Plans in progress.

Belleville, Ont.
Interior alterations to post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Maple floors, office fixtures.

Broughton, Que.
School planned by School Commrs. Plans, etc., at office of Sec.-Treas., Jos. Ludger Beaudoin, West Broughton, who will receive tenders for construction of school No. 6.

Forest, Ont.
Steam heating system for Town Hall planned by Town Council. Mayor, H. J. Pettypiece. Tenders will be called.

Hamilton, Ont.
Addition to school, cost $82,000, Stinson street, planned by Board of Education. Secretary, R. H. Foster, City Hall. Architect, A. W. Peene, Clyde Block. Tenders to be called shortly. Two stys., 10 rooms, brick construction, central heating plant, modern ventilating.

Les Ecureuils, Que.
School planned for R. C. School Commissioners Sec. No. 4. Sec., Oliva Auger.

Plans can be seen at office of Secretary who will receive tenders.

London, Ont.
Board of Education are asking for prices for seating in two new schools. Further information from E. R. Dennis, Chairman, Board of Education.

Minnedosa, Man.
Interior fittings for post office, etc., for Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders will be received by Secretary until November 17th. Plans, specifications, etc., at office of T. Blankenstein, Clerk of Works, Public Bldgs., Minnedosa, H. E. Matthews, resident architect, Winnipeg, and at Department, Ottawa.

Montreal, Que.
Post office at Verdun planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Further information from Mr. Gadboury, Montreal.

College contemplated, Cote Des Neiges. Architect, G. A. Monette, 260 St. James St., Montreal, is preparing plans.

School, Shirley, for Protestant Board of School Commrs., 197 Peel St. Architect, F. Belfrey, c/o Commrs. Two stys., concrete foundation, brick construction, felt and gravel roofing. Plans drawn.

Ottawa, Ont.
City Council, Board of Health, plan installation of 100 flush closets in city. Tenders to be called shortly. Mayor, Mr. Ellis. Chairman, Dr. Parent. M. H. O., Dr. Lomar.

Town hall, fire and police station, cost $25,000 to $30,000, planned by Town Council of Eastview. Mayor, C. Gladu, McArthur Rd. Council contemplates raising debentures for above projects, also for the purchase of 2 chemical fire engines (twin tank).

Lanterns required by Dom. Govt. Dept. of Marine and Fisheries. Deputy Minister, Alex. Johnston, Ottawa. Tenders received until noon, Nov. 8th, for supplying 4-7 ft. Standard cast iron lighthouse lanterns, as per plans and specifications, prepared by Dept., to be delivered free of all charges at the Dominion Lighthouse Depot, Prescott, Ont. Plans and specifications from Purchasing Agent of Dept., Ottawa, Agent of Dept., Montreal, and from Collector of Customs, Toronto.

Sisters of Precious Blood, Echo Drive, propose to rebuild the whole of convent, chapel, etc.

Theatre, cost $40,000, planned for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Excavating, mason and foundation, A. Tubbe, 72 Lees Ave. Tenders open for steel and brick work.

Palmerston, Ont.
Post Office, cost $20,000, contemplated by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Further information from W. A. Clarke, M.P., Palmerston. Red pressed brick and stone trimmings construction, concrete and stone foundation.

Regina, Sask.
Church, cost $20,000, for Anglican Congregation. Pastor, Rev. E. C. Ear, 2300 Smith St. Plans in progress.

Club house, cost $15,000, contemplated by Prov. Conservative Association, New Bank of Ottawa Bldg. Sec., Jas Balfour, 2315 Victoria Ave. Two storeys. Plans will be prepared.

Redcliff, Alta.
Moving picture theatre, cost $5,000, 3rd, for Messrs. Eastland Bros. One storey, 25 x 100. Moving picture theatre equipment required. Walls up.

St. Catharines, Ont.
Hospital contemplated by the Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Site purchased, 23 acres. Hospital will be for accommodation of workmen on new Welland Canal.

St. Janvier de Bainville, Que.
School planned by School Commrs. Plans and specifications at office of Sec.-Treas., Dr. J. W. Brunet, St. Janvier, who will receive tenders until noon Nov. 20th.

St. John, N.B.
Club house, cost $3,000, for Cliff Club, c/o W. H. Thorne, Prince William St., and F. E. Sayre, 24 Long Wharf. Architect, Garnet Wilson, 50 Princess street. Frame construction. Plans in progress.

St. Marys, Ont.
Gymnasium, cost $3,200, planned by the School Board. Chairman Com., Dr. Knox. Architect, W. Fletcher Shepherd, 774 Shaw St., Toronto. Tenders will be received by Chairman. White brick veneer construction.

Swift Current, Sask.
School planned by Town Council. Architects, Reilly, Dawson & Reilly, 512 Western Chmbrs., Regina. Tenders received by Sec.-Treas., J. T. Dodds, for foundation close No. 4th. Plans and specifications with Architect and at 20-21 Russell Block, Moose Jaw.

Toronto, Ont.
Board of Control has authorized M. H. O. to equip a wing of the Old General Hospital for treatment of measles. Chairman Board of Health, Ald. H. A. Rowland, Gerrard and Parliament Sts. Med. Health Officer, Dr. C. J. C. O. Hastings, City Hall.

Truro, N.S.
Hall and offices, cost $25,000, Prince St., planned for Independent Order of Oddfellows. Probable architect, E. D. Vernon, Dominion St. Two storeys, 90 x 60.

Toronto, Ont.
Church, cost $30,000, planned for Royce Ave. Presbyterian Congregation. Treas., Jos. Reid, 9 Hugo Ave. Work may start in spring of 1914. Presbytery has given permission to raise above sum.

Y. W. C. A. building contemplated. Site purchased on Mavety St., West Toronto, and plans will be prepared.

Church at Leaside, planned. Architect, Thos. Livingstone, 2 Leader Lane, Toronto. Tenders close with Architect on Oct. 31st for all trades except heating. Concrete foundation, brick construction.

Winnipeg, Man.
Addition to Broadway Baptist Church, Walnut and Broadway. Pastor, Dr. Sowerby, Walnut and Broadway. Architects, Jordon & Over, Canada Life Bldg. Work will be let in spring. Plans drawn.

Engineering building, St. Vital, planned for Manitoba University Council. Prov. Architect, V. W. Horwood, 261 Fort St., Winnipeg. Constr. Architects, Brown & Vallance, McArthur Bldg., Winnipeg. Three storeys, 200 x 75. Building will have 2 wings, 70 x 40. Two storeys. Tenders will be called early in 1914, and work will start in spring.

Wallace, N.S.
School, cost $7,000, planned. Architect, Willard Mitchell, Amherst. Tenders received by Sec. School Trustees. One storey, 70 x 80, brick foundation, frame and Wallace brick construction, ventilating system, library fittings.

CONTRACTS AWARDED

Amherst, N.S.
School addition, cost $30,000, Acadia St. Chairman School Commsn., B. J. Lawson. Architect, Willard Mitchell. General contractor and plastering, J. E. Lusby. Heating and plumbing, Hagen & Co. Electrical, Jno. Conn, 122 Victoria St. Interior fittings, Ainslie Allen. 2½-storeys, 70 x 70. Lighting, steam heating, ventilating system, ventilators, lime and sand plaster.

Armories, cost $81,100, Agnew-Acadia Sts., planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Rhodes Curry Co., Ltd. Stone and brick will be required at once. Two storeys, 80 x 86, sandstone, reinforced concrete and brick construction, steel trusses and metal, architectural iron stairs. Foundations started.

Belleville, Ont.
Dormitory building planned by Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Toronto. General contractors, Thos. Manley & Son. Plumbing, Purdy Mansell Co., Albert St., Toronto. Electric wiring, Greenleaf & Son, Belleville, Ont. Heating tender in, not yet awarded.

Brantford, Ont.
Dormitory, cost $40,000, planned by Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughton, Toronto. General contractor, Jess Bartle, 172 Darling St. Plumbing, Drake Avery Co., John St., Hamilton. Heating and wiring tenders in, not yet awarded.

Calgary, Alta.
Examining warehouse, 11th Ave. E., planned by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Ornamental iron, Western Steel & Iron Co., Office Chalmers, Elmwood, Man. Steel work completed, stone work started.

Edmonton, Alta.
Public school, cost $150,000, 3rd St. E. Sec.-Treas., Mr. Brady, Mortlake Block. Architect, Mr. Turner, Mortlake Block. General contractors, Read, MacDonald & Brewster, 604 Tegler Block. Two stys., 116 x 164.

Grimsby, Ont.
Pre. cooling plant, cost $12,000, for Dominion Government, Department of Agriculture. Secretary, A. L. Jarvis, Ottawa. Architect, E. J. Greenstreet, 631 Huron Street, Toronto. General contractor, D. Marsh, Grimsby. Machinery, Madison Cooper Co., New York. Two storeys, 48 x 120, frame construction, concrete foundation.

Hanover, Ont.
Church, cost $20,000, Durham, for Baptist Congregation. Builder and general contractor, Jacob Hahn. Heating and

plumbing, Young Bros. Electrical, Hanover Elec. Light Co. Interior fittings not awarded yet. One storey and basement.

Moncton, N.B.
Church, cost $62,200, Church and Queen, for First Baptist Congregation. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, J. M. Clark, 54 Church St. Foundations in.

Montreal, Que.
Theatorium, cost $9,000, Queen street, for A. J. Bentley, Montreal. Architect, F. R. Cowan, Montreal. General contractor, T. Essery, 2277 Hutchison. Excavating done.

Theatre, cost $25,000, Papineau. Owner and general contractor, B. Damien, 894 Mt. Royal T. Architect, J. A. Godin, 269 St. Denis St. 44 x 118, concrete foundation, waterproofing, brick construction, copper cornices, felt and gravel roofing. Permit issued.

Prince Albert, Sask.
Skating rink, cost $35,000, River St., for East Prince Albert Rink Co. Architect and general contractor, T. Manley. 140 x 80, mill construction, concrete and waterproofing foundation, felt and gravel roofing, temperature regulators, ventilating system.

St. John, N.B.
Observatory, cost $25,000, planned by Dom. Govt. Meteorological Service. Architect, Garnet Wilson, 50 Princess St. General contractors, British American Constr. Co., Ltd., Prince William street. Roofing, Jas. McDade, Mill street.

Truro, N.S.
Church, cost $60,000, Young St., for First Presby. & St. Pauls United Congregations. Sec. Bldg. Com., H. A. Dickie, Royal Bank Bldg. Architects, Curry & Sparling, 105 Bond St., Toronto, Ont. General contractors, Wilson's Ltd., Truro. Excavating done.

Windsor, Ont.
Parish hall, cost $7,500, London street, planned by Church of Ascension. Chairman, O. E. Fleming. Architect, Harold Barrons, 38 Curry Ave. Mason, T. Jones. Carpenters and roofing, Irwin & Johnson. Steel and heating, Pennington & Brian. Plastering, Kennedy & Sons. Plumbing, Robert Paddon. Electrical, Dom. Electrical Co. Two storeys, 42 x 50.

I. O. O. F. hall, cost $35,000, Wyandotte. Chairman, Thomas Yates. Architect, J. C. Pennington. Carpenter, Williamson Constr. Co. Three storeys, 52 x 90. Foundations in.

Winnipeg, Man.
School, cost $90,000, St. James, Linfield St., for Rural Municipality of Assiniboia. Sec.-Treas., Frank Ness, Kirkfield Park P.O. Architect, Alex. Melville, Builders Exchange. General contractors, Frid Lewis & Co., Somerset Bldg. Three storeys, 135 x 85.

Yorkton, Sask.
Monastery and church, cost $35,000. for Redemptionist Brothers. General contractors, Newert Construction Co. Two storeys, brick and stone construction, brick foundation. Foundations in.

Church, cost $5,000, for German Lutheran Church. General contractor, T. W. Rahn. Brick construction and foundation. Foundations in.

Business Buildings and Industrial Plants

Belleville, Ont.
Hotel annex, cost $5,000, Front St., for Tom Powers. Four storeys, 20 x 50, pressed brick construction, cement foundation. Plans in progress.

Glencoe, Ont.
Garage, cost $7,000, Main. Owner and architect, Alex. Duncanson. Two stys., 40 x 70, white brick construction, concrete foundation, felt and gravel roofing, store fronts, equipment and tools required. Plans in progress.

Hamilton, Ont.
Addition to factory, cost $5,000, Shaw St. Owners and architects, Boston Insulated Wire Co., Shaw St. Two storeys, brick construction, concrete foundation, felt and gravel, roofing. Plans in progress.

Kilmartin, Ont.
Farm buildings, cost $4,000. Owner and architect, Neil Munroe, Kilmartin, Glencoe, P.O. Concrete foundation, fire proof construction and roofing. Plans drawn.

Leadville, Que.
Saw mill for C. N. Boright, Mansonville. Private plans are being prepared.

Leamington, Ont.
Addition to canning factory, cost $10,000, for Gorman, Eckert & Co., 318 Rectory St., London. Manager, Wm. Gorman. Architect to be selected. Additional equipment to be installed. White brick construction. Plans in progress.

Montreal, Que.
Store and flats, cost $5,000, Maisonneuve (Ontario St.), for Aug. Tetrault, Lafontaine and 2nd Ave., Maisonneuve. Three storeys, 23 x 30, stone and concrete foundation, frame and brick construction, felt and gravel roofing. Plans in progress.

Store and flats, cost $4,800, St. Hubert, for Hector Belanger, 2820 St. Hubert. Three storeys, 25 x 50, concrete foundation, felt and gravel roofing. Plans ready.

Factory, cost $25,000, for C. W. Lowes, Sherbourne St., Montreal. Six storeys Plans ready.

Orillia, Ont.
Remodelling stores, cost $4,000, planned for Mrs. Quinn. Tenders received by architect, J. H. Robinson.

Ottawa, Ont.
Addition to store, cost $3,800, Somerset. Owner and architect, Eugene Hurtubise, 763 Somerset St. Concrete foundation, solid brick construction, felt and gravel roofing, store fronts and fixtures. Plans ready.

Printing plant, cost $40,000, Nepean St., for Lowe-Martin Printing Co., Albert St. Architect, Allan Keefer, 229 Sparks St. Five storeys, reinforced concrete construction, concrete foundation, waterproofed, felt and gravel roofing. Plans drawn.

Stores and residences, cost $12,000, Bank, for Oakland Land Co., c/o Mr. W. J. Spratt, Ottawa South. Two storeys, 50 x 50, brick veneer construction, stone and concrete foundation, felt and gravel roofings. Plans in progress.

Workshop and greenhouse, cost $10,500, John St., for Geo. and Mrs. D. McLaurin, 42 Stanley St. Architects. Lord & Burnham Co., New Arlington Hotel. Brick foundation, concrete and stone, steel frame construction. Plans drawn.

Store, Bank St., contemplated for A. E. Rae Co., Ltd., Rideau St. Architect not yet appointed.

Ridgetown, Ont.
Bank offices, cost $12,000, Main, for Royal Bank of Canada. Manager, W. A. Pow. Architect Kenneth G. Rae, 54a Beaver Hall Hill, Montreal. Two stys., concrete and stone foundation, stone trimmings and Milton pressed brick construction, felt and gravel roofing. Plans drawn.

Addition and alterations to store, cost $4,500, Rideau, for E. C. Grant & H. P. Fleming, 22 Metcalfe. Architect, C. J. Burritt, 193 Sparks St. Stone foundation, brick construction, felt and gravel roofing, plate glass, store fronts and fixtures. Plans drawn.

St. Marys, Ont.
Addition to flour mill planned by Carter Milling Co. Ratepayers will vote on new by-law to grant company loan of $50,000 Nov. 20th.

Toronto, Ont.
Warehouse planned for McColl Bros. & Co., Don Esplanade, now ready to receive tenders for excavating only.

Warehouse, cost $8,000, Atlantic Ave., planned for Dominion Linseed Oil Co., Kent Bldg. Contracts not awarded until November 5th. Two storeys, 40 x 72, brick and steel construction, brick foundation, felt and gravel roofing.

Alterations to office building for Mail Printing Co., King and Bay. Tenders received by Architect, Gordon M. West, 2 College St., for alterations to main door way, vestibule door, etc.

Restaurant for R. H. Holmes, Philadelphia, Pa., and Toronto. Owner has secured lease of No. 83 Yonge St. Site 20 x 100, and plans will be prepared.

Wilkie, Sask.
Flour mill, cost $10,000, for F. L. Bishop, Strome, Alta. Board of Trade has granted owner free site, and plans will be prepared.

Windsor, Ont.
Alterations to restaurant, cost $3,000, Sandwich St. W., for King Lee, Chatham, Ont. Architects, G. Jacques & Co., Windsor, are preparing plans.
Plans in progress.

Stores and apartment house, cost $40,000. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. Tenders received by Architects. Three storeys, 60 x 40, 80 x 60, concrete foundation, waterprofing, brick construction, plate glass, mantels, store fronts and fixtures.

Windsor, Ont.
Factory contemplated for No Draught Ventilator Co. Secretary, Edw. J. Post, Staunton, Va. Plans will be prepared.

CONTRACTS AWARDED

Belleville, Ont.
Bakery, cost $4,000, Dundas St., for W. Gilbert. Builder, Ira Thompson. Two storeys, 30 x 40, brick construction, shingle roofing, electric lighting, motors and generators. Foundations in.

Edmonton, Alta.
Stores, cost $15,000, Bellamy. Owner and architect, Mr. Montgomery, 9427 Bel-

lamy St. General contractor, Mr. Watt, 598 Kennedy St. Painting, Mr. Hall, Kirkness St. Heating and plumbing, Domestic Engineering Co., 780 Jasper Ave. E. Electrical, Burnham & Frith Elec. Co., McDougall St. One storey, 40 x 172, felt and gravel roofing.

Stores and apartments, cost $20,000, Alberta Ave. Owners, architects and general contractors, Pietz & Schoeffel, 1063 Fraser Ave. Three storeys, 31 x 80, brick construction, concrete foundation, felt and gravel roofing, wood fibre plastering, plate glass, fire escapes, store fronts and fixtures. Work to start about June, 1914.

Stores and rooms, cost $5,000, 124th. Owner, architect and general contractor, J. A. Kruger, 10804 125th St. Two stys., 36 x 50, brick construction and foundation. Excavating done.

Warehouse, cost $75,000, 7th and Peace Ave., for Tees & Peresse, 7th St. Architects and general contractors, Fysche, McNeil, Martin & Trainer, Laugheed Bldg., Calgary. 1st, 5th and 6th floors to be occupied by Owners for wholesale house purposes; 4th floor by Wilson Ltd., wholesalers; basement, by Plunkett & Savage, wholesale fruit dealers. Six storeys.

Gananoque, Ont.

Rebuilding factory for the Spring & Axle Co., King and Pine Sts. General contractors, Anglins Ltd., 65 Victoria St., Montreal.

Halifax, N.S.

Store, cost $6,000, Argyle St., for I. E. Sanford, Cor. Argyle and Sackville Sts. General contractors, mason and carpenter, W. T. Harris & Son, 190 Maynard St. Two storeys, 33 x 60, cement foundation, red brick construction, felt and gravel roofing.

Hamilton, Ont.

Two stores, cost $5,000, Ottawa St., for H. Grierson, 164 King St. E. General contractor, F. G. Cameron, 16 Norway Ave. Two storeys, brick construction, brick and concrete foundation, felt and gravel roofing. Excavating done.

Montreal, Que.

Store and flats, cost $40,000, Sherbrooke W., for Thos. Coggins, 319 St. Antoine St. Architect, Chas. E. Mitchell, 11 Beaver Hall Hill. General contractors, Jas. Adam & Co., 745 St. Catherine W. Plans were changed and building made larger. Contracts roofing and plastering to be given next week.

Factory alterations, cost $30,000, Fortification and St. George, for Royal Trust Co., for Montreal Star, St. James St. Architects, Ross & MacDonald, 1 Belmont. General contractors, Jas. Shearer Co., 225 St. Patrick. One storey, 32 x 144, felt and gravel roofing.

New Hamburg, Ont.

Addition to factory, cost $15,000, for The Silversmiths Co., Ltd. General contractor, Alex. Fraser. Concrete block construction, concrete and stone foundation.

Prince Albert, Sask.

Offices, cost $40,000, Central Ave. Owners, architects and general contractors, Craag & Co. Three storeys, 50 x 100, concrete, brick, stone and waterproof foundation, artificial stone, reinforced concrete fireproof and steel construction, electric lighting, steam heating, temperature regulators, fireproof floors, metal ceilings, ornamental plastering, terrazzo tile.

Quebec, Que.

Addition to store, cost $4,500, for E. A. Antil, 51 Buade St., Que. Architect, R. P. Lemay, 21 d'Aguillon. General contractors, mason and plastering, J. B. Verret & Son, 190 3rd Ave., Limoilou. Other trades not yet awarded. Two storeys, 46 x 22, stone foundation, red brick construction, steel beams. Excavating done.

Regina, Sask.

Garbage transfer station, cost $15,000, planned by City Council. M. H. O., Dr. M. R. Bow. Architect, R. W. Allen, City Engineer's Office. General contractor, J. G. Traub, Dominion Trust Bldg. 2½-storeys, brick and reinforced concrete construction. Foundations in.

St. John, N.B.

Remodelling laundry building, Waterloo, for Ungars Laundry Ltd. Manager, A. K. Mundee, 28 Waterloo St. Architect, Garnet Wilson, 50 Princess Street. Work being done by day labor.

Bank building for Royal Bank of Canada. Manager, J. B. Blair, King W. Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Steel work started.

Bank for Bank of British North America. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St. Walls started.

South Edmonton, Alta.

Store, cost $10,000, Whyte Ave. Owner, architect and general contractor, Jno. Irving, 463 2nd Ave. S. W. Two storeys, 66 x 66, concrete foundation, brick construction, felt and gravel roofing. Excavating started.

Swift Current, Sask.

Warehouse for Moose Grocery. General contractors, Western Constr. Co., 11th Ave. Walls up.

Toronto, Ont.

Bank and offices, cost $15,000, 130-2 Church, for Bank of Nova Scotia, Melinda St. Architects, Sharp & Brown, 18 Wellington W. General contractors, Harris & Harris, Confederation Life Bldg. Mason, J. McLeod, care general contractor. Steel, Reid & Brown, Esplanade St. Two storeys, 40 r 52, brick and steel construction, concrete foundation. Foundations in.

Factory addition, cost $25,000, for Can. Rogers Co., 570 King St. W. Architect, Company's Engineer. General contractor, W. J. Trimble, Peterkin Bldg. Brick and steel construction, stone foundation, felt and gravel roofing. Work started.

Warehouse, cost $60,000, Church & Lombard, for H. M. Stevenson, Richmond E. Architect, J. W. Gray, Confederation Life Bldg. Day labor under supervision of architect. Five storeys, brick and mill construction.

Addition to factory, cost $25,000, for C. J. W. Lowes, 90 Sherbourne St. General contractor and carpenter, R. G. Kirby, 539 Yonge St. Mason, Chalkley & Son, 34 Victoria St. Owner will let plastering, painting, heating, plumbing and electrical. Six storeys, 60 x 48, brick construction and foundation.

Warehouse, Pape and Gerrard, for Geo. Gale & Sons, 323 Notre Dame W., Montreal. General contractor, T. Essery, 4 Chicora Ave. Mason, Dancy & Son, Mail Bldg. Heating, Sheldons Ltd., Kent Bldg. Plumbing, T. G. Barrington, 1000 College St.

Factory, cost $6,000, Eastern, for W. Harland & Son, 400 Eastern Ave. General contractors, Wm. Hughes & Co., 216 Simcoe St. Two storeys, 21 x 38, brick and steel construction, brick foundation, felt and gravel roofing.

Six stores and apartments, cost $25,000, College and Sheridan. Owners and general contractors, Roberts Bros., 228 Dovercourt Rd. Owners buy all material and superintending construction. Trimming 2 stores and excavating 2 stores. Brick construction and foundation, felt and gravel roofing, galvanized iron, store fronts.

Garage and stable, cost $5,000, Aylmer Ave. Owners and general contractors, Britnell Contracting Co., 209 Davenport Rd. Architect, Neil G. Beggs, 12 Cosgrave Bldg. Tenders received by Architect. Two storeys, 44 x 80, brick construction and foundation.

Walkerton, Ont.

Foundry and repair shop, cost $5,000, Station Road. Owners, architects and general contractors, Ellenhauser Bros. One storey, 40 x 50, white brick construction, patent roofing, concrete floors, high pressure piping. Walls started.

Winnipeg, Man.

Stores and rooms, cost $3,000, Broadway. Owners, architects and general contractors, Walch Land Co., Northern Crown Bank Bldg. Two storeys, frame construction, veneer brick front, concrete foundation. Excavating started.

Bank building, Portage Ave., for Quebec Bank. Architects, Brown & Vallance, 1006 McArthur Bldg. General contractors, Carter-Halls & Aldinger, Union Bank Bldg. Foundations in.

Residences

Belleville, Ont.

Residence, cost $5,000, Albert St., for Fred Quick. Two storeys, brick construction, cement foundation. Plans in progress.

Montreal, Que.

Residence, cost $23,000, for J. E. Dalrymple, 4684 Westmount Ave. Architect, A. K. Hutchison, 702 New Birks Bldg., Montreal. Concrete foundation, brick construction, felt and gravel roofing. Plans ready.

Eight flats, cost $9,000, Royer, for Jos. V. Belanger, 2005 Christopher Columbus. Three storeys, 50 x 55, concrete foundation, felt and gravel roofing. Plans ready.

Nine flats, cost $8,000, for J. P. Petel, 901 Cartier. Three storeys, 50 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Two flats, cost $7,500, Chambly, for Eug. Sansregret, 86 Berri. Three stys., 35 x 38, concrete foundation, felt and gravel roofing. Plans ready.

15 flats, cost $12,000, Suzanne, for Denis Magnan, 2816 St. Dominiue. Three stys., 75 x 70, concrete foundation, felt and gravel roofing. Plans ready.

Nine flats, cost $9,000, Marie Anne, for W. D. Lambert, 1481 St. Andre. Three storeys, 24 x 40, concrete foundation, felt and gravel roofing. Plans ready.

Three flats, cost $5,500, Christopher

(Continued on page 73)

Tenders and For Sale Department

Special Notice to Contractors

Re Greater Winnipeg Water Supply

Estimated Cost $13,500,000.00

Notice is hereby given to contractors that tenders will be invited early in the year 1914 for the construction of the works necessary for the delivery of water from Shoal Lake to the Greater Winnipeg Water District. The following is a brief description of the proposed works:

1. A dyke and channel for the diversion of the Falcon River into Snowshoe Bay.
2. 85 miles Concrete Aqueduct.
3. 10 miles Pipe Line. (Probably 1916 work).
4. 900 lin. ft. tunnel under Red River.
5. 85 miles of construction railway.
6. Telephone Line.
7. Clearing and ditching.

The fall season of the year affords the best opportunity for inspection of proposed route of the aqueduct, and it is recommended that contractors having a view to tendering on the work should send their inspectors over the line at as early a date as possible.

Particulars as to estimated cost of the work and map of approximate location and profile of aqueduct may be obtained from the undersigned.

M. PETERSON,

Acting Secretary of the Administration Board,
Greater Winnipeg Water District
City Hall, Winnipeg, Canada,
October 6th, 1913.

Note.—Copy of report of the Consulting Engineers, plan and profile of work and typical details of design may be seen at the office of this magazine. 42-45.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension to Wharf at Callendar, Ont.," will be received at this office until 4 p.m., on **Monday, December 1, 1913**, for the construction of an Extension to Wharf at Callendar, District of Parry Sound, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont., Midland, Ont., and on application to the Postmaster at Callendar, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—49762. 45-46

Equipment Wanted

Canadian Stewart Company are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on their work in

Toronto Harbor

Communicate with

Canadian Stewart Co., Ltd.,
C. P. R. Building, Toronto.

45-48

To Contractors

Canadian Stewart Company desire proposals from experienced contractors

on

Pile Driving, Capping, Crib Work and Concrete Walls,

Ship Channel for

Toronto Harbor Contracts

Plans may be seen at our office.

Canadian Stewart Co., Ltd.,
C. P. R. Building, Toronto

45-48

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Proposed Government Buildings Ottawa, Ont.

Extention of Time

Notice is hereby given that the time for the reception of designs in the first competition for the erection of Departmental and Courts Buildings, is extended for three months to **Thursday, April 2nd, 1914.**

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
—49657. Ottawa, October 23, 1913. 44-45

Sealed tenders addressed to the undersigned and endorsed "Tender for Construction of Wharfs at Victoria Harbour, B.C.," will be received at this office until 4 p.m., on **Tuesday, December 9, 1913**, for the construction of Wharfs at Victoria Harbour, B.C.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' offices at New Westminster, B.C., Victoria, B.C., Confederation Life Building, Toronto, Ont., Post Office Building, Montreal, P.Q., and on application to the Postmaster at Vancouver, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 27, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45197. 44-45

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf and Warehouse at Richard's Landing, Ont.," will be received at this office until 4 p.m. on **Tuesday, December 2, 1913,** for the construction of a Wharf and Warehouse at Richard's Landing, St. Joseph Island, Algoma District, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' Office, Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Richard's Landing, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 31, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48268. 45-46

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour and River Improvements in the Mission River, Fort William, Ont.," will be received at this office until 4 p.m., on **Friday, November 21, 1913,** for the construction of the Harbour and River Improvements.

Plans, specification and forms of contract can be seen and forms of tender obtained at this Department and at the office of W. P. Merrick, Esq., District Engineer, Fort William, Ont.; J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont.; J. L. Michaud, Esq., District Engineer, Post Office, Montreal, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupation and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 22, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46879. 44-45

Tenders for Construction of Sewer

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned up to noon of **Saturday, November 15th, 1913,** for the construction of a sewer on Bathurst St., in the Township of York.

Plans, specifications and all information may be obtained at the office of Frank Barber, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, Nov. 4, 1913. 45

Tenders for Rocmac Pavement

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned up to six o'clock of **Saturday, November 8th, 1913,** for the construction of Rocmac pavement on Spadina Road in the Township of York.

Plans, specifications and all information may be obtained at the office of Frank Barber, C.E., 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, Nov. 4th, 1913. 45

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
Aylmer, Ont.
45-46

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
Woodstock, Ont.
45-46

Engineering Salesmen

Good future offered for a few clean cut Engineering Salesmen, technical graduates preferred, to act as outside representatives, for an established Consulting Engineering and Construction Corporation, based on co-operative plan. Main offices in Cleveland. Highest references and financial interest required. Contract with salary, commission and expenses guaranteed. Answer "Engineering Salesmen," c/o Contract Record, Toronto. 45

Residences

(Continued from page 71)

Columbus, for B. Sauve, 462 Colonial Ave. Three storeys, 25 x 56, concrete foundation, felt and gravel roofing. Plans ready.

12 flats, cost $13,000, St. Dominique, for D. Lamoureux & Beaudin, 1923 St. Lawrence. Three storeys, 52 x 45, concrete foundation, felt and gravel roofing. Permit issued.

Flats, cost $20,000, Blvd. Gouin, for Mr. Racine, care Architect, Z. Trudel, 238 St. Andre. Three storeys, 60 x 78, concrete foundation, brick construction. Plans drawn.

Two flats, cost $6,000, Clifton, for E. Consineau, 99 Delisle. Two storeys, 50 x 36, concrete foundation, felt and gravel roofing. Plans ready.

Flats, cost $18,000, Maisonneuve (Boubeniere St.), for P. Gadbois, 754 Adam St., Maisonneuve. Three storeys, 112 x 52, stone and concrete foundation, artificial stone, frame and brick construction, felt and gravel roofing. Plans in progress.

Eight flats, cost $9,000, Chambly, for Eug. Chaperon, 285 Stadacona. 24 x 45, concrete foundation, felt and gravel roofing. Plans ready.

Ottawa, Ont.

Apartments, cost $160,000, Metcalfe, planned. Architect, W. Herbert George, Castle Bldg., Queen St. An early start is contemplated. Six storeys; solid brick construction stone and concrete foundation.

Apartments, cost $9,000, 3rd Ave., for Jas. Hill, 68 Isabella. Stone and concrete foundation, brick veneer construction, felt and gravel roofing. Plans in progress.

Residence, cost $5,000, Willard Ave., for Oakland Land Co., c/o Mr. W. I. Spratt, Ottawa South. Brick veneer construction, stone foundation. Plans in progress.

Residence, cost $5,500, Powell. Owner and architect, W. L Brown, 133 Hopewell Ave. Brick veneer construction, stone foundation, shingle roofing. Plans in progress.

Apartments, cost $14,000, Frank, for Mrs. C. E. Hesser, 424 Lisgar. Architect, A. Tracey, Gladstone Ave. Brick veneer construction, stone and concrete foundation, felt and gravel roofing. Plans in progress.

Addition and alterations to apartments, cost $6,000, 5th Ave., for J. Moffat Ross, Metcalfe St. Architect, W. Herbert George, Castle Bldg., Queen St. Brick veneer construction. Plans in progress.

Residence, cost $10,000, Monkland. Owner and architect, W. Herbert George, Castle Bldg., Queen St. Stone foundation, solid brick construction. Plans in progress.

Quebec, Que.

Flats, cost $32,000, St. Cyrille and Cartier, for Magloire Cauchon, 309 Richardson. Architect, P. Raymond, Beauport, Que. Three storeys, concrete foundation, steel beams, frame, red and Scotch brick construction. Plans in progress.

Toronto, Ont.

One detached residence, cost $7,000, Indian Grove. Owner and general contractor, Fred Holt, 34 Victoria St. Tenders in. Contracts not awarded. 2½ storeys, 24 x 42, brick and steel construction, brick foundation, slate roofing.

Residence, cost $4,800, Bloor W., planned for Dr. W. J. Wilson, 159 College St. Tenders received by Owner. 2½ storeys, 24 x 42, brick construction and foundation.

CONTRACTS AWARDED

Edmonton, Alta.

Apartment block, cost $30,000, Bellamy St., for Wm. Stubbe, 717 Syndicate Ave. Architects and general contractors, Pietz & Schoeffel, 1063 Fraser Ave. Steel, Edmonton Iron Works, Kinistino St. Heating and plumbing, G. M. Holt, 64 Nelson St. Electrical, Installation Co., 1055 Namaya Ave. Three storeys, 41 x 80.

Residences, cost $17,500, 25th. Owner, architect and general contractor, C. R. Horne, 1700 24th St. Two storeys, 24 x 30, frame construction, concrete foundation. Expect to start work about Nov. 10th.

Montreal, Que.

15 flats, cost $15,000, Richelieu St., for J. P. Tremblay, 341 Oxford Ave. Architect, R. Charbonneau, 15 St. James St. Owner doing all work by day labor. Three storeys, 80 x 68.

Residences, cost $15,000, Outremont (Outremont), for Denis Magnan, 1816 St. Dominique St., Montreal. General contractor, A. Piche, 524 Casgrain St. Three storeys, 60 x 60, concrete foundation, brick construction, felt and gravel roofing. Excavating done.

Residences, cost $25,000, Outremont (Champagneus), for A. Villeneuve, 20 Villeneuve W. General contractor, Jos. Charbonneau, 428 7th Ave., Rosemount. Concrete foundation, brick construction, felt and gravel roofing. Excavating done.

Two residences, cost $16,000, Westmount, Belmont and Westmount Ave. Owner, architect and general contractor, Geo. E. Blackwell, 4184 St. Catherine W. Two storeys, 40 x 62, 27 x 64, concrete foundation, stone and brick construction, felt and gravel roofing. Permit issued.

Flats, cost $15,000, Delorimier. Owner and general contractor, J. A. Duval, 1701 St. Lawrence St. Architect, Z. Trudel, 238 St. Andre St. Three storeys, 25 x 90, concrete foundation and brick construction, felt and gravel roofing. Excavating done.

Three flats, cost $15,000, Draper. Owners and general contractors, Laflamme & Bidford, 296 Prudhomme. Work done by by day labor. Two storeys, 24 x 36, concrete foundation, felt and gravel roofing.

Three flats, cost $16,000, St. Hubert. Owner and general contractor, L. Clement, 30 Christophe Colombe. Architect, Z. Trudel, 238 St. Andre. Work done by day labor. Three storeys, 25 x 122, stone and brick construction, felt and gravel roofing.

24 flats, cost $24,000, Westmount (Western Ave.). Owners, architects and general contractors, G. N. Clermont & Co., 97 St. James St., Montreal. Work done by day labor. Three storeys, 195 x 50, concrete foundation, stone and brick construction, felt and gravel roofing. Permit issued.

Quebec, Que.

Flats, cost $7,500, Limoilou (2nd Ave.). Owner, general contractor and carpenter, Philippe Cote, 157 Commissioners St. Other trades not yet awarded. Three storeys, 48 x 54, concrete foundation, frame and Scotch brick construction, felt and gravel roofing. Excavating done.

Regina, Sask.

Residence, cost $5,000. Owner and general contractor, D. O. Edgar, Garnet St. Two storeys, brick and frame construction, concrete foundation, shingle roofing.

Residence, cost $10,000, Rae. Owner and general contractor, Willis Rounding, Western Trust Block, c/o Rounding Land Co. 2½-storeys, brick and stone construction, brick foundation.

St. John, N.B.

Residence, cost $10,000, for Jno. Seeley, 100 Leinster St. Architect, F. Neil Brodie, 42 Princess St. General contractor, Jno. Flood, 123 Duke St. Walls up.

South Edmonton, Alta.

Apartment house, cost $18,000, 1st Ave. N. Owner and architect, Mrs. Z. Fontaine, 1st Ave. S. Work done by day labor. Three storeys, 26 x 80, frame construction, concrete foundation. Excavating done.

Toronto, Ont.

One pair residences, cost $6,000, Ashworth. Owner and general contractor, W. Prince, 17 Garnet, will receive tenders about Nov. 15th, for plastering, painting, heating, plumbing and electrical. 2½-storeys, 36 x 42, brick construction and foundation, shingle, felt and gravel roofing. Excavating done.

Apartments, cost $25,000, 1050 College St. Owner, general contractor and carpenter, Donnenfield Bros., 62 Spruce Hill Rd. Mason, T. H. Jones & Co., 314 Clinton St. General contractors will let roofing, plastering, painting, heating, plumbing and electrical. Three storeys, 48 x 62, brick and steel construction, brick and concrete foundation, felt and gravel roofing.

Four-family apartment, cost $15,000, 126 Springhurst. Owner and general contractors, W. & A. Hutchins, 167 Pearson Ave. Two storeys, 45 x 65, brick foundation and construction. Walls started.

Residence, cost $5,000, Nassau. Owner and general contractor, A. Rotstien, 55 Oxford St. Architect, J. H. Galloway, 23 Toronto St. 2½-storeys, 30 x 36, brick construction, brick foundation. Excavating done.

One detached residence, cost $15,000, Warren Road, for F. Mowat, 16 Spadina Rd. Architect, W. A. Langton, 38 North St. Mason, Orr Bros., Queen E. Carpenter, Booth & Co., 249 Davenport Rd. Balance of trades will not be awarded until about Nov. 25th. 2½-storeys, 28 x 40, reinforced concrete and brick construction, brick and concrete foundation, shingle, slate, felt and gravel roofing.

Seven pairs residences, cost $35,000, Gibson Lane. Owners and general contractors, Britnell Contracting Co., 209 Davenport Road. Architect, Neil G. Beggs, 12 Cosgrave Bldg. Tenders received by Architect. Two storeys, 40 x 48, pair, brick construction and foundation, felt and gravel roofing.

Apartment, cost $12,000, Dundas. Owner and general contractor, M. Shienkman, 405 Runnymede Rd. Architect, W. C. Mason, 358 Montrose Ave. Three stys., 40 x 60, brick and steel construction, brick foundation, felt and gravel roofing.

Westboro, Ont.

Residence, cost $5,500, Highland Ave. Owner, architect and general contractors, A. Rogers. 2½-storeys, brick veneer construction. Foundations in.

Residence, cost $5,500, Golden Ave Owner, architect and general contractor, G. F. Hinchcliffe, 39 Bayswater Ave., Ottawa. Brick veneer construction. Foundations started.

Winnipeg, Man.

Apartment building, cost $80,000, Lenore and Wolseley. Owner, heating and plumbing, L. Halpenny, 883½ Main St. Architect, D. Abramovitch, 219 McIntyre Bldg. Work done by day labor. Three storeys, steel and pressed brick construction, stone foundation, felt and gravel roofing. Excavating done.

Apartment block, cost $40,000, Lipton St. Owners and general contractors, West End Realty & Bldg. Co., Portage Ave. and St. James St. Architects, Hooper & Davis, Confed. Life Bldg. Three storeys, 40 x 86, 14 suites, stone foundation, pressed and common brick construction. Work postponed until 1914.

Two residences, cost $9,000, Lipton St. Owner, architect and general contractor, H. Haldorson, 48 Merchants Bank Bldg. Frame construction, stone foundation. Foundations in.

Apartment block, cost $65,000, Grosvenor avenue, for D. H. Bradley, care Architect, A. B. Scarlett, 797 Jessie Ave. General contractors, Winnipeg Stone Co., Elmwood. Walls up.

Power Plants, Electricity and Telephones

Burford, Ont.

Hydro power contemplated by the Village Council. By-law to be submitted in January.

Belleville, Ont.

Telephone exchange, cost $20,000, for Bell Telephone Co., H. O. Montreal. Architect, W. J. Carmichael, c/o Co., Montreal. Builders, Pounder Bros., 25 McNab St., Stratford. Three storeys, 25 x 50, brick veneer construction, cement foundation, felt and gravel roofing. Foundations in.

Forest, Ont.

Electric light plant planned by Town Council. Mayor, H. J. Pettypiece. Engineer in charge, H. A. McLean, Sarnia. General contractor, Wm. Ross, Sarnia. Contract for all electric meters and for transformers awarded to the Canadian Westinghouse Co., Hamilton.

Kingsville, Ont.

Transformer station, cost $7,000, for Edison Elec. Light Co. General contractors, The Albrecht Co., Detroit, Mich Concrete foundation, brick construction. Excavating done.

London, Ont.

Hydro Commission plan to purchase electrical apparatus, cost $20,000. Converter and other machinery to be installed for supplying hydro to companies not having direct current motors. Chairman, Philip Pocock. Engineer, H. J. Glaubitz.

Electrical apparatus required. The London Street Rly. Co. will use 800 h.p. hydro power, electrical converters and other machinery will be purchased. Manager C. B. King.

Montreal, Que.

Electrical installation in market, cost $6,103, for Town of Maisonneuve. Sec., Mr. Ecremont. General contractors, Canada Electric Co., 230 Dorchester W.

Owen Sound, Ont.

At a meeting of Council, Oct. 27th, Mayor and Clerk were authorized to sign contract for 1,200 h.p., price not to exceed $31 per h.p. Contract to run for 30 years. Power to be generated at Eugenia Falls on Beaver River. Transmission line about 30 miles. Plans to be prepared and contracts awarded during the winter,

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Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

Commission to start work of installing plant as early as possible in spring.

St. Marys, Ont.
Lighting equipment planned by Town Council (Water, Light and Heat Commission). Supt. of Commsn. Mr. Miller. Arc light system to be replaced with individual tungstens, brackets, etc., required.

St. Catharines, Ont.
Sub-station, etc., cost $116,000. By-law passed for stepping down plant and distribution system for use of hydro power. Clerk, J. A. Pay.

Winnipeg, Man.
Underground cable required by Board of Control. Engineer, J. G. Glassco, 54 King St. General contractors, Imperial Wire & Cable Co., Ltd., 902 Elec. Rlch. 5,500 ft. of No. 00 B. & S. 3 core, 2,200 volt, paper insulated, lead covered cable, $2,684.

Yorkton, Sask.
Electric power house, cost $36,000, planned by Town Council. Clerk, F. T. F. Atcheson. General contractors, Ritchie & Watters. One storey, brick construction and foundation. Foundations in.

Miscellaneous

Regina, Sask.
Lumber required by the City Council. Engineer, F. McArthur. City Commsr., L. A. Thornton. General contractors, Lumber Mfr.'s Yards Ltd., S. Railway St. For supply of lumber $9,908.40, for laying plank sidewalks, $3,296.40. General contractor, R. Flemming, 1554 Garnet St. Approximately 7 miles.

Toronto, Ont.
Tenders received until November 6th for construction and erection of 7,000 ft. of wire fence for the Humber Boulevard. Plans, etc., at Parks Department. Mayor, H. C. Hocken.

Business Notes

Brantford, Ont.
Factory and office building, Greenwich St., burned. Owned by Thornton's Ltd. (Hide, Wood and Leather Merchants). Manager, Percy S. Thornton, 120 Wellington St. Office building, two storeys, factory 1 and 1½ storeys, roof and upper parts of buildings destroyed. Loss on buildings, $6,000; contents, $60,000; insurance, $80,000. Will rebuild.

London, Ont.
Warehouse of Ontario Spring Bed & Mattress Co., 90 York St., burned. Loss to building and stock between $20,000 and $30,000.

Montreal, Que.
Wholesale house burned. Owned by the Brodeur Co., Ltd., China and Glassware, 86 St. Peter St., Montreal. Merchant, Alp. N. Brodeur. Loss $25,000.

Bakery of Jas McKeown, 370 St. Antoine St., burned. Loss $6,000.

Port Arthur, Ont.
Livery stables of Bert Graves burned, loss $5,000.

Paynton, Sask.
Factories burned, Colbourne and Wellington streets. Owners, Factory Waste & Machinery Co., Industrial Mfg. Co., Dom. Machinery Supply Co., Canada Machinery Co., Ires Modern Bedstead Co., Can. Office Furniture Co. Loss $200,000, partly covered by insurance.

Business block burned. Owned by R. Merrick, 74a Cumberland St. S. Loss $20,000, covered by insurance. To be repaired at once. Curved plate glass, store front required.

Hardware store, Cumberland St. S., owned by Fallis Foote Hardware Co., Cumberland St. S., burned. Loss $12,000, nearly covered by insurance. Store fixtures and stock required.

Winnipeg, Man.
Brewery, owned by Canada Malting Co., William Ave., and Board of Trade Bldg., Toronto, Ont., burned. Loss $100,000.

New Companies

Canadian Bitumastic Enamels Company, Ltd., has been incorporated with a capital of $40,000, to carry on business as a general contracting and building company, with head office at Toronto. The provisional directors are A. W. Holmstead, barrister, and A. B. Mortimer, law student, all of Toronto.

Niagara Brick and Tile Company, Ltd., has been incorporated with a capital of $100,000, to erect buildings and deal in building material, with head office at Niagara Falls. The provisional directors are F. W. Griffiths, H. F. Upper, solicitors, and W. B. Masters, real estate dealer, all of Niagara Falls.

Oshawa Central Land Company, Ltd., has been incorporated with a capital of $40,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are Russell Perkins, real estate agent, J. N. Dean, investment agent, and C. E. Johnson, bank manager, all of Toronto.

The A. M. Shaw Company, Limited, has been incorporated with a capital of $40,000, to carry on business as timber merchants, sawmill owners, etc., with head office at Fort Frances. The provisional directors are A. M. Shaw, lumberman, M. J. Noland, manager, and A. E. Carterm, merchant, all of Fort Frances.

Port Weller Land Company Limited, has been incorporated with a capital of $40,000, to carry on business as general contractors and builders, with head office at Toronto. The provisional directors are W. R. Wadsworth, D. R. Leask, barristers, of Toronto.

Clovelly Park Limited has been incorporated with a capital of $150,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are G. D. Waters, cashier, H. A. Hall, bookkeeper, and L. F. Black, accountant, all of Toronto.

Crescent Realty Company, Limited, has been incorporated with a capital of $40,000, to carry on business as builders and dealers in building material, with head office at Toronto. The provisional directors are J. J. Gray, G. H. Gray, barristers, and W. R. Willard, law student, all of Toronto.

Glen Grant, Limited, incorporated with a capital of $200,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are L. F. Black, accountant, H. A. Hall, bookkeeper, and G. D. Waters, cashier, all of Toronto.

Windsor Sand and Gravel Co., Ltd., has been incorporated with a capital of $40,000, to manufacture and deal in contractors and builders supplies, with head office at Windsor. The provisional directors are H. A. White, merchant, F. W. Barclay, bookkeeper, all of Windsor.

Toms Contracting Co., Ltd., has been incorporated with a capital of $40,000, to carry on business as brick manufacturers and dealers in all kinds of building materials, with head office at Toronto. The provisional directors are F. P. Toms, salesman, C. G. Toms, civil engineer, and A. W. Hunter, barrister, all of Toronto.

The National Forging Company, Limited, has been incorporated with a capital of $100,000, to carry on business as a general land and building company, with head office at Chatham. The provisional directors are G. H. Quennard, manufacturer, of New York, R. W. Hees and L. L. Odette, manufacturers, of Tilbury.

Hamilton Home Construction Company, Ltd., has been incorporated with a capital of $100,000, to carry on business as contractors, lumbermen, etc., with head office at Hamilton. The provisional directors are T. A. Silverthorn, F. J. Foley, barristers, and J. H. Flett, law student, all of Toronto.

The Uxbridge Foundry Company, Ltd., has been incorporated with a capital of $40,000, to carry on a general foundry, carpentry and contracting business, with head office at Toronto. The provisional directors are W. S. Thomas, broker, R. J. Christie, valuator, and W. W. Cole, accountant, all of Toronto.

Hamilton-Buffalo Real Estate Company, Ltd., has been incorporated with a capital of $200,000, to carry on business as a general land and building company, with head office at Hamilton. The provisional directors are R. L. Smith, merchant, Lewis Mitchell, manager, and F. H. Gage, builder, all of Hamilton.

Gummed Papers, Limited, have been incorporated, with a capital of $50,000, to carry on business as paper manufacturers, dealers in wood pulp, etc., with head office at Georgetown. The provisional directors are R. R. Barber, E. R. Colbert, manufacturers, of Georgetown, and G. F. McFarland, barrister, of Toronto.

General Investments, Limited, have been incorporated, with a capital of $40,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are A. H. Goodenow, D. A. Atkinson, accountants, and A. H. Moore, clerk, all of Toronto.

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	27 00
No. 1 Hemlock Decking	25 00	27 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	27 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 90	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.50

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 7 cents per lb.; traps and bends, 40 per cent.; pig lead, 5¾ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.28	¼ inch	$3.18
⅜ "	2.28	⅜ "	3.18
½ "	2.72	½ "	3.57
¾ "	3.28	¾ "	4.43
1 "	4.85	1 "	6.55
1¼ "	6.56	1¼ "	8.86
1½ "	7.84	1½ "	10.59
2 "	10.55	2 "	14.25
2½ "	16.67	2½ "	22.52
3 "	21.80	3 "	29.45

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 60 and 5 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.35 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	65c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 65 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $17 to $18 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 40 and 42½ per cent.

Free stone delivered, $17 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.15 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.40 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $7.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 33 cents; white, 43 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $8.40 per 100 lbs

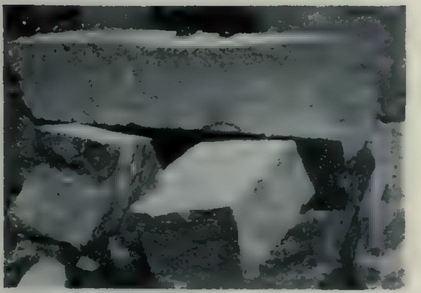
Boiled Linseed Oil in bbls., 67c per gal of 9 lbs.

Raw Linseed Oil, in bbls., 64c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.



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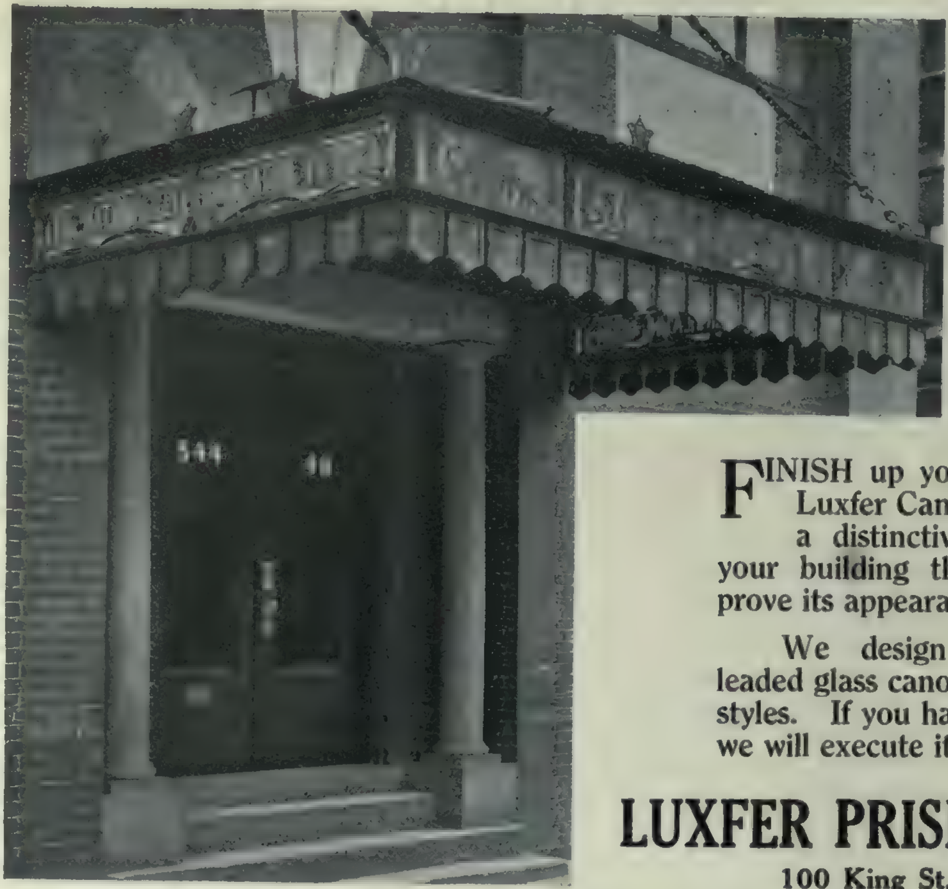

A Luxfer Canopy

FINISH up your entrance with a Luxfer Canopy and you will add a distinctive "something" to your building that will greatly improve its appearance.

We design and manufacture leaded glass canopies of all sizes and styles. If you have your own design we will execute it faithfully.

LUXFER PRISM CO., LIMITED
100 King St. West, Toronto

Storage Houses Oil Houses

¶ We have the best possible facility for making all kinds of storage houses of one storey, no matter of what dimensions.

¶ We will undertake to furnish and erect such buildings complete ready for occupancy.

¶ No steel building is too small or too large for us to figure on.

¶ We shall be pleased to furnish estimates and sketches on this class of work at any time. Write us and tell us what you need and we will prepare estimates for you at once.

Cut shows an all-steel building used for storing expensive patterns and dies. The size of this is 18′ x 39′ and it has been doing service for years and gives the same good service as when erected.

The Metal Shingle & Siding Company, Ltd.

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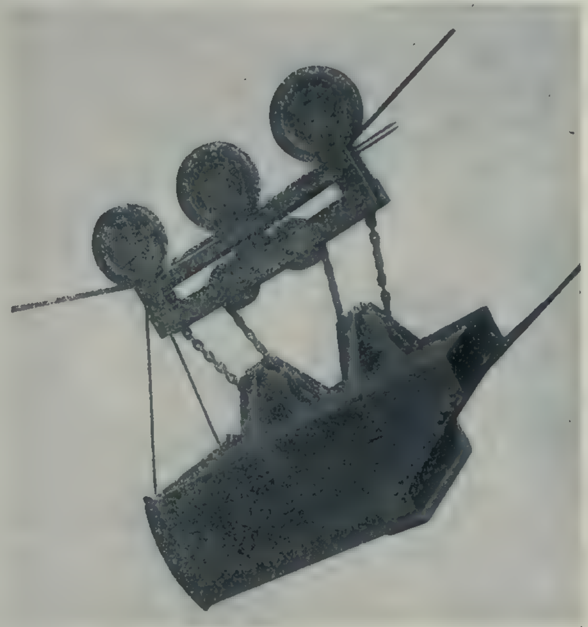
THE DULL DRAG LINE EXCAVATOR



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**Alphabetical Index of Advertisers
Page 16**

Vol. 27 November 12, 1913 No. 46

City Awards Without Tenders

THE recent action of the Montreal City Council in awarding to the Elder-Elbano Company the contract for next year's supply of asphalt at $26.00 a ton without calling for tenders is open to criticism in whatever light it may be viewed. The defence is that under the arrangement effected the council can obtain any quantity of the asphalt they like without stipulating the amount in the contract and that the quality of the asphalt is beyond dispute, it having been in use for some three years. One of the authorities indulges in the open confession that it is sometimes necessary to "take a chance" in purchasing material ahead of requirements.

In this instance we are persuaded that the element of chance is entirely in favor of the successful contractor. Fortune can favor the Montreal ratepayer only in the unlikely event of an extraordinary scarcity of asphalt which would cause the material to soar above the price contracted for by the city.

There are cases in which the field is so restricted that calling for tenders would be a mere formality, but this argument cannot be adduced in favor of the course taken at Montreal. One of the controllers admits that an offer at $21.00 a ton was declined on account of the doubtful quality of the asphalt. Could not this doubt have been removed by submitting the material to a testing expert?

But there is another consideration which would seem to indicate that competition was not sought for. A local building supply firm declare that if tenders had been asked they would have put in a price of $25.10 a ton for asphalt which comes from Vera Cruz, Mexico, only five miles away from the source of the Elder-Elbano Company's supply.

Figuring the amount of asphalt which the city will use at eight thousand tons, the difference between $25.10 and the accepted figure of $26.00 means a loss of $7,200.

One's state of mind in considering such a matter is complex. It is difficult to determine whether the dominating feeling permits one to congratulate the Elder-Elbano Company, to condole with the ratepayers or to censure the administration.

All things considered, perhaps the most abiding impression is that the city authorities should not have the power to award such contracts without calling for tenders. Awards of this kind are not calculated to promote an observance of the unwritten code of contracting ethics.

The Gratuitous Bid

UNDER some such title as "The Ethics of Tendering" a work would make interesting reading, especially having regard to the fact that ethics play but a small part in this preliminary to a contract. In the everyday business transaction the labourer is deemed worthy of his hire. The reward may be small to negligibility and may be utterly inadequate to the services rendered; none the less, commerce is not based upon philanthropy, and payment or promise of payment is the basic condition in every business transaction. Contractors, as a class, stand apart. They alone among men are required to render gratuitous service, and it must be remembered that to refuse such service would spell certain bankruptcy. That a contractor is a man who carries out contracts is an obvious definition within the intelligence even of Macaulay's schoolboy, and it is equally obvious that before a contract can be obtained a competitive tender must be submitted. For this preliminary work the contractor is paid nothing, and insult is added to injury by calling upon him to pay a lump sum down—returnable possibly, but none the less payable—for the privilege of having his gratuitous work considered side by side with other and similar gratuitous work.

It is argued by those interested in preserving the present system that no other course is possible. Prices, and competitive prices necessarily, must be obtained, and the contractor must rest content with his sporting chance. He obtains at least a percentage of the jobs for which he tenders, and what he loses on the swings he can very well make good on the roundabouts. But there is another way of looking at it. A contract is advertised and thirty men go to the trouble and expense of pricing the bill of quantities. Now of these thirty men, twenty-nine stand to get no return whatsoever. Their work must be purely gratuitous, without reward either present or future, and the same thirty men will compete again and again with each other, with a similar result. There would be some element of scant justice if failures went to a man's credit, if, in other words, repeated tendering insured some degree of preferential treatment. But this is not so, and the evil has grown apace, until men have been forced to recognise the fact that cut prices are the only road to success. And with cut prices—cut only too often below the actual cost of honest workmanship and good material—have come scamping and subterfuge of a virulent type. The contractor is the last man who should be blamed. He is merely the victim of a pernicious system, to the code of which he must conform if he would live.

The sole alternative is to pay the contractor for the trouble he is put to in tendering and to reimburse him any expenses he may incur. Only those who have been behind the scenes can appreciate the amount of labour involved in pricing a large bill. Beyond the actual pricing there will be visits to the site of the proposed works and to the offices where the plans are deposited; inquiries galore will have to be instituted concerning local prices, transport facilities, time deliveries and a hundred and one other items; while rough tracings and a precis of the specification have not infrequently to be made. Now, is there any reason why all this should be done, say, twenty-nine times over, for nothing? To pay for services rendered would add necessarily to the expense of the job, but surely it is not fair to expect nine-and-twenty men to relieve the employers of what amounts really to a legitimate expense. The employers benefit (or hug themselves in the belief that they do benefit) by competitive tendering, and there is no reason on earth why a portion of the expenditure they are saved in the carrying out of the work should not find its way back into the pockets of the unfortunate twenty-nine who are left out in the cold. As matters stand now an employer can obtain a hundred prices without one penny of expense, and (deeper depth) he need not even accept one, owing to that delightful clause "the lowest or any tender will not necessarily be accepted." From whatever standpoint the matter is viewed, one broad fact remains, and that is that it is grossly unfair and commercially immoral to compel any body of men to work for nothing. Tradition, custom, expediency—these may all be urged in extenuation, as they have been urged over and over again in extenuation of almost every other injustice perpetrated by man upon his fellows. But the bedrock fact remains; and one may leave it at that.

Competitive Tendering

COMPULSORY and gratuitous competitive tendering brings many evils in its train, among which scamped workmanship and inferior materials take an easy first. The lowest tender is almost universally the one accepted, and the whole ingenuity of the estimating clerk must be directed towards cutting things fine. A full and well-drawn bill, without errors or omissions, is his despair. His work must then be confined to pricing and extension. But his chance comes with a lax bill, and if he knows his work he is quick to take advantage of it, subject of course to the approval of his boss. Thus, an important item may have been under-measured, and extras on it will arise upon final adjustment. This item he prices high—as high as the job, having regard to the total, will stand. Another will be over-measured and this, with the inevitable deduction starting him in the face, will be priced correspondingly low. The two items may be made to equal each other so far as the total goes, but the very reverse takes place on settlement. An omission may be prepared for in similar manner, the scheduled items of work being so manipulated as to return a smart profit when it is valued. Careful inspections of the site, after as careful a perusal of the plans and specification, will often reveal a lot to the experienced contractor. He will realise difficulties which have escaped the notice of the engineer, and will be able to anticipate to a nicety the variations, omissions, and additions which together may not only save the loss inevitable upon his cut prices, but may return him a fair profit. Assuming however that the bill is absolutely correct, and that nothing in the way of variations, omissions and additions arises, the engineer is in for a worrying time if the accepted tender has been cut too fine. Even a contractor must live, and unless he be in a big way and prepared to meet his losses, circumvention of the engineer is his only chance. A warfare of wits commences from the day the first sod is turned, and who will win lies on the knees of the gods. Many an engineer has built up a reputation by "breaking" contractors, but on the other hand a dishonest contractor has many a time and oft ruined the reputation of the engineer.

Now nothing of this kind should be necessary. Work is to be done, and the man who does it should be paid its cost with the addition of a certain profit. It is absolutely immoral and dishonest to compel an unfortunate man to continue the execution of work upon which he is losing large sums. There should be some method of arbitration, some court before which a case could be argued and the contractor afforded what measure of relief he might be entitled to. It is obviously wrong that an employer should reap a profit from the contractor's loss. For every evil of this kind competitive tendering, with the acceptance of the lowest tender, is primarily to blame, and censure should be placed upon the engineer who recommends his client to accept a price palpably below that at which the work could be creditably performed. The acceptance of the lowest tender but one is a way out of the difficulty and a case for it has been ably argued on many occasions. Space does not allow the points urged in its favor to be detailed here, and it must suffice to say that the adoption of the system would give the deathblow to cut-throat tendering, for a man would have to be as careful not to go too low as he is now not to go too high!

The system of deposits is one against which contractors should clamour in a common voice. To ask a man to submit with his tender the name of two personal sureties or the bond of a guarantee company is carrying things quite far enough; but it is simply iniquitous to demand the deposit of ten per cent. of the amount of the tender, for forfeiture if he decline to sign a contract or fail to complete his contract in accordance with the terms of the tender. A man may have excellent reasons for withdrawing his tender, especially when he has seen the tenders of his competitors. A mistake may have been made, the price of certain materials may have gone up during the time that has elapsed between the submission and acceptance of his tender, labour troubles in certain trades may be pending, other and more favourable work may have come in—there is no end to the reasons which may prompt a contractor to desire withdrawal, and why in the name of everything honest should a man not be allowed to change his mind (for a good and sufficient reason) at any time before the actual signing of the contract? Delay in the carrying out of this formality may itself offer good cause for withdrawal, for in certain classes of work the season of the year in which it is commenced may mean just the difference between profit and loss. Then when the work is well in hand things may go wrong with the contractor. He cannot proceed; and his ten per cent. deposit on the whole sum stands forfeited. In common fairness the employer should at least deposit an equal sum with the contractor, so that, if for any reason for which the employer is responsible the contract is not signed, or having been signed is not completed, the contractor may annex the deposited sum. As matters are, he stands to lose on every count.

Hamilton City Engineer's Suggestion

IN our issue of November 5 we referred editorially to the suggestion to have the proposed Canadian municipal engineering organization affiliated with the Institution of Municipal and County Engineers of Great Britain. Apropos of this suggestion Mr. A. F. Macallum, City Engineer of Hamilton, writes us as follows, offering a counter-suggestion:—

"I do not see what can be gained by affiliation with the Institution of Municipal and County Engineers. While the editorial sounds very plausible, the conditions are not parallel with ours, as are those existing in the country to the south of us—facetiously called "the land of the free." While such amalgamation might be of slight mutual benefit, yet it would not be nearly so considerable as in the case of amalgamation with the American Society of Municipal Improvements, which has now just absorbed the Society of Standard Specifications and whose problems and municipal endeavors are identical with our own. Several municipal engineers are already members of this society,—in fact Mr. C. H. Rust, of Victoria, is a Past-President. A perusal of their proceedings will show the benefit that would be derived from such an association."

The Good Roads Movement

THE great scope for the Ontario Good Roads Commission was shown conclusively at the recent meeting in Ottawa which was attended by representatives from almost every municipality in the Ottawa valley. It will be remembered that this commission was appointed by the Ontario government last July to investigate the good roads movement, particularly in the older and more settled portions of the province. It will submit a report making suggestions as to how the interests of the movement can best be promoted. The commission has visited various parts of the United States, and members have attended conventions where the good roads problem has been taken up. With a view to awakening public interest a series of meetings at different points in the province has been arranged, with the object of giving those interested an opportunity to come forward and express their views on the subject—a subject, which as expressed by the chairman of the commission, "begins with the assessment roll and ends with greater facilities and comfort in the conduct of the business of the entire country."

The Commission as a body is well equipped for the work in hand, comprised as it is of Mr. C. A. McGrath, of Ottawa, the chairman; Mr. A. M. Rankin, M. L. A. for Frontenac, and Mr. W. A. McLean, chief engineer of the Provincial Department of Highways.

The appointment of this commission by the Ontario government is intended doubtless to lead to a larger and more complete organization for road building. It may be expected confidently that it will lead to such an organization as will create permanency in every respect, for authorities and public alike are coming to a general appreciation of the fact that good roads are essential to the greatness of any country.

One of the most encouraging features of the meeting at Ottawa was the high type of opinion expressed by those giving evidence for the commission, showing that the people realize the magnitude of the good roads question and that they are thinking carefully along the line of more efficient organization. There is an intensity of public interest which will overcome all obstacles, just as the intensity of public interest in road building overcame incomparably greater obstacles in the days of the Roman ascendancy. The ready response which the commission met at Ottawa is most significant.

Among the many valuable suggestions received mention may be made of a main road between Ottawa and Prescott; a main road along the St. Lawrence shore; a permanent Highways Commission; general Government supervision of local road construction; a fixed Government standard for local road construction; the abolition of statute labor; and a centralization of control such as would ensure uniform local development.

Electrical Sterilisation of Water

A NEW electrical water steriliser is described in a recent issue of the Engineering Record of New York. This is a direct-current sterilising machine, for which it is claimed that it will remove colour from the water, and that it will destroy and remove all vegetable matter and pathogenic germs, leaving the water bright, sparkling and full of oxygen. It is to be noted that the electrical process is followed by settlement and double filtration, so that the process is not entirely electrical.

In this particular apparatus the water passes first through an electrode box consisting of a series of pure iron plates separated by marginal insulating gaskets. These plates are perforated at alternate ends, so that the water passes through the holes and between the plates through the whole series, and is exposed in a film to the surfaces of the plates in succession. Electric connections are so arranged that the entire series of water films is in the circuit at the same time. The effect of the current passing through these films of water is partly to dissociate the hydrogen and oxygen of which the water is composed, and at the same time to throw off hydroxide from the pure iron plates. The oxygen in its present form permeates the entire water body, and by oxidation is said to assist in destroying all animal and vegetable life in the water. The iron hydroxide surrounds the matter in suspension, forming a sponge-like mass. The water then passes from this electrode box into a settling chamber, where the heavier matters settle. Thence it passes to a filter, through which it flows to a second filter, after which it is ready for consumption. There are special arrangements for preventing clogging of the filters and for cleaning.

The machine works with a direct current of from 110 to 220 volts, and the electrode box is arranged to take any number of plates, the voltage between the plates being regulated by the number of plates put in series.

The machine is controlled by the Electric Water Sterilising Company of Scottdale, Pennsylvania, and is said to be an improvement made by Mr. H. B. Hartman over his patents of 1909 and 1910.

A steel bridge of continuous-arch type has been built over the Drau River at Marburg, Germany, and was recently opened for traffic. The bridge comprises three main arch spans of 131-ft. span each, made of girder ribs. The ribs of adjoining arches are continuous where they meet and are supported on the river piers by segmental roller bearings. The thrust is taken by the end abutments only. Unequal loading of adjoining spans producing differences in thrust must, therefore, be taken care of by distortion of the arches. The steelwork of the bridge amounts to 1,000 tons.

Greater Vancouver Sewerage Scheme

Organizing and Financing Project for Draining 55,600 Acres, with Data on Rainfall and Float Tests of Dispersion of Outfalls

THE very rapid increase of population in and around Vancouver, B.C., requiring a corresponding development of sewerage systems, has brought about the necessity for more or less sewer construction in the near future in each of the natural drainage basins of Burrard peninsula. This peninsula includes 55,600 acres, of which only 9,500 acres are within the present boundaries of Vancouver, the remainder being in New Westminster, South Vancouver, Point Grey and Burnaby. However, the ultimate necessity of a joint sewer system embracing the entire peninsula was early recognized, and in 1910 steps were taken to secure united action before there should be constructed by any of the independent municipalities, sewer systems which might not harmonize with the scheme most desirable for all.

Accordingly, in April, 1911, the several municipalities, with the exception of New Westminster, appointed a committee, composed of two representatives from each council, for the purpose of inquiring into the best means of placing the question of sewerage and sewage disposal on a sound and permanent basis. This committee retained Mr. R. S. Lea, consulting engineer, of Montreal, to advise them as to a general scheme for the whole peninsula and the best means of constructing and maintaining such a scheme in a state of efficiency. Acting on these instructions, a comprehensive report was submitted early this year and adopted by the joint committee.

The report advised the formation of a permanent sewerage board, and in February, 1913, there was drafted an act, based on the recommendations of the report, forming such a board. The Provincial Government was then approached with a request for legislation, and at the same time was asked for financial assistance in the form of a Government guarantee for a bond issue. With some minor amendments, the act passed the legislature and became effective August 1, 1913.

This act virtually gave Government sanction to the board of control, a Government guarantee to secure the bonds which would furnish money for construction and empowered the board to construct and maintain sewer systems in accordance, substantially, with the report which was submitted by Mr. Lea. The act provides that the chairman of the board shall be appointed by the Lieutenant-Governor in council, the other members also being so appointed on recommendation of the municipalities which they represent. The chairman and other members of the board "remain in office during the pleasure of the Lieutenant-Governor in council," who fixes the salaries of each.

The Government guarantee covers the interest on the $10,000,000 for which the board is empowered to issue bonds and $5,000,000 of the principal. Anticipating the possibility of some time being required to dispose of the bonds, the board has been authorized to borrow $350,000, so that there shall be no delay in carrying out that part of the work required at once.

It was proposed to finance the sewer development on forty-year bonds and to design the systems so as to be of adequate size for handling the sewage of the probable population in 1950. In order not to burden the ratepayers of to-day with an excessive capital outlay on sewers for future needs, estimates embodied in the report were divided into "immediate construction" and "deferred construction"—the former covering work to be carried out during the next five years at a cost of $5,500,000 and the latter covering the probable extension in the ensuing twenty-five years at an approximate cost of another $5,500,000. This plan makes it possible to go ahead immediately with sewer construction wherever needed, and at the same time co-ordinates the work in various districts so that all is combined into the most advantageous system.

Population Curve

For the purpose of estimating the population increase of Vancouver the growth of six American and three Canadian cities has been plotted, as shown in the accompanying diagram, the starting point in each case being taken at a time when the city had a population of 150,000, which was approximately the population of Burrard peninsula in 1911. On this chart it is noticeable that inland cities show a slower rate of growth than seaports, and also that there is a great difference in rates. Growing at the rate that applied to Boston in the forty-year period following the 150,000 stage, Vancouver would have a population of 500,000 in 1950, while if it grew at Chicago's rate the population in 1950 would be 2,000,000. The curve for Vancouver has been plotted midway between that of Chicago and New York, and the sewer development has been designed so as to permit of its being extended from time to time until there is provision for a population of 1,400,000.

Five Drainage Areas

Burrard peninsula is divided naturally into five drainage areas, which discharge respectively into Burrard Inlet, False Creek, English Bay, Fraser River and Burnaby Lake. Each of these areas was studied as a separate problem in laying out the general scheme, except that the disposal of sewage from each area was considered in the light of its relation to the other districts or the waters there available for dilution. The volume of sea water subject to tidal flow which was adopted as necessary for diluting sewage without nuisance or injury to fish life was taken as 100 times the quantity of sewage involved.

The average rainfall in Vancouver for the last seven years has been 56 in. per annum. During 1912 careful records kept at New Westminster showed that on only three days did more than ¼ in. of rain fall in an hour. On the other hand, very heavy downpours occur at rare intervals, and drain capacities are required for storms such as the one that occurred in June, 1913, when there was a precipitation of 0.45 in. in ten minutes and 0.9 in. in thirty minutes. The sewerage systems now under way, however, are being constructed on the combined system, with the exception of the False Creek and English Bay areas.

English Bay and False Creek

The total area draining into English Bay and False Creek is 8,650 acres, which is estimated to have a population of 270,000 in 1950. The standard of purity demanded for the foreshore waters of English Bay is high owing to the presence of bathing beaches, and for the area affecting these waters a separate sewerage system is advised, limiting the combined system to those parts of this basin where is has already been installed. The point of discharge selected for this area is in English Bay, some 5,000 ft. out from the shore on the line of Imperial street. The first outfall pipe will be 60 in. in diameter, and will be carried out, at first, a distance of 3,000 ft. and will be extended and other outfall pipes added as the population increases. One of the reasons for selecting this outfall location was that there is a stretch of level land near by on which some form of sewage-treatment works could be installed, should these become necessary at some future time.

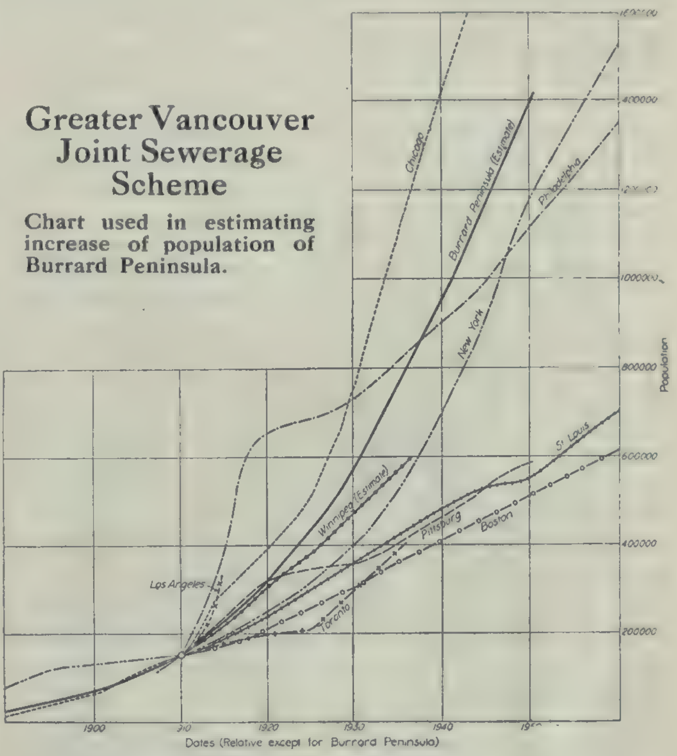
The route to be followed by the interceptor passes first along the high-water mark on a grade of 1 in 2,700, the sewer here having an inside diameter of 9 ft. and beginning with its invert elevation 93 ft. above the city datum. At Balaclava Street, meeting the Balaclava sewer, the diameter decreases to 8 ft. and the interceptor continues on a grade of 1 in 2,400. Five main trunk sewers feed this interceptor, as well as two low-level areas from which sewage will eventually have to be pumped. The largest of the five contributory areas is served by the Balaclava trunk sewer, 2,350 ft. of which has already been completed. This completed section has an inside section 10 ft. 4 in. wide by 8 ft. 3 in. high, and pending the construction of the interceptor has a temporary outfall direct into English Bay.

Float Measurements

Before selecting the location of the Imperial Street outfall numerous float experiments were made to determine the point where the best diffusion could be obtained. The accompanying chart shows the average dispersion of floats for various periods of time. The floats used were cut from 6 x 6-in. timber in 2-ft. lengths, and were weighted so as to float upright. It was found that the Fraser River caused a definite current from Point Grey to the First Narrows at all stages of the tide, the effect being more marked during the high stages of the river. Between this line and the shore there was found to be at all times a circular, clockwise movement of the water. The two float charts reproduced herewith show what comparatively slight advantage there would be in placing the outfall at the extreme end of Point Grey, although at first sight this might seem to be by far the more desirable location.

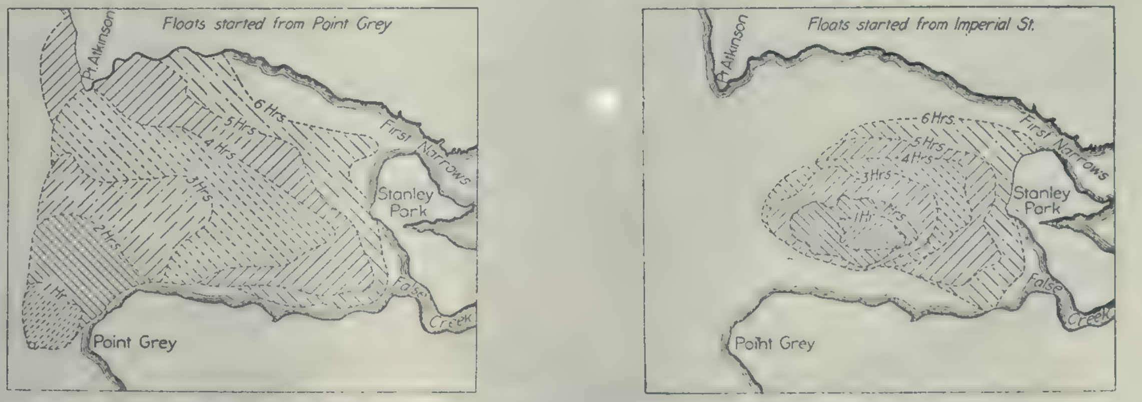
Fresh and Salt Water

An important feature of the Fraser River effect on English Bay is that the fresh water spreads out above the salt water and covers a larger area than would be the case if these waters, by reason of temperature differences, mingled along the line of contact. The Fraser River water normally extends to a depth of 10 feet below the surface, the depth reducing to a thin sheet along the line of advance of an incoming current. The river water carries much glacial silt and its muddy color readily distinguishes it from the clear water of the bay. This color difference often makes the slight depth of the overlying fresh water apparent in the wake of vessels, a path of clear water marking that which has been churned from below by the propeller. The surface blanket of fresh water will have a beneficial effect on sewage dilution, it is believed, because of its lower specific gravity, which will retard the tendency of sewage to float. Although the prevailing winds at the outfall are off shore, arrange-



Greater Vancouver Joint Sewerage Scheme

Chart used in estimating increase of population of Burrard Peninsula.



Dispersion in English Bay of floats starting from two different points.

ments are to be made for the interception of all floating matter, so as to prevent the possibility of any of it being carried back and strewn along the beach.

False Creek has an area at high tide of about 1½ sq. miles, and the volume entering it on a 10-ft. tide is about 1,600,000,000 gal. Due to the fact that there are bathing beaches on either side of its outlet, it is not considered a suitable place for the dilution of raw sewage. It is, however, looked upon as a relief outlet, in times of heavy storm, for those adjacent areas where the combined system is in use.

Burrard Inlet

The principal discharge into Burrard Inlet will be through an outfall located at Clarke Drive, which is to drain an area of 8,250 acres, with a population, it is estimated, of 238,000 in 1950. Parts of the area being made tributary to the Clarke Drive sewer would naturally drain into False Creek and Burnaby Lake. In view of the fact that the upper part of False Creek is about to be filled in, it is recommended that suitable provision be made prior to this fill for a relief outelt, which would come into use should the Clarke Drive outfall become gorged by any extraordinary rainfall.

In rating the capacity of Burrard Inlet for diluting sewage it was assumed that at some future date a dam might be thrown across the Second Narrows. For this reason, only that area between First and Second Narrows was considered available, and of this area one-half was figured as belonging to the north shore. Thus, omitting as before the low-water volume, there remained one-half the tidal volume between the First and Second Narrows, which would, on a basis of 1 to 100, effectively dilute the sewage from a population of 1,200,000. Besides the Clarke Drive trunk there are smaller sewers which are to discharge in Burrard Inlet, the largest being the Hastings Park outfall, draining 800 acres. The only requirement for these smaller sewers is that the outfall pipe be carried beyond the pier line into deep water.

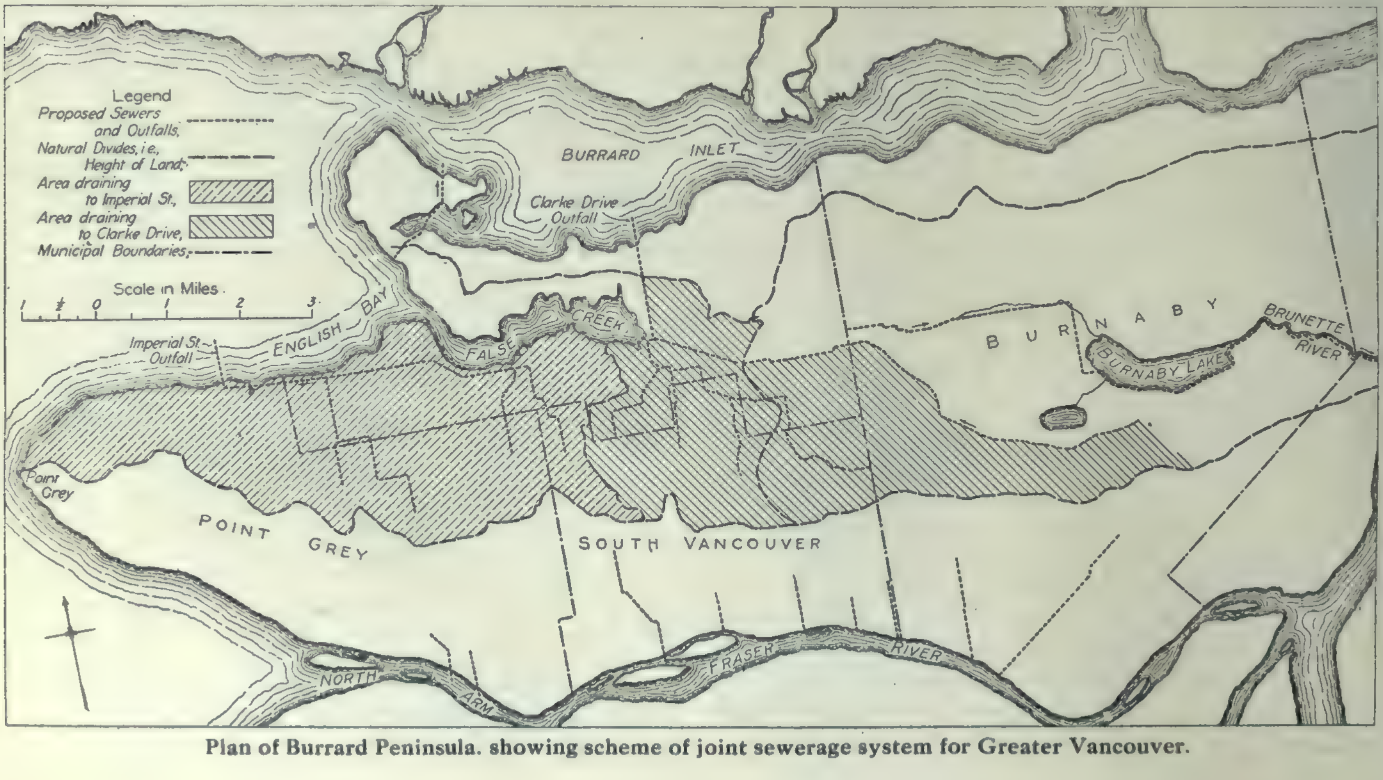
Because of there being little through current in Coal Harbor no outfall will be permitted between Brocton Point and the Canadian Pacific Railway wharf. The present sewers discharging into this area are to be intercepted and the sewage carried across to the northeast shore of Stanley Park, where the tidal currents run as high as 9 knots per hour.

Burnaby Lake

Burnaby Lake has a mean water area of about 430 acres, with a maximum depth of 9 ft. After a period of dry weather it is practically stagnant and not capable of digesting any amount of raw sewage. The total area draining into this lake is about 26 square miles, which has its only outlet through the Brunette River. By 1950 it is estimated that the population of this watershed will be about 200,000, and the placing of streets and roofs over the present highly absorbent soil of the basin will materially change the runoff. It is estimated that with this population the heaviest storms will give rise to a runoff from the watershed of at least 4,000 sec.-ft. That is to say, assuming a velocity of 5 ft. per second and a channel depth of 10 ft., the outlet will have to be 80 ft. wide. It is pointed out that it will be of the utmost importance to conserve the natural drainage channels of this district. In the estimates for "immediate construction" there is an item of $200,000 for improving Still Creek and the Brunette River and providing two interceptors for sewage disposal during the next five years.

Fraser River

The minimum discharge of the Fraser River, occurring in March, amounts to about 20,000 sec.-ft. at Hope, B.C., which is 80 miles above New Westminster. The maximum flow, which comes in June, is about 40,000 sec.-ft. Just below New Westminster the north arm leaves the main river, and the influence of tides here makes it difficult to determine the proportional flow down each of the channels. It is believed, however, that the flow in the north arm will never fall below 1,000,000,000 gal. per day under present conditions. This amount, on the standard basis of dilution, would handle the sewage from 100,000 persons. On the same



Plan of Burrard Peninsula, showing scheme of joint sewerage system for Greater Vancouver.

basis the minimum flow of the river would oxidize the sewage of 900,000 people.

The area contributory to the north arm of the Fraser River includes 17,000 acres, and in 1950 the estimated population on this area will be 250,000. To meet the needs of the district in the next five years the combined system trunk sewers indicated on the map have been provided for in estimates for "Immediate Construction." It is believed that the time will come when an interceptor will have to be constructed or some form of local treatment introduced in this area. Provision for the former has been made in estimates on "Deferred Construction."

The surveys, estimates and designs embodied in the report submitted by Mr. Lea were made under the personal supervision of Mr. A. D. Creer, Mem. Can. Soc. C. E., A.M.I.C.E., who is still in charge of engineering work for the Greater Vancouver joint sewerage board.—Engineering Record.

New Method of Concentrating Sewage Sludge

THE method which is mostly in use for concentrating sewage sludge is that of filter pressing. I have found that practically the same results that are obtained by filter pressing can be achieved in a far simpler and cheaper manner, writes Dr. Grossmann, of Manchester, Eng., in the Surveyor. In order to make my explanation perfectly clear it is necessary to begin at the beginning—that is, at the point at which the sludge is ready to be taken from the settling tanks.

It is stated in text-books, and generally accepted, that the sludge which is obtained from settling tanks contains from 5 per cent. to 15 per cent. and over of solid matter. With proper arrangements and management there should be no difficulty in obtaining from the settling tanks sludge which averages between 10 per cent. and 15 per cent. of solid matter, and even more.

I have on a previous occasion (Journal of the Society of Chemical Industry, January 15, 1912) gone into the question of sludge disposal, and I have shown there that, in making one's calculations on the proper basis—i.e., only reckoning the actual sludge worked up, and not including lime or precipitants which have been added (and which are only so much dead weight), the cake produced by filter pressing will not, on an average, contain more than from 25 per cent. to 30 per cent. of actual sludge, and that where centrifugal machines are used for the purpose the results obtained are even below these figures. I have also shown that in practical work the costs of sludge disposal by filter pressing are much higher than is generally assumed. This is due to the fact that, instead of stating the results obtained on the amount of actual sludge which has been worked up, the sum of the actual, precipitants and lime has been taken for that quantity, and thus rendered comparisons with regard to cost of different methods of sludge concentration and disposal entirely fallacious.

If, then, we have our calculations on the amount of actual sludge contained in the pressed cake we may take it that, as a fair average, it does not contain more than 27½ per cent. of actual sludge. I have found, as I shall show later on, that sludge of any description can be manipulated in such manner as to yield by settling a product which will contain from 20 per cent. to 25 per cent. (say 22½ per cent. on an average) of actual sludge, and the question arises whether it is worth while to filter-press sludge when such results can be achieved by far cheaper means. Of course, if we compare the consistency of settled sludge with filter-pressed cake containing the same percentage of actual sludge the latter appears more solid; but this is chiefly due to the percentage of lime which has been added in order to facilitate pressing and to obtain a cake of fairly solid consistency. That amount of lime varies considerably; it may be anything from 10 per cent. to 50 per cent. of the actual sludge and more; but lime is an expensive material, and where filter pressing is not resorted to there is no reason why another material whch would stiffen the consistency of sludge should not be equally applicable. The cheapest material of that kind available is cinders, and I have found that by adding from 10 per cent. to 20 per cent. of fine-riddled cinders to sludge of 22½ per cent. a mass can be obtained which in every way is equal to the average filter-pressed cake produced at sewage works, and whereas it costs from 2s. 6d. to 5s., and more, to obtain 1 ton of pressed cake containing 27½ per cent. of actual sludge, a product of the same consistency can be made from settled sludge of 22½ per cent. and cinders at a cost of less than 8d. per ton. Calculating this on 27½ per cent. instead of 22½ per cent., it is evident that the same amount of sludge as is contained in 1 ton of pressed cake can in this manner be disposed of at a cost of less than 1s. In many cases it will, of course, not be necessary to mix the settled sludge with cinders.

I have found that with sludge of from 10 per cent. to 15 per cent. or more of solid matter from the settling tanks, a tank of the description given in my Patent Specification No. 28328/1911, and worked on similar lines to those given there, will enable one to obtain sludge by secondary settling, which will vary from 20 per cent. to 25 per cent. according to the quality of the sludge; these tanks work very satisfactorily, with one drawback, and that is, that as the sludge in coming from the settling tanks cannot be obtained of uniform consistency, the time required for settling in these tanks varies. Further difficulties are encountered in the case of sludge which is in that peculiar stage of decomposition which lies between fresh sludge and sludge which has been completely septicised, and in which state the sludge becomes unmanageable so far as settling operations are concerned. I have therefore endeavored to discover a method by which sludge of any description can be concentrated in settling tanks to approximately 20 per cent. of solid matter, and I have ultimately succeeded in this. I have found that on mixing sludge with a small amount of acid and letting it stand for a few days a complete separation takes place. The sludge settles out at the top in a thick layer, while underneath is a clear, or almost clear, liquid, and the two can be separated by running off the clear liquid from the bottom. Any tank with an outlet at the bottom can be used for the purpose, but preferably I use a tank of similar construction to that described in the patent previously referred to, and in which the thick sludge obtained after running off the clear liquor below can be further concentrated by draining and filtering. The principle of the method consists in the fact that nearly all sludge contains sufficient sulphides and other compounds which, in contact with acid, produce gaseous matter, which surrounds the particles of sludge and acts in the same way in which a lifebelt acts with human beings, thus enabling the sludge to float on the top of the liquid. Practically, it thus produces the same result in two or three days which is produced by the fouling-out of septic sludge, which takes weeks and months. If a sludge should not contain a sufficient quantity of those substances which evolve the necessary gaseous matter a small quantity of septic sludge or other suitable material can be mixed with it before the addition of acid. I have worked this method (which is protected by application for Letters Patent) for some time at the Oldham Corporation sewage works on very troublesome sludge with invariably good results, and there is no doubt that the same result which is now obtained by filter pressing or centrifuging can be obtained in a far simpler and incomparably cheaper way by the adoption of my method of concentrating sewage sludge as described above.

Advantages and Disadvantages of Intercepting Traps*

I HAVE really very little to say in their favour. I am of opinion that where drains are laid underneath dwelling-houses or other inhabited buildings they should be trapped, unless they are constructed of heavy iron pipes embedded in cement concrete, in which case I would omit an interceptor. Many are so constructed in my district. They would probably be preferable also on steep gradients where thickly built upon, with the windows of one house immediately above the vent pipes of a lower one. But even this may be obviated to a considerable extent by dividing the sewer into lengths by means of a trap or flap.

In my opinion, the chief objections to interceptors are as follows:—

(1) Their liability to become stopped or unsealed.

(2) Fresh air inlets must be used, and these under certain conditions may become a source of danger to occupiers and others.

(3) They always contain several gallons of stagnant sewage.

(4) They necessitate the erection of ventilating shafts in streets near houses.

With respect to (1), the sanitary inspector frequently finds that the source of a complaint of offensive drains is due to the interceptor being blocked. Drains may remain in this condition for months before the cause of the trouble is discovered by the occupier. Generally, what happens in these cases is that through some object gaining entrance to the trap it is gradually choked, perhaps not entirely, but nearly so, the pressure of sewage being sufficient to force a small trickle through the trap or leaky joints, so that before the drain is actually stopped, and sewage appears at the lowest gulley, a considerable time has elapsed. The inhabitants have been conscious from time to time of a bad smell, generally at the fresh air inlet, a defective joint at the gulley or soil pipe, from the inspection chamber cover or under a floor. I have found numbers of drains in this condition, and when covers are removed they are seen to be charged with stagnant, semi-liquid sewage giving off a horrible stench. Then before it can be remedied the whole contents may have to be baled or pumped out, for it is impossible to get at the trap or clearing eye until this is done. I am quite aware that there are many patent devices for removing the plug of the clearing eye without the trouble of emptying the drains, but how many does one find in use? I have seen very few, except at good-class residences. In some districts the by-laws require the provision of a chain attached to the plug and brought up to the underside of the cover, or fixed in some other way. These are undoubtedly very helpful, but here again their use is very limited. It is remarkable what is sometimes found in these blocked interceptors; I have seen sticks, children's hats, stones, glass bottles, fruit and fish tins, brushes, coal, cinders, ashes, and articles of clothing, among other things.

In my district it is an exception to find a well-laid drain stopped. Then with respect to traps becoming unsealed. On p. 362, Moore's "Sanitary Engineering," six ways are given in which the trap may fail in its purpose, the author adding that they (traps) are necessary evils.

I have little personal experience of a properly set trap becoming unsealed, but I have frequently found one fixed in such a manner as to nullify its object, usually by tipping the trap forward, and it is quite conceivable that the desired effect can be defeated in the manner mentioned by the author. I have seen an interceptor of a certain pattern so choked that it withstood a head of over 10 ft. of sewage.

(2) It is generally agreed that a fresh air inlet is a necessary adjunct to a trap. In the majority of cases the inlet is fixed on the front wall of the house or in the forecourt a few feet above ground level. In my opinion they are a snare and a delusion. More often than not the mica flap is damaged, and frequently it has disappeared together with the front of the inlet, and in this condition is worse than useless. Children use them for receptacles for all kinds of things. It may be said that they should not be allowed to remain in this condition; it is easier said than remedied. In the event of the drain becoming stopped or the trap unsealed, they must then become a source of great danger to health.

(3) There is always several gallons of sewage in the trap which is frequently being stirred up, for I think it is safe to say the contents are not wholly displaced at each flush by the incoming sewage; this naturally gives rise to offensive odours.

(4) With respect to the effect of interceptors on the ventilating of sewers, it appears to me to have a very important bearing.

It is generally agreed that thorough ventilation of sewers is very necessary. Under sec. 19, Public Health Act, 1875, we are told it shall be done; notwithstanding this, I believe it is entirely omitted in certain towns—that is to say, it is not provided for by local authorities—but it is fairly safe to assume that the sewers are ventilated in some other way. In my district we have practically no interceptors and no public sewer ventilators, except where there are long lengths of sewers through fields or other open ground.

The district was sewered some thirty years ago, and for some reason, which I am unable to give, traps were omitted from the start, and have been up to the present. I believe in the whole of this time not a single complaint has ever been received of an offensive vent pipe. We have entirely omitted the use of street ventilators; in effect their place is taken by the drain vent shaft on every house.

Over ten years ago I went to East Grinstead imbued, like most other sanitary engineers, with the importance of intercepting house drains. I was surprised to find that their use had been studiously avoided. My professional curiosity was aroused, and I gave a good deal of time and study to the subject. I candidly admit I was somewhat hostile to the idea, and naturally looked for the results I had been taught to expect, but I failed to find them, and now, after over ten years' experience, I feel bound to say my views on the subject have been considerably modified, to say the least. I feel sure our health statistics will compare very favourably with any town similarly situated where interception is enforced. A well-known authority on sanitation once said to me, when discussing this matter, "that towns like mine would have good health whether interception was carried out or not." I replied: "If that is so, why use them?" His reply was a shrug of the shoulders. I have had twenty-five years' experience in sanitary work in widely separated districts where interception is and is not strictly enforced, also where it is omitted, and my conclusions are based upon this experience.

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*Paper presented at a Southern District Meeting of the Institution of Civil Engineers (Great Britain).

In a town where the interceptors are in use the effect of ventilating from the houses vent pipes could be tried by taking out the stoppers from interceptors, and placing them in a fresh air inlet pipe. It would be interesting to know the result. Of course, the piece of sewer experimented with should be temporarily trapped off from the general system.

The Georgia-Harris Viaduct, Vancouver

The problem of relieving the heavy pressure of traffic on Hastings and Pender streets, two of the busiest thoroughfares in Vancouver, will be solved for some time to come at any rate, by the erection of the Georgia-Harris Viaduct, a structure which will extend from the west end of Harris street in a westerly direction, crossing over an arm of False Creek, the properties of the Canadian Pacific Railway, B. C. Electric Railway, and the Great Northern Railway, until it reaches the present eastern end of Georgia street. Some four years ago an estimate was made for the erection of such a structure at this point, and was finally endorsed by the citizens in January, 1912. In the open competition held a short time after this date, fifteen designs were submitted by a number of widely-known engineers, the first prize being awarded to Mr. C. A. P. Turner, M. Can. Soc. C. E., M. Am. Soc. C. E., of Winnipeg and Vancouver, the inventor and patentee of the "Mushroom" system of reinforced concrete construction.

Mr. Turner submitted two designs. One of these provided for the use of the standard Mushroom type of reinforced concrete throughout, excepting in the arch span over False Creek, while the second and accepted design called for long spans over the C. P. R. yards and consisted of four parallel Warren continuous trusses.

The plans of the viaduct reveal a number of rather unique features in different styles of construction. The total length of the structure is 2,854 feet, its total outside width 66 feet, comprising a central roadway 53 feet wide carrying a double-track for street cars and two 6 ft. 6 in. sidewalks. Provision is made for a short filled approach of 69 feet at the Harris street end. Commencing from this point there are twelve spans of the Mushroom type, ranging from 25 ft. to 30 ft. 6 in. The 400-foot section immediately to the west forms an interesting type of design for long spans in reinforced concrete. At that point the 123-foot arch over False Creek is cantilevered out from each pier, and the west side of the arch is continued as a reinforced concrete continuous girder, with spans varying from 50 to 63 feet, the length of the spans having been determined by the position of the tracks leading to the Great Eastern Railway freight yards. These girders are also cantilevered out from the end support, thus materially reducing the cost of the spans. The arch consists of three ribs, 25 ft. 3 in. on centres, and is reinforced with structural members sufficiently strong to carry the dead load of the span, thus permitting rapid erection without interfering with navigation on False Creek.

From the end of the continuous girders the Standard Mushroom type is again used for fourteen spans, ranging from 26 feet to 40 feet. The succeeding 150-foot section of the structure consists of three parallel reinforced concrete girders, with two spans of 60 feet approximately, and cantilevered out from each end support. These spans cross over the tracks leading to the British Columbia Electric Railway Company's local freight yards. For the next 260-foot section there are seven standard Mushroom spans varying from 37 ft. 9 in. to 43 ft. 6 in. The latter is the largest Mushroom span on the structure and is about 85 per cent. of the length of the other existing spans using this type of construction.

With the exception of the filled approach at the western end, the remaining portion of the viaduct consists of four continuous structural steel Warren trusses, supported by legs with expansion rollers at the base of the supports which is approximately 22 feet below the lower chord of the trusses. The individual members of these trusses are encased in concrete in order to conform with the appearance of the balance of the viaduct, as well as to protect the structural members from weathering and locomotive gases.

At the eastern end, the trusses are cantilevered out from the support and terminate into reinforced concrete girders, which rest on a specially designed bracket on the column supports of the western end of the Mushrooms spans. The entire deck of the structure is reinforced concrete with ornamental cast stone handrailing and lamp standards of modified Corinthian columns in the same material, there being 55 lamp standards altogether, spaced 100 feet apart. Steel trolley poles will be erected between the lamp standards every 100 feet where practicable.

Tenders for the Georgia-Harris viaduct were called for on January 30th of this year, and the contract awarded a short time later to Messrs. J. McDiarmid & Company, of Winnipeg and Vancouver. Actual work commenced on April 3rd last, and has been progressing steadily since that date. The foundations have practically all been placed, and at the present time the contractors are making rapid headway with the construction of the deck.

The foundations in False Creek were placed by sinking reinforced concrete caissons, 12 ft. in diameter and 40 ft. high. The caissons consisted of an 8-inch concrete shell with a steel cutting edge at the bottom. The method of placing these piers comprised the building of the form of the concrete shell for the caissons on top of the steel shoe. This was thrown into place by means of a derrick and stayed in a vertical position with the aid of guide piles previously driven. The concrete was then poured. After setting sufficiently the forms were removed, and excavation was commenced, an orange peel bucket being used for the latter operation. The structural steel for the trusses over the C. P. R. tracks is now in transit from the Dominion Bridge Company's works at Montreal, and it is fully expected that work on the entire structure will be completed well within the time limit for the contract, which expires on June 1, 1915.

The work is being executed under the direct supervision of Mr. A. P. Hueckel, district engineer for Mr. C. A. P. Turner, the consulting engineer, and Mr. F. L. Fellowes, supervising city engineer of Vancouver. Mr. T. Borgford, local manager for Messrs. J. McDiarmid & Company, has charge of the actual construction. The total cost of the viaduct has been estimated at approximately $500,000.

Georgia-Harris Viaduct, Vancouver. Sinking caisson into position in False Creek.

Every draftsman has occasion at one time or another to color a drawing or a whiteprint. The use of colored inks is unsatisfactory; cross-hatching in colors obscures the details and is slow, while water colors have the disadvantage of slowness besides being difficult to apply evenly. A quick and satisfactory method of coloring involves the use of ordinary wax crayons and gasoline, says the Engineering and Mining Journal. Crayon of the color desired is applied and then rubbed with a piece of cloth, wet with gasoline, until the color is even, and extended to the limits desired. If it overruns the lines, it can be erased with a pencil eraser. Some colors, particularly the yellows, purples, greens and light blues, produce much better results than others. It is probable that the gasoline dissolves the wax from the crayon, leaving the pigment as an impalpable powder, which, when rubbed over the paper, colors it uniformly. The method is applicable with equal success to egg-shell and smooth drawing papers and to white prints on both paper and cloth.

At the present time there is $83,000,000 of work going on in connection with the subway lines of the dual system of rapid transit in New York, with an average daily force of 17,000 men. It is estimated that the city-owned lines will, when completed, cost about $200,000,000. There is about two-fifths of the value of this work already under contract. Of the remainder, to cost $117,000,000, it is expected that more than one-half will be under contract before the end of the year, so that by that time, nine months after the signing of the dual system operating contracts, actual construction work will be in progress on three-quarters of the city-owned lines.

The Design of Concrete Abutments Without Wing Walls for Deck Girders

By C. M. Luther[*]

IN designing concrete abutments for railway bridges, there are certain occasions when it is permissible to let the earth fall in front of the abutment: in other words, certain conditions justify construction of abutments without wing-walls. When such is the case, care must be taken to see that the earth does not encroach on the bridge seat.

Assuming that the bridge seat is at some distance above the surface of the ground, the following points enter into the design as important factors, in so far as the question of keeping the earth away from the bridge seat is concerned:

1. Rate of slope of the backfill.
2. Width of the ballast wall proper, and rate of frost batter on back of same.
3. Distance D from the bridge seat to the top of the ballast wall.

In addition to these, the length of the bridge seat as compared with the width of the subgrade or roadbed, and the distance from the subgrade to the top of the ballast wall, also require consideration, the discussion of which, however, will be omitted, as the difficulty arising from these adjusts itself to the circumstances in many cases.

A rock backfill presents but little trouble in this respect as compared with dry, loose earth backfill. This is equivalent to saying that, other factors being the same, the steeper the slope of the backfill, the easier would the solution of the problem be. This can readily be seen by a glnace at the accompanying figures, and does not need any further explanation.

The width of the ballast wall is generally taken from 1 ft. 6 in. to 2 ft. 6 in. for ordinary abutments; and there are conditions which forbid the designer to take excessive width. The frost batter on the back of the ballast wall can profitably be made light in a ments for through girders, as in that case the distance from bridge seat to ballast wall is comparatively small. Most engineers prefer to have the width of the horizontal section of the ballast wall on the plane of the bridge seat not less than one-half the distance from

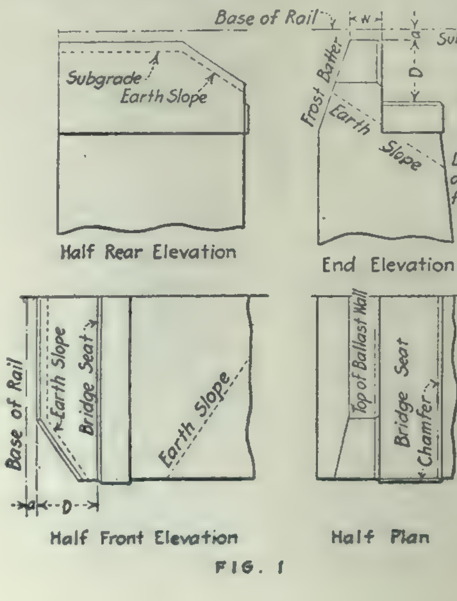

FIG. 1

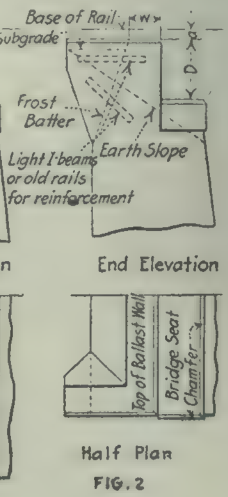

FIG. 2

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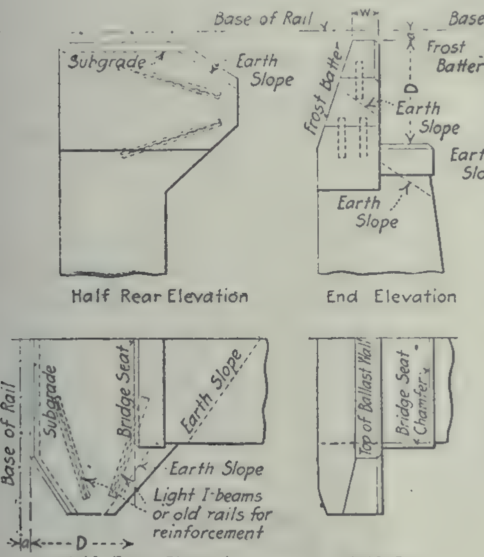
[*] Designing Engineer, MacKenzie, Mann & Company, Limited, Toronto

base of rail to bridge seat. This may be stated by the formula $W + Db = \frac{D + a}{2}$ in which (see Fig. 1)

W = Width of the ballast wall on top;
D = Distance from the bridge seat to the top of the ballast wall;
a = Distance from the top of the ballast wall to the base of rail;
b = Rate of the frost batter per unit of height.

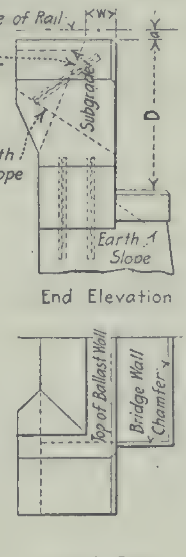
If this practice is endorsed, ballast walls of abutments for deep deck plate-girders must necessarily be given greater width on top and heavier frost batter on back. The wider the ballast wall and the heavier its frost batter, the further would the earth fall from the bridge seat.

When D is small the problem is comparatively simple: and in fact in many cases a ballast wall of ordinary width with an average frost batter, coupled with slight changes from an ordinary design, is enough to prevent the earth from running on to the bridge seat. This is particularly true in the case of abutment designed for through plate-girders, in which D seldom exceeds 4 ft. Fig. 1 illustrates an abutment of this class. It must be noticed that for through bridges the ballast wall proper is shorter than the bridge seat; so that the earth will start to fall along the side of the abutment at a considerably lower point than it would have done were the ballast wall proper longer than or equal to the bridge seat. Therefore, the excess of the length of the bridge seat over that of the ballast wall proper will of necessity, help the matter considerably.



Half Rear Elevation End Elevation
Half Front Elevation Half Plan

FIG. 3



End Elevation
Half Plan

FIG. 4

In the case of an abutment for short deck plate-girders, in which D is same as in Fig. 1 but the bridge seat, instead of being longer than the ballast wall, is practically of same length, to attain the desired object the ballast wall is turned at its ends, parallel to the centre line of the track, with a battered surface on its back (Fig. 2). In this case the earth begins to fall along the side of the abutment from the level of the subgrade, but at a considerable distance back from the face of the ballast wall.

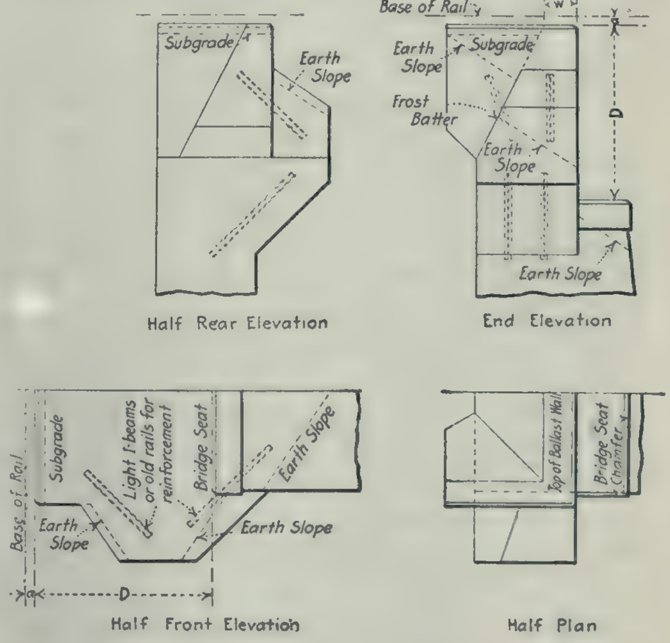
In cases for long deck plate-girders, however, in which D varies from 7 ft. to 12 ft. or even more, it is difficult to keep the backfill from encroaching on the bridge seat in ordinary abutments, unless short wing walls are provided. Fig. 3 shows an abutment without wing walls, intended for deck plate-girders, suitable for cases in which D is about 7 ft. or under. To attain the point in view, the ballast wall proper is extended, following the slope of the backfill, and retaining the frost batter of the ballast wall as well, forming a short cantilever. For lack of better terms, we will call these extensions lugs. The earth slopes down along the back and to the end of the lug; then turns along its side at some distance below the subgrade, which is determined by the length of the lug, and the slope of the backfill. These lugs are reinforced with light I-beams or old rails. This type of abutment has been extensively used by the Canadian Northern Railway on their Eastern Lines and has been found very satisfactory.

For same slope of the backfill, the greater the distance D, the longer will the lugs be; so that higher values for D call for excessively long lugs, which are, of course, objectionable. But by modifying the ballast well, or the lug or both, as the case may require, the matter can be considerably simplified. Fig. 4 shows a design in which D is about 10 ft. In this case the ballast wall is turned at its end, parallel to the centre line of the track, with a battered surface on the back, and a short lug attached on the front.

Fig. 5 shows another type with some modifications, having nearly 13 ft. for D. The ballast wall has been turned and battered on the back, as in the preceding case, while part of the front of the turned portion is vertical. The lug instead of starting from the top of the ballast wall, starts at some distance below, depending upon the slope of the backfill, length of the turned portion of the ballast wall and the frost batter of the lug itself.

In these types the ballast wall proper is taken equal to the width of the subgrade, or roadbed. These cases have been cited to serve as simple examples. Special cases must be given special consideration. It is believed that these abutments can profitably be adopted when conditions warrant having the earth partly cover the breast of the substructure. There is, undoubtedly, considerable saving in concrete, in this design, which would not be feasible where short wings are used.

A design is sometimes used similar to that shown in Fig. 4, except that it has little curtain walls on the sides of the bridge seat, extending from the face of the ballast wall toward the breast of the abutment, and fol-



Half Rear Elevation End Elevation
Half Front Elevation Half Plan

FIG 5

lowing the earth slope. This design, however, calls for unnecessarily long bridge seat, unless the curtain walls are properly reinforced and then projected beyond the sides of the bridge seat. The vertical surface on the bridge seat may also be objected to, on the ground that undesirable material may accumulate between the girder and the adjacent wall, especially when the bridge seat is comparatively short. Furthermore, the girders during erection may hit the thin curtain walls and demolish them.—Engineering News.

Design of Steel Mill Buildings—Part II[*]

Practical Considerations Influencing Type and Proportions of Members Commercial Features, Detailing, Architecture, Drawings and Specifications

By R. Fleming[†]

For steel members in compression there are a number of column formulae in common use. The straight formula, $S = 16{,}000-70\ l/r$, is recommended, in which S is the allowable stress per square inch, l, the effective length of member in inches, and r, least radius of gyration of the member in inches. The maximum value of S is 14,000.

Wind Pressure

It is with considerable hesitation that the writer approaches this much-discussed subject. Much that is written on wind pressure and the stresses resulting therefrom is based on assumptions that are too uncertain to warrant the accuracy and amount of work involved in their treatment. There are many steel mill buildings that have been standing for the last 15 or 20 years in good condition, many members of which, if calculated for wind according to some of the theories advanced, would be stressed beyond their ultimate strength. This is especially true in the case of side girts supporting metal covering. If they are considered as beams, the calculated stresses for bending are far beyond allowable limits; if considered as suspension rods between columns the connections are entirely inadequate.

In an ordinary mill building the wind does not play the important part that it does in a high office building, but the designer should know as far as can be ascertained to just what extent it affects the structure and make assumptions accordingly. The wind as a part of the roof load has been mentioned under "Roof Loads." We have yet to dispose of the problem of wind on the sides of a building.

The general method is to consider the wind stresses carried to the foundations transversely by each separate bent of the building. The Chicago building law, which is one of the latest and best of our building codes, has the provision: "All buildings shall be designed to resist a horizontal wind pressure of 20 lb. per square foot for every square foot of exposed surfaces. For stresses produced by wind forces combined with those from live and dead loads, the unit stress may be increased 50 per cent. over those given above; but the section shall not be less than required if wind forces be neglected."

With the wind blowing horizontally, a load of 20 lb. per square foot on the side of the building and on the vertical projection of the roof surface is thought ample. The ends of the columns are considered fixed at the base, with the point of contraflexture midway between the base and the foot of the kneebrace, or, in the absence of kneebraces, midway between the base and the gusset plate connecting the truss to the column. One-half the wind load on the surface between the foot of the kneebrace or gusset plate and the column base will be carried directly by the column to the foundation and need not be considered further. The remaining side pressure is concentrated at the foot of the kneebrace or gusset plate and the panel points of the roof truss. The bases of the columns are each assumed to take one-half of the horizontal reaction. A stress diagram should be made based on these assumptions.

The stresses due to the dead and snow load can easily be found either by taking a proportion of the stresses already found due to the combined dead, snow, and wind load on the roof or by making a new stress diagram. Comparing the two sets of stresses in accordance with the Chicago building law it will readily be seen what unit stresses are to be used in proportioning the members. In no case, however, should the sectional area of any member be less than that required by the combined dead, snow, and wind load mentioned under "Roof Loads" using the working stresses given under "Unit Stresses." In addition to direct stresses, the columns take bending from the wind load. The maximum bending occurs in the leeward column at the foot of the kneebrace and at the column base, being equal to one-half the distance from the foot of the kneebrace or the gusset plate to the ground, multiplied by the horizontal reaction at the point of contraflexure. From the bending moment the flange stresses in the columns are found. As these flange stresses are due to wind, the higher unit stresses can be used in determining the flange area required. Making comparisons in the manner mentioned above it can be determined whether the sectional area of the column required by the direct stress should be increased.

A weak point in the above method is in the assumption of the point of contraflexure. In actual practice the bases of columns are seldom fixed sufficiently to warrant such an assumption. Again the assumption that the horizontal reaction is equally divided between the two columns may or may not be true. A compensation for these errors is found in the fact that a wind load of 20 lb. per square foot for areas near the ground is excessive.

Another method is to consider the columns as beams uniformly loaded and the reactions at their tops taken, by means of a system of bracing in the plane of the lower chords of the roof trusses, to the ends of the building and thence to the ground by diagonal bracing in the plane of the ends. This method is well adapted for buildings where the bottom chord is a considerable distance above the floor, provided the building is not so long that it requires expansion joints and that there are no openings in the ends to interfere with diagonal bracing.

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[*] Second and concluding portion of article reproduced by courtesy of The Engineering Record. Part 1 appeared in our issue of November 5.

[†] Designing Engineer, American Bridge Company, New York City.

In proportioning the members a copy of some standard general specifications for steel work will call attention to many points which might otherwise be passed by. Thus, the length of compression members shall not exceed 125 times, and those used for wind and lateral bracing 150 times, their least radius of gyration; material less than ¼-in. thick, except for fillers, shall not be used, and a number of similar requirements will be found.

The designer of a structure may not make the working drawings, but he should be competent to do so. Unless he has had actual experience in detailing it is probable his design will have more or less serious defects. For this reason one of our largest structural steel companies makes it a rule that engineers before entering their designing department should have not less than three years experience making shop drawings.

A common error is to so proportion a girder that a sufficient number of rivets cannot be used to develop the flange stresses. Crane girders have been designed with the flanges of 6 x 4-in. angles (4-in. legs vertical) and cover plates, ample for compression or tension with a web sufficiently thick for shearing stresses. When it comes to be detailed it is found impossible to get enough rivets in the 4-in. leg of the angles to transmit the stresses from the flanges into the web plate. A thicker web plate to increase the bearing values of rivets, or, better still, 6 x 6-in. angles allowing a double row of rivets might have obviated the difficulty.

Commercial Features

In addition to the purely technical there are also the commercial features of structural engineering. Some of these it is well for the designer to know. For instance, the hand-books of the steel companies generally classify the sections as standard or special. The latter, on account of the smaller demand, are rolled less frequently, and hence it is often difficult to obtain them in a reasonable length of time. When the demands for any given size have accumulated to a certain tonnage it is included in the schedule of rollings. A whole structure has been held up indefinitely waiting for some pieces of an odd size. As a rule, the fewer the sizes used the more prompt will be the delivery.

Three or four years ago the engineer of a building near Philadelphia used a ship channel that he had found listed in an old hand-book for the tracks of an extensive system of suspended trolleys. After the contract was placed it was found these channels had not been rolled for five years. There was not enough tonnage to warrant a special rolling; besides, the rills were out of order. With considerable annoyance the engineer changed his tracks and track supports.

Mere ingenuity or originality of design is not enough to warrant a departure from standard types of trusses, girders, or other parts unless accompanied by a reduction of cost. Precedents need not be followed blindly, but "indifferent originality is more expensive and less creditable than good imitation, and the success of the engineer is directly proportional to the success of his work and to the lowness of its cost."

The pitch of the roof will largely determine the outline of the roof truss. The Fink type of truss is the one most commonly used for roofs of 5 or 6-in. pitch. The Warren and Pratt trusses are well adapted to a roof nearly flat. The factors determining the most economic spacing of wall-bearing roof trusses are the trusses themselves, the bracing, and the purlins. If the steel columns, side girts, or crane girders are used, they also are to be considered together with the cost of foundation. It is to be noted that the net cost per pound of purlins is much less than that of columns and trusses.

The theoretical economic spacing of roof trusses is about one-quarter the span, but the actual spacing may be governed entirely by conditions peculiar to the structure under consideration. If the covering or sheathing rests on purlins a spacing of about 16 ft. is commonly used up to spans of 65 ft.; beyond that the spacing may be one-quarter the span. Where plank sheathing rests directly on the trusses the spacing may be 8 to 10 ft. for 2-in. and 12 to 14 ft. for 3-in. tongue-and-groove plank. This method can often be used to advantage for spans up to 40 or 50 ft. As there are no purlins in this case, there should be a system of bracing to hold the trusses in place.

If spans are of unusual length or roof loads are very heavy it may be found economical to use jack rafters resting on latticed or beam girders framed into the roof trusses. Purlins can be used on top of the jack rafters or wood sheathing can extend from rafter to rafter.

Wooden purlins used with steel trusses are often made to act as struts for a system of diagonal bracing, but the practice is not to be commended. The struts as well as the diagonals should be of steel.

Roof trusses are mostly made up of angles, sometimes entirely so. Flat bars should not be used for tension members. They are easily bent in handling and the stress coming upon them is often not enough to straightem them. If there are loads between panel points producing a bending stress sufficient to warrant it, the top chord should be made of two channels or two angles and a stem plate. The stem plate should not be too thin for its width or it will buckle along its lower edge when fully loaded. The bottom chord may be of similar construction where bending stresses occur from various causes. It is a good plan to detail the lower chord channels about 1 in. apart so that ¾ or ⅞-in. bolts can be run between them and attachments easily made. Purlins should be made of single rolled shapes—channels, beams or angles. Trussed purlins should not be used.

Columns

The plate and four-angle type of column with cover plates when necessary is mostly used in mill buildings on account of its low cost of fabrication and the ease with which trusses, girts, or beams can be connected to it. For interior columns, where the loads and unsupported distances of columns are not great, the steel section known as Carnegie mine timber can be used to advantage. The H columns rolled by the Bethlehem Steel Company have been received with favor, but are used more in office buildings than in mill buildings. The box section of columns generally made up of two channels latticed is not so well adapted to mill buildings on account of its higher cost and the greater difficulty of painting and inspection. Connections are not so easily made, and it is likely to become a receptacle of dust and moisture. Closed-box sections should not be used at all.

The exterior columns should be proportioned for (1) direct stress due to roof, floor, crane, or other loads; (2) bending due to wind on the sides of the building; and (3) stress due to eccentric loads. For columns supporting crane girders, the flange of the column under the girder is usually considered as carrying the total crane load together with its share of roof load and any floor load that may come upon it. When this load is large, or the unsupported distance of column is great, a channel or plate can be used on the backs of the angles under the crane girder. Of course, bending stresses from the wind or from eccentric loads can be lessened by increasing the width of the columns. When the columns are assumed to have their lower ends fixed, care should be taken that the bases are firmly anchored to the foundation by set bolts.

Kneebacks

Attention is here called to that important member, the kneebrace. While it should be of abundant strength to take the stresses coming upon it, it is folly to make the kneebrace "good and strong" unless there is provision to take the thrust or tension at each end. If the trusses and columns have been figured for uniform load only, the stresses due to the kneebraces should be determined and sections increased where necessary. Similar calculations should be made when travelling cranes require gusset plates to be used in place of kneebraces.

The sight is not altogether unfamiliar of a kneebrace of liberal proportions fastened at one end with three or four rivets or bolts to a latticed column and fastened at the other end to the bottom chord of a roof truss having at that point a diagonal member consisting of a single light angle. Such connections are able to develop the strength of only a very light kneebrace. The lacings in the columns should be replaced by a plate, the number of rivets in the connections should be increased and the single-angle diagonal in the truss should be made of two angles. In a cement mill near Allentown, Pa., are some kneebraces of 6 x 6-in. angles fastened by only a single bolt at each end.

Beams and Girders

The safe loads that can be carried by the various sizes of rolled beams are given in the Carnegie and other handbooks. Care must be taken that the tabular safe loads are reduced when the top flanges are without lateral support for more than 20 times their width. In certain cases, for instance where a ceiling is supported by beams, the limits for deflection should not be exceeded. The comparative cost of rolled beams and plate girders should be considered when there is a choice between them. Preference is generally given to rolled beams where they can be used. In proportioning plate girders their depth should be taken as the distance between the centre of gravity lines of the flanges, with one-eighth of the web area allowed as part of the area of each flange. A more nearly correct way is to design plate girders by their moments of inertia.

For lateral stiffness the top flange of a crane girder should not be less in width than 1/20, or 1/25 at the most, of its span. A channel riveted to the top-flange angles gives stiffness and adds to the flange area. If the rolled channels are not of sufficient width a built channel of a plate and two angles answers the same purpose. Addditional area if required can be made up of cover plates. If runway girders are riveted to the sides of columns it will be difficult to secure a proper alignment. They should rest either on the tops of columns or columns should be stepped off to receive them. For light cranes they are sometimes carried on brackets attached to the columns. Crane rails are sometimes riveted to the top flanges of girders, but this allows no alignment. The rails should be fastened by hook bolts or by adjustable clamps and bolts.

An end greatly desired in all steel structures is that they should be well braced. No general rules can be given for bracing. It is not entirely a matter of calculation. Experience, common sense, and a comprehensive grasp of the situation are needed. In bracing for wind it should not be forgotten that the wind blows against the ends of a building as well as against the sides. Two years ago a pier shed along the New Jersey coast had to be braced longitudinally to keep the ends from blowing in. The designer had made no provision whatever for wind pressure against the ends of the building. A certain amount of bracing is needed for erection purposes. Better reduce the main members themselves than economize in bracing. A building seldom fails from lack of material in the main members, although these are sometimes greatly skimped.

Architectural Features and Details

Ruskin gave the advice, "Do not construct ornamentation, but ornament your construction." A mill building is designed, first of all, for utility, and the architectural features are usually a secondary matter. But this is no reason why a building should be an architectural monstrosity. A slight expense will oftentimes change a structure that is unsightly to one that will at least not be an eyesore. In the future there will be greater economic values attached to symmetry and beauty than at present.

The part of the detailer in making or marring a structure can hardly be overestimated. Some of the buildings of the Gary plant of the United States Steel Corporation are 1,400 ft. long and more than 100 ft. high. The engineer under whose supervision the designs were made writes: "While the assumptions of loads and their application to structures of this class may not always have been entirely correct, I am satisfied that we have had more trouble and failures due to the lack of proper consideration of the details of this structure than to improper assumption of their loading."

On receipt of the design drawings the detailer should examine them carefully to ascertain if he has all the necessary information. As he proceeds with the working drawings he should take up with the designer any points that are not entirely clear. He had better ask six foolish questions than omit an important question that should be answered. At the same time he should report any faults he may discover; for instance, swinging sash that if open would be struck by a traveling crane in passing.

As soon as possible a plan should be prepared for the purchaser, showing the size and location of column bases and anchor bolts. This drawing is generally called a " foundation plan"; but this name is a misnomer, as it usually shows only the location of steelwork. The loads coming upon the foundations from the steel columns should be given. The drawing now gives enough information for the foundation to be designed by others, as it is seldom that the structural engineer is called upon to do this. A crane clearance diagram, if there are traveling cranes, should also be prepared at an early date and sent to the purchaser for the use of the crane maker.

Details should be designed for strength and economy, in accordance with shipping facilities, cost of transportation and ease of erection. Connections producing secondary stresses are sometimes used when, by a little ingenuity, they could be avoided. When there is a direct vertical load on a plate girder, such as the wheel load from a traveling crane, sufficient rivets should be provided throughout the top flange of the girder to take the resultant of the vertical load distributed over a given length and the difference in flange stresses. Economy will be gained by having as many duplicate parts as possible. Close fits are expensive, so also is needless refinement in workmanship.

Shipping Dimensions

The maximum dimensions of a piece that can be shipped on a car will sometimes be needed. The railroads charge for freight by the pound in carload lots, with a higher rate for less than full cars. There is a minimum weight for a carload lot. If this was 30,000 lb. and the car was loaded with 20,000 lb., the rate per pound would prevail. The lesser loading, from the nature of the pieces shipped, can not always be avoided, but the detailer can often lessen or increase the amount that can be loaded on a car by the location of his splices and his decisions regarding field and shop riveting.

The steamship companies have, for export work, a rate per cubic foot of space occupied and another rate per pound. The rate which will bring them the most money prevails. This is liable to be the rate per cubic foot. The remedy is for the designer to detail his work to be shipped "knocked down" as much as possible. An extra rate is charged if single pieces exceed certain lengths or weights. Some trusses for a light highway bridge were once shipped from an inland shop to the steamer riveted together. The steamer charges for freight were more than one-half the price received for the bridge.

Erection and Expansion Joints

Ease of erection should be borne in mind by the detailer. While it may lessen freight charges to ship a truss in many pieces, it will increase the cost of field riveting in erection. A study should be made to determine which had better be done. Every erector of steelwork who has been long in the business will recall details that have unnecessarily added hundreds of dollars to his expense account. Beams framed between girders striking stiffeners, girders and framed beams striking rivet heads in columns, insufficient clearances elsewhere, and too close fits are common difficulties in erection.

In continuous structures more than 300 ft. long expansion and contraction due to changes in temperature must be considered. A few years ago an outdoor crane runway in Ohio was built with each girder bolted to its neighbor for the entire length of 1,500 ft. The first change of season played havoc with that runway and it had to be altered at considerable expense. A mill building is much more flexible in this respect than a bridge, and for the average mill building of medium size no provision need be made. Expansion in the direction of the width of a building will take care of itself; it is unusual lengths that need be considered.

If preliminary drawings only are wanted to give the prospective customer an idea of his building, a great deal of information can be omitted that is necessary on the finished design. It is a wise plan, however, to make even the preliminary drawings as full and complete as time and the circumstances will warrant. After a contract is taken the design drawings should be carefully checked and such additional information added as will enable the drawing room to make its working drawings expeditiously and with certainty as to the intent of the design. The revised design should be sent to the purchaser for his approval. All dimensions, distances and sizes of materials should be shown on the drawing. Descriptive matter properly belongs to the specifications, though notes on drawings should be freely used even if their purport is repeated in the specifications.

Checking Drawings

A careful check should be made by the designer after the drawing is entirely finished. Every discrepancy found and corrected will save time and trouble in correspondence later. It is annoying in laying out the work to find the distances between two fixed points given differently in different places on the design. Another common annoyance is to find that the sum of several intermediate distances does not equal the figure given for the total distance. Sometimes a necessary distance or angle is omitted.

All angles and all sides should be given in the survey of a plot of ground. Right angles should be given as 90 deg. and not left to be assumed by the detailer. A common cause of annoyance is to find that the sides and angles of the survey do not check with each other when a trigonometrical calculation is made. This can be avoided by the man who makes the survey checking his work before it leaves his hands. The points of the compass should be shown in order to refer easily to any side or end.

A cross-section should be taken through a definite line on the plan and so marked. "Cross-section on line A-A" means much more than "Cross-section through machine shop." As many sections as are necessary to make clear the intent of the design should be shown.

The location of doors and windows and side and end bracing should be shown on the side and end views. The plan should indicate clearly the roof bracing. The bracing in the planes of top and bottom chords can be shown on one plan by using full lines for one and broken lines for the other. Angles with unequal legs should be marked so that there is no doubt as to which leg is vertical and which outstanding.

Loads and stresses throughout, maximum bending moments and maximum shears in all girders, and in beams used as crane girders, should be given. It should be stated whether stresses are given in thousands of pounds or in tons. The omission of this once caused some trusses to be detailed for tons when the stresses were given in thousands of pounds. The detailer was a new man and had been accustomed to stresses given in tons; the designer had always done his thinking in thousands of pounds. Stresses are generally given in thousands of pounds with the + sign denoting a tensile stress and the — sign a compressive stress.

Avoid Ambiguity

An essential in the design drawings, in fact in all drawings, is clearness. On a certain design, underneath the diagram of crane wheels, was the notation "Maximum wheel load, 30,000 lb." with an arrow drawn to each wheel. This was a cause of confusion because it was not known whether the 30,000 lb. was the load on each wheel or on both wheels. The designer intended "Maximum load on each wheel, 30,000 lb," and it should have been so stated. On the cross-section of another design below the column base was written "Two 1¼-in. anchor bolts 4 ft. long," with an arrow drawn to each of two anchor bolts shown in elevation. It was not certain whether two or four anchor bolts were wanted for the column. A repetition of the note on each elevation would have left no cause for questioning the meaning of the legend.

Abbreviations should be used very sparingly. It should be borne in mind that the design drawings pass into the hands of non-technical men. The notation "No. 20 G.C.S. covering" many mean No. 20 galvanized corrugated steel covering and "Pl. G." may mean plate girder to the man who makes the drawings, but to some that are unfamiliar with his work they are meaningless. The force of an office in Philadelphia spent a good part of the forenoon questioning the meaning of the notation "D. & M. plank" on a drawing which had been received in the morning's mail. At noon the designer came along and gave the information that dressed and matched plank was intended.

Specifications

Clearness is an essential quality in specifications as well as on drawings. They should be so written that the structural-steel contractor should be able to tell from them just what his work includes. There should be a clear-cut division between his work and that of other contractors. Stair work, cast-iron door sills, steel sash and doors, gaspipe railing and similar work should be so described that they can be bid upon separately if desired. The structural-steel contractor should furnish all bolts or rivets connecting steelwork with steel, but should not be called upon to furnish bolts for connecting the work of other trades to steel. Bolts for fastening woodwork belong to the carpenter, mason's anchors should be furnished by the mason.

What are known as "blanket clauses" should not be used when writing specifications for steelwork. Architects are great sinners in this respect. These clauses are generally due to lack of study on the part of the writer in finding out just what is required and are inserted to provide, at the expense of the contractor, for any contingency that may arise. Nothing is gained by this method, for the bidder adds enough to his bid to cover all uncertain meanings of the specifications and the purchaser pays the bill. Occasionally the bidder is caught napping and this renders him even more cautious afterward.

The specifications for one of the West point buildings called for the steel contractor to furnish "all lintels over openings as required." Under this clause he was made to furnish several tons of lintels over openings for heating and ventilating pipes. While the heating and ventilating plans did show openings, there were no lintels called for, neither were they shown on any steel plan. Hence they were not included in the estimate upon which the bid was based.

It is not necessary to repeat in the specification the dimensions, sizes, and weights that are shown on the drawings. In brief, the specifications for steelwork should cover (1) an introductory section indicating the scope of the work and referring to the drawings by number; (2) the quality of the material and the tests to be made; (3) the workmanship, shearing and bearing values for rivets and bolts, whether field connections are bolted or riveted and who furnishes and sets anchor bolts; (4) the approval of working drawings; (5) inspection; (6) the erection of the steelwork; (7) painting, both in shop and after erection; (8) any special requirements.

If there are no general specifications, the definition of party of the first part and party of the second part, the provision for settlement of disputes that may arise, the terms of payment, and similar matters of a legal nature should be embodied in the steel specifications.

Foundations

The most important part of a building is its foundation. If this is not stable the whole building is affected. The inquiry for a prospective mill building generally specifies "to be built upon foundations furnished by the owners," and the structural engineer feels relieved that the responsibility for the design of the foundation does not rest upon him. At the same time, if trouble ever came from the foundation the probability is he would be put on the defensive to show that the steelwork was not at fault.

For the ordinary mill building the loads on the columns are comparatively small and the building is on firm ground. This explains why so many foundations proportioned in a haphazard way answer their purpose. There are cases, however, where this careless method will not answer and trained judgment as well as engineering skill will be required. The difficulty is not to provide unyielding foundations on a compressible soil, but to provide foundations that will settle uniformly throughout the building. When the loads are large there will be some settlement, and if this is much more in some parts of the building than in others there may be serious trouble.

Knowing the bearing value of the soil and the loads to be carried, it would be a simple matter of division to find the required area of footing if the entire load was a dead load or if the live load bore the same ratio to the dead load in all columns. But the live loads are intermittent and constantly changing, while the proportion of the live to the dead loads is different for the various columns. In the design of the modern high office building this is a serious problem. While in a lesser degree the problem enters into mill buildings, it often needs be considered. This is the case in factory or other buildings where the walls are carried by the exterior columns. The dead load forms a large percentage of the total load on these columns, but the interior columns carry mostly a live load. In a machine shop with a center aisle served by a traveling crane with a gallery or two on each side, the percentage of live load on the interior columns is much greater than on the wall columns. Schneider's specifications on this subject are:

"The live loads on foundations shall be assumed to be the same as for the footings of columns. The areas of the bases of the foundations shall be proportioned for the dead load only. That foundation which receives the largest ratio of live to dead load shall be selected and proportioned for the combined dead and live loads. The dead load on this foundation shall be divided by the area thus found, and the reduced pressure per square foot shall be the permissible working pressure to be used for the dead load of all foundations."

The writer prefers in mill building the word "average" to "largest" in "that foundation which receives the largest ratio of live to dead load." But no definite rules can be given for the proportioning of foundation footings. They must be determined from a knowledge of the local conditions and from experience in that particular line of work. If the engineer has not had this experience he should have his work examined by one competent to pass upon it.

When the column loads together with the bearing capacity of the soil are such as to require large footing areas, grillages of steel beams embedded in concrete are often used. Heavy masonry with deep excavations and excessive steel or cast-iron bases is thus avoided. In proportioning these grillage beams the loading should be considered uniformly distributed over the length on which it is applied, the beams uniformly supported from below over their entire length, and maximum bending to occur at the center of the beam.

Comparative Advantages of Different Types of Roads Crusts*

THE subject of Communication No. 4 is a "Technical and Economic Study of the Comparative Advantages of Different Types of Roads." The eight reports sent in differ much as regards the method of dealing with the subject, and some of the reporters have failed to grasp the significance of the word "type." The extent to which a study of particular methods is covered by the titles chosen for other communications and questions suggests that it was intended that Communication No. 4 should be devoted to comparisons of well-defined types rather than to descriptions of particular kinds of paving and discussion of their value. In the following summaries attention is mainly directed to the comparisons properly belonging to the subject in hand, but some notes are also made of other points of interest. The summaries, or rather abstracts, as given by "The Surveyor," are very short, as the arguments put forward cannot conveniently be followed in an abbreviated form, and it is difficult to make useful selections from tables of data.

GERMANY

Mr. Scheuermann, Stadtbauinspektor, Wiesbaden; and Mr. Pietzsch, Finanz-und Baurat, Chemnitz, Saxony

The report begins with an interesting discussion of the properties of different kinds of rock employed for stone paving. Small-stone paving laid in sand on macadam is recommended as much to be preferred to large stone paving on a bed of sand directly on the substructure of the street. Attention is drawn to paving made from fine stone grit mixed with asphalt mastic and tar, the proportion of stone being about 45 to 55 per cent. The material is considered suitable for gradients up to 4½ per cent. In comparing the grouting and mixing methods of preparing bituminous-bound road crusts, the former is stated to be the simpler and cheaper, the latter the more refined and reliable process. Surface tarring is recommended for town streets with light traffic, such as residential streets. For country roads small-stone paving is strongly recommended, representing "the most important advance in the whole practice of road making that has been made since the times of Macadam and of the introduction of the road roller." The use of this kind of paving is being rapidly extended all over Germany. The first cost is a third, or at most a half, that of large-set paving. The first installation of small-stone paving costs about three times as much as the renewal of ordinary metalling, which gives a basis for the comparison of costs. For gradients for not more than 1 in 20, tar-grouted macadam may be used, if the means available do not admit of the use of small-stone paving. The sums expended on surface tarring are at least partly made good—exact observations are not yet available—and surface tarring of ordinary metalled crusts may be recommended for roads with light traffic, especially light motor traffic, when stress is laid on the diminution of dust, in dry and sunny situations, and on gradients not greater than 1 in 20. "Ordinary metalling, as it has hitherto been exclusively used in the country road building practice of Germany, will in future be steadily more and more ousted by small-stone paving and by tarred metal (tar-macadam). On all country roads with small traffic, however, where a dust nuisance does not exist or is not objected to, or where a steep or damp situation does not admit of the use of tarred metal, it will continue to hold its own."

UNITED STATES

J. R. Rablin, Chief Engineer, Metropolitan Park Commission, Boston, U.S.A.

This is a very short report. As regard roads in suburban and country districts, the author makes the following remarkable suggestion: "In view of the fact that the conditions of traffic in suburban and country districts so suddenly changed a few years ago, and are so rapidly increasing along these changed lines, it is a question whether it would not have been advisable, when it was first realized that the old type of water-bound macadam could not withstand the new conditions, or at least whether it is not at present advisable to adopt these types of so-called permanent pavements for these roads." As matters stand, the bituminous-bound road crust, made either by the mixing or the grouting method, is recommended for main trunk highways, and the same kind of paving for small towns and in the more thickly settled country districts. On lateral roads leading into the trunk road in the country districts water-bound macadam or good gravel crusts are suitable, and may with advantage be protected by a carpet or surface treatment. The kind of gravel road referred to is made with specially selected gravel screened to the proper size. On park drives and boulevards it is necessary to have a bituminous-bound surface, and carpeting or surface treatment is usually given to this class of road.

FRANCE

H. Sigault, Ingenieur en Chef des Ponts et Chaussees

This report was written after consultation with the author's colleagues, and it therefore sets forth a considerable body of opinion. The point of traffic intensity at which it becomes necessary to abandon the ordinary water-bound crust depends largely upon circumstances. In one town it has been found desirable to make the change at 816 "colliers," in another not until the traffic amounted to 2,884 "colliers." When the traffic is moderate, and fast automobiles do not preponderate, the traffic limit is usually about 1,000 "colliers." Surface tarring has important advantages, but too much must not be expected of it. The detritus cannot get out of the road, but it is formed nevertheless. "This statement is supported by the fact that when this protecting layer of tarred metal is worn away at any point a pothole is formed at once, which deepens very quickly; it would appear that the detritus which had accumulated under the protecting layer is soon dispersed." The author advocates the continual maintenance of the tarry film, tarring being renewed often enough "to prevent the protective layer from disappearing altogether." Though he points out the ordinary limitations of surface tarring, the author states that good results followed surface tarring of strong roads in order that they might resist the heavy traffic of the beetroot season. The crust, when rendered waterproof, was of sufficient strength, and the practice has been continued for six years, making it unnecessary to resort to paving, which would otherwise have been regarded as inevitable. This is a very interesting point in the study of the comparative values of different types of roads.

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* Communication No. 4, Third International Road Congress.

As regards bituminous-bound roads, a case is cited in which limestone coated with tar proved more durable than the quartzite which was replacing the water-bound limestone. The author regards the use of stone setts as being possibly to a large extent a temporary expedient, pending better information as to bituminous-bound road crusts. As regards conversion from ordinary metalling to setts, the change is made to meet traffic conditions, only one case, and that exceptional in character, having shown a saving in cost. On the other hand, there is usually a saving in changing from setts to metalling.

THE UNITED KINGDOM

H. T. Wakelam, County Engineer, Middlesex;
A. Dryland, County Engineer, Surrey;
Col. R. E. Crompton, Consulting Engineer to the Road Board;
T. W. A. Hayward, Borough Engineer, Battersea;
F. J. Wood, County Engineer, East Sussex.

This is a short report, but it contains important data. A table contributed by Mr. J. A. Brodie, M. Inst. C.E., shows, for seven kinds of paving or road crust, the life in years, the life tonnage per yard width, ton miles per yard, width per penny of cost, and other data. The ton-miles per yard width per penny are: 6-in. setts, 34.0; 4-in. setts, 24.0; 4-in. pitch-macadam, 20.6; softwood, 15.5; 7-in. water-bound macadam, tar-sprayed, 11.4; 7-in. water-bound macadam, 7.6; hardwood, 7.4. The nature of the foundation in each case is not stated, but it may, of course, be assumed that the foundations were all suitable and adequate. Another table shows the "weight" of traffic in tons carried 1 mile for one penny of maintenance cost on water-bound crust and water-bound tarred crusts. The weights are the estimated or arbitrary weights of the Road Board table. The weight carried 1 mile for one penny ranges from 1.4 to 15.1, the average for Norfolk roads being 6.0, and for Warwickshire roads 3.7. The opinions of a number of individual surveyors with respect to different kinds of paving are given in a table. The opinions of road users were also collected by the committee. For heavy haulage, such as that near docks, stone setts are regarded as satisfactory, especially for low speeds. For the transport of the goods at considerable speed from business centres into the surrounding country, the owners of heavy vehicles, such as traction engines and motor wagons, carrying 8 tons on the back axle, do not favor any type of bituminous construction, partly on account of the increased tractive effort required in hot weather. It is not clear from the report what are the types of road crust preferred by drivers of commercial vehicles of moderate weight, such as delivery vans. Drivers of light motor vehicles, motor cyclists, and ordinary cyclists prefer, it is stated, well-made water-bound roads which have been surface tarred. As regards the dividing line at which broken stone road crusts may with advantage be given up in favor of stone setts, it is suggested that, instead of taking as the criterion the maintenance cost per square yard per annum, it might be better to make the change when the cost per traffic ton-mile exceeds a certain figure.

ITALY

P. Cattaneo, Engineer to the Municipality of Milan

(1) Report of M. Columbo, Engineer, Milan

In his consideration of foundations the author points to some disadvantages of the concrete foundation—rigidity, high cost, difficulty of access to the subsoil—and suggests that it might be advantageous to employ large pebbles or quarry stones, the latter being the waste from cut stones. On account of the cost of making bituminous joints in paving, and some difficulties in its application, an alternative, the author suggests, might be found in the use of a mortar made of heavy clay soil mixed with sand and pasted on to the stones with a trowel when they are put in position. Clay swells with moisture, remaining watertight, and the watering which is now always considered necessary in dry weather would keep the joints moist.

(2) Report of C. Corazza, Engineer, Turin

The author of this part of the report describes several kinds of paving. One of these consists of flat stones placed on edge, used with an asphalt binder. The stones are 12 centimetres thick, the joints being filled with "ordinary artificial asphalt as a paste." This paving seems to have given satisfaction. A form of wood paving which was tried three years ago has proved successful. It consists of cylindrical blocks of acacia wood 2 centimetres deep, with the fibre vertical, the spaces between them being filled with asphaltic bitumen. It is proposed to use existing road crusts as the foundation for this kind of paving. The diameter will be limited to 12 centimetres, the bark being stripped from round wood blocks. "The timber may be taken from the roadside acacia trees, which are now practically given away."

(3) Report of F. M. Bellandi, Engineer, Florence

This contribution is devoted to an account of work with tar-macadam, which, it is considered, promises to prove a useful material in Italian towns. There are no comparisons with other kinds of paving, except that surface tarring is stated to give decidedly inferior and less economical results under certain urban conditions. The kind of pavement constructed "has all the qualities as well as the appearance of compressed asphalt without its slipperiness, as long as it is kept properly clean, and it may solve the road building problem and that of general paving in the centre of cities." It is considered that for the maintenance of such a road crust a simple tarring of the carriageway, at a cost of 0.12 lira to 0.15 lira per square metre, is sufficient, "while no other work than good sweeping is required on the side walks and margins."

(4) Report of F. Nigra, Engineer, Turin

The best paving for roads with tramways is stone setts, and it is suggested that its use should be made compulsory between the rails and for 50 centimetres on each side. Generally, stone paving should be provided if the traffic exceeds 2,000 "colliers." Bituminous-bound road crusts may be used for roads 10 metres wide and where the daily traffic does not exceed 400 "colliers," if they are to last about four or five years.

Summing up, Mr. Cattaneo expresses the opinion that granite paving is the best for heavy traffic, and that for roads with a large amount of light traffic surface tarring is suitable. He does not consider that any definite conclusion can be expressed as regards bituminous-bound crusts.

MONACA

Dr. E. Guglielminetti (well known as a Pioneer of Dust Abatement on Roads)

This report is on the economic results of surface tarring. The author states that in Monaco town the chief engineer, Mr. Curti, has found that surface tarring results in an economy of 40 per cent. on roads with light traffic and 25 per cent. on roads with medium light traffic, during a period of ten years. Mr. Bourre, chief road engineer of the town of Nice, has found that the period between renewals is greatly extended, and that "the saving on the cost of maintenance almost compensates for the cost of tarring them." For roads with heavy traffic tarring is desirable, though there are many complaints on account of the formation of black, sticky mud in wet weather. Dr. Guglielminetti concludes that the roads on which tarring is to be done must be selected judiciously, and he points out that for roads with heavy traffic it is necessary to have a strong crust, since if the crust gives way the tar will follow. A metalled road which requires resurfacing every two years or oftener cannot be improved in any useful degree by surface tarring, and bituminous-bound crusts would probably prove suitable for such roads.

RUSSIA

B. S. Kouperstein, Engineer, Chief of Section of the Road from Moscow to Varsovi

This report contains some interesting analyses of costs of different kinds of paving and road crusts. Except in the streets of large towns, Russian roads are built on a layer of sand, usually with an ordinary water-bound surface, but sometimes with a paving of natural or artificial stone, the latter being called "artificial stone" (clinker), and being, it seems, some kind of brick. The author points to the advantages as regard traffic and noise. The clinker or brick road is not noisy, and the traffic effort required upon it is small, but the coefficient of wear is low, and the roads become dusty. Metalled roads are laid on a bed of sand 18 centimetres thick, the stone crust being 7 centimetres thick after rolling. The maintenance of such a road is costly. The results attained depend on the materials used, the stone employed in Russia being often of mixed qualities obtained from the fields, and the limits of size are very wide. The binding material is usually dry screenings, and the author has found it lacking in binding qualities and more of the nature of a packing material. Surface tarring is costly, 47 centimes per square metre in a case cited, excluding labor and the cost of heating the tar. A Portland cement and lime binder mixed with screenings has given good results, the mixture being spread first on the picked road surface and the stone spread over it and rolled until the cement floats to the surface.

The author concludes that the most economical roads are those made with round field stones, but they are not good roads. The clinker (or brick) paving is to be preferred to the water-bound metalled road, chiefly on account of the defects of the latter, as made in Russia, and more generally for roads with heavy traffic. For very heavy traffic it is better than metalled roads of a good class, and for a further range of roads it is practically to be preferred, except when the materials for a metalled road are good and cheap, and the construction better than is usual in Russia. Paving with regularly shaped stone is costly in the Russian Empire, and is only done in a few large towns.

THE NETHERLANDS

Dr. L. R. Wentholt, Engineer of the Waterstaat of the Netherlands

Of the 1,900 kilometres of State roads, 1,200 kilometres are paved with brick. Brick paving has the following advantages: Its maintenance is simple and easily understood; it is free from dust in summer and from mud in winter; it can easily be taken up for pipe laying and so forth; and it provides sufficient foothold for horses. On the other hand, its maintenance expenses are very high; it is not strong enough to carry a very heavy load; and unless the surface is very well maintained it is not a good one for cyclists. After pointing out advantages and disadvantages of stone sett paving, and of gravel and shingle road crusts, the author includes that "there is not much to choose between the advantages of brick roads, gravel roads, and roads built with large setts and shingle, when one weighs the pros and cons of each class of road, and the selection of the type to be adopted in each particular case will entirely depend upon financial considerations." In his final summing up, Dr. Wentholt states that a brick road is, from the financial point of view, to be preferred to a road paved with large setts, and that outside the towns a shingle surface is usually to be preferred to either, except where there is very heavy traffic, such as that in the beetroot district, and in some other cases in which a brick road is preferable. The report contains tables showing, for numerous roads of a large total mileage, the proportion of road surface renewed annually, the annual cost of maintenance, the coefficient of traffic, the number of bicycles, the annual cost in terms of traffic, and the condition of the road.

INTERESTING statistics regarding the new Equitable Building, now under way on the site of the old structure in lower Broadway, New York City, convey in a measure the magnitude of the undertaking. Among other things there will be required 33,000 barrels of cement in the foundations, 120,000 cu. ft. of cement in the building itself, 1,215,000 cu. ft. of broken stone, 168,000 cu. ft. of terra cotta, 4,000,000 hollow tiles, 350,000 sq. ft. of marble trim and material for flooring, 1,350,000 cu. ft. of sand and 17,500,000 common brick. The estimate is about 5,500,000 more brick than was required for the Pennsylvania Railroad Terminal and about 10,000,000 more than was used in the construction of the twin Hudson Terminal buildings. There will be 152 steel supporting columns, the weight of the heaviest of which will be 32 tons. The structural steel work will require 18,000 gal. of paint to coat it. There will be 50 elevators in the building so arranged that if a firm occupies several floors it will have its own private elevator. All the elevator shafts will be enclosed in brick and will have fireproof doors. The stairways, enclosed completely in tile or brick, also have fireproof doors. The building will contain 5,000 windows and all offices will have washbasins with hot and cold water connections.

Vicars, Sons & Maxim, the well-known British engineering and shipbuilding firm, will establish a huge plant at Montreal. The shipyard will be capable of accommodating a ship 880 feet in length, or nearly 100 feet longer than the Mauretania.

Glossary of Terms Used in Road Construction

AN interesting and valuable work has been completed by Mr. H. Percy Boulnois, M. Inst. C.E., Member of the Advisory Committee of H. M. Road Board (Great Britain), in the compilation of a glossary of road terms which appears in part in a recent issue of our London Contemporary, "The Surveyor," and which we are reproducing by the courtesy of that journal in the columns of the "Contract Record." In introducing his work Mr. Boulnois explains that he has made no reference to the various geological names of road-making rocks, but has contented himself with following the names settled by the Engineering Standards Committee. It is hoped that any omissions and errors will give rise to criticism of a constructive character.

Abrasion.—The act of rubbing off or wearing of a stone or other material.

Absorption.—The act or quality of a stone or other material to absorb water or moisture.

Abutments.—The supporting side walls of a bridge, but often applied to the sides or haunches of a road.

Acidphalte.—The trade name of an asphaltic composition.

Acme Paving.—The trade name of a special method of wood paving.

Adamant Stone.—The trade name of an artificial stone, flag or sett.

Adaptable.—The trade name of a horse sweeping-machine.

Adhesion.—The act or quality of adhering or sticking closely together.

Aeberli System.—The trade name of a method of road making.

Affinity.—Sometimes used to denote cohesion.

Agglomerate.—To gather together in a mass.

Agglutinate.—To unite or cause to adhere with a viscous substance.

Agglutinous.—The property of adhering or being in a viscous condition.

Aggregate.—"A sum, mass or assemblage of particulars," generally applied to the matter comprising the principal portion of the materials of which a road surface or concrete is formed.

Akonia.—The trade name of a dust palliative.

Alignment.—Laying out or regulating the ground plan as distinct from gradient or profile; the line of a road, or "to bring into line."

Alley.—A narrow street or passage.

Alluvial.—A geological term applied to recent deposits of soil or detritus washed down from rivers, etc., into valleys.

Almajan.—The trade name for a method of surfacing roads.

Ambulator.—An instrument for measuring road distances.

Amiosite.—The trade name of a dust palliative.

Ammoniacal Liquor.—"An aqueous solution of ammonia and compounds of ammonia and of phenols."

Andesite.—The trade name of a road-making rock as settled by the Engineering Standards Committee.

Angular.—A material with sharp edges.

Annular.—Having the form of a ring.

Anthracene.—Heavy tar oil. An aromatic hydrocarbon produced in large quantities in the manufacture of coal gas, and found in the tar in varying proportions.

Antistaubite.—The trade name of a dust palliative.

Aplite.—A road-making rock, coming under the trade name of "granite," as settled by the Engineering Standards Committee.

Apokonin.—The trade name of a bituminous mixture for road construction.

Aqueduct.—A bridge carrying water.

Arcade.—A covered lane or passage containing shops.

Argillaceous.—Partaking of the nature of clay.

Argillaceous Soil.—Soil of a clayey nature.

Arkose.—A road-making rock coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Arris.—The edge of a dressed stone or of a wood block.

Arterial.—A term applied to a system of streets diverging from a common centre, or joining up with main roads.

Artificial Asphalte.—A generic term applied to various bituminous compounds or mixtures containing more or less natural rock-asphalte.

Asphalte.—Sometimes spelt "asphalt." There has been some confusion in the use of this name. It was formerly understood to mean the natural asphalte rock found in certain localities, such as Val de Travers, Limmer, Seyssel, Lobsann, etc. This rock consists of pure carbonate of lime intimately combined and impregnated with mineral bitumen in variable proportions. The term is now applied to various bituminous mixtures.

Asphaltenes.—A term applied to certain components of bitumens in petroleum products, etc.

Asphaltic.—Of a character similar to that of asphalte, or containing a proportion of asphalte.

Asphaltic Macadam.—A term sometimes applied to tar-macadam, but a proportion of real asphalte is generally understood to have been used in its composition.

Asphaltoiline.—The trade name of a bituminous compound.

Asphaltum.—A mineral pitch not to be confused with asphalte. It is found in a soft or liquid state in some parts of the world. It is generally called bitumen.

Atlas Stone.—The trade name of an artificial flagstone.

Atomise.—To reduce to atoms, as in tar-spraying.

Attenuate.—To make thin or less viscid.

Attrition.—The act of wearing or rubbing down by contact. See also "Inter-attrition."

Avenue.—A long street or road of considerable width, and generally with trees planted on each side.

Axle.—The bar transferring the weight of a vehicle on to the wheels. All weights of vehicles are calculated by the weights on the front and back axles.

Baffles.—The plates in mixing machine which break up and change the direction of flow of the material, thus ensuring a perfect mixture.

Ballast.—A generic term applied sometimes to denote river gravel or stones, and also to the matrix of the material used in making concrete.

Barrel.—Or "barreling." The camber, contour, cross-section or crossfall of the surface of a carriageway.

Basalt.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee, including basaltic whinstone.

Base.—Sometimes used instead of the word "foundation"—for instance, "the concrete base" under setts.

Batch.—Any quantity of a material made at once; for instance, the charge put into a mixing machine.

Bath Mixer.—A special form of mixer used for mixing bituminous materials.

Batten.—A thin strip of wood, used, inter alia, between concrete "bays" laid in situ.

Batter.—The slope or inclination of the face of a retaining wall.

Bay.—A term used to denote a square of concrete paving; in bridges, the portion between the piers.

Bearing.—The solid support of a girder or beam.

Beater.—See "Rammer."

Bed.—That on which anything rests, a layer or stratum; to embed or fix in a permanent position; to impose in a position a stone or a brick. Sometimes applied to the support of the foundation.

Beech.—A wood sometimes used for paving blocks.

Beetle.—A heavy wooden mallet or beater.

Benching.—Cutting or leaving edges or steps to strengthen embankments in process of construction.

Bench Mark.—A permanent mark used in levelling.

Bent Grass.—A grass largely planted to retain sand and prevent its being blown away.

Besoms.—A birch broom.

Beton.—A form of concrete in which large stones are embedded.

Betterment.—Increase in the value of property caused by a road or street improvement.

Bevel.—To cut away or slope off to an angle.

Bifurcate.—To divide into two. Where two roads meet at an acute angle they are said to bifurcate.

Billhook.—A hatchet with a long handle for trimming hedges.

Bin.—A box, generally of iron, in which is kept sand or gravel to be sprinkled on road surfaces when slippery. An "orderly bin" is used to receive the refuse off roads.

Binder.—A term sometimes used to denote small material used for binding an aggregate, and sometimes for the sand, gravel, or grit used to bind the surface of a water-bound macadam road. The word is also now used to designate various bituminous compounds used as binders to consolidate carriageways.

Binder Course.—A course of fine bituminous concrete spread between the lower and the upper crust of a road.

Binding.—The material used on ordinary macadam roads to bind the surface stones together. Sometimes called "blinding."

Bitulithic.—The trade name of a bituminous mixture.

Bituflux.—The trade name of a bituminous mixture.

Bitumen.—A mineral substance of a resinous and viscous nature, chiefly composed of hydrogen, carbon, etc. The word is often applied wrongly to residuums of distillation. If pure or natural bitumen is meant, the term should be prefixed by a qualifying description, as Trinidad Lake, Mexican, Ebano, etc.

Bituminous.—Containing bitumen or having a close resemblance to bitumen.

Bituminous Macadam.—See "Tar-macadam."

Black Ash.—Crude carbonate of soda.

Blades.—Fixed or movable projections.

Blanket.—A term used to designate a thin crust or carpet of some bituminous mixture laid on the surface of a carriageway.

Blast-furnace Tar.—A material obtained from blast furnaces, using Scotch splint coal as fuel.

Bleeding.—The exudation of pitch or bitumen from the road surface or from the prepared material.

Blending.—The act of mixing certain ingredients together in fixed proportions.

Blinding.—See "Binding."

Blocking Course.—The filling-in course or termination course of a row of paving stones, bricks, or wood blocks.

Blocks.—Pieces of wood or stone squared into shape, but which are not cubes.

Blowhole.—A small hole in the surface of asphalt or similar material caused by steam generated below in laying the hot material on a wet surface.

Blue Gum.—A species of Australian eucalyptus or gum tree, from which wood blocks for paving have been made.

Bond.—A joint, or a jointing material. The word is sometimes used to designate the cohesion of one material to another.

Boning.—The act of levelling by the eye with cross-heads called "boning rods."

Boost.—To raise something by packing it up from underneath.

Border.—The edge or verge of a country road. Sometimes the word "border stone" is used to designate a rough kerb.

Boring.—A small hole made to ascertain the nature of the subsoil.

Borrow Pit.—A pit or excavation from which earth is taken to make up an embankment or raised road.

Boss.—A thickened head or swelling.

Bottle-neck.—Applied to the short, narrow entrances of a street or road which afterwards widens.

Bottoming.—The lowest portion, or layer, of a carriageway resting on the ground formation. Now frequently called the "bottom course," or "bottom coat."

Boulder.—A large piece of rounded, waterworn rock.

Boulder Clay.—A tenacious clay of the glacial or drift epoch.

Boulder Pavement.—A pavement made with "cobbles" or large, rounded stones, now quite obsolete.

Boulevard.—Usually applied to a wide avenue or street which partly or wholly encircles a town, but the word is frequently used instead of "avenue."

Box-drain.—A drain with a flat top and bottom.

Breaking Track.—A term sometimes used to designate vehicles which do not follow in the same track.

Breasts.—Sometimes used to designate the outside portions or haunches of a carriageway.

Breast Wall.—A revetment wall.

Breccia.—A road-making rock, coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Breeze.—Small coal, ashes, clinker, or cinders; sometimes used for binding.

Bridle Path.—A path that can be used by horses, but not by a vehicle.

Briquette.—A small artificial brick or tile.

Brittle.—Easily broken, fragile, the reverse of "tough."

Buddle-hole.—A gully constructed partly under the kerb and footpath, with an elongated entrance parallel to the channel. (Local term).

Bumping.—A technical term used for the violent movement of tar, etc., when boiling.

Bunches.—A term sometimes applied to humps on the tops of "waves" in the surface of a carriageway.

Bunney.—A short, small culvert or drain. (Local term).

Burnetise.—A process of impregnating wood blocks with a solution of chloride of zinc.

Buthaltic.—The trade name of a special method of constructing tar-macadam roads.

But-joint.—A joint between two setts or blocks without any space between them.

By-pass Road.—Generally applied to a road which diverts the traffic for a short distance so as to avoid congestion of traffic in a town or elsewhere.

By-road.—A private or obscure road which diverges from a main or district road.

Calcareous.—Partaking of the nature of lime, or chalky.

Calcium Chloride.—A binary compound from calcium, a member of the alkaline earth group of elements. Largely used as a dust palliative.

Calkins.—The rough-pointed projections on a horse's shoe.

Caloric.—Pertaining to heat.

Camarco.—The trade name of a road composition.

Camber.—The convexity or curve of the cross-section of a carriageway. Also called "barrel," "crossfall," "curvature."

Camphor Wood.—A hardwood from Borneo, sometimes used for paving carriageways.

Camp Sheeting.—Close piling or boarding to resist pressure of earth, etc., from behind. Sometimes called "camp sheathing."

Cant.—To turn over, tilt, or place at an angle—for instance, a canted or hanging road.

Cantar.—The trade name of a hand tar-spraying machine.

Carbenes.—Components of bitumen petroleums, etc.

Carbon.—From "Carbo," a coal. It is insoluble and infusible.

Carpet.—A term used to denote a thin covering or coat of asphaltic, bituminous, or similar material on the surface of a carriageway.

Carriageway.—The part of a road used by wheeled vehicles.

Cart.—Formerly used to denote a two-wheeled vehicle without springs, but now generally used to denote an open vehicle on two wheels. Also used as a verb to denote the haulage or carrying of materials.

Catchment Area.—The area from which the surface or storm water is gathered.

Catch Basin.—See "Catchpit."

Catchpit.—A pit at the side of the road into which the surface water drains. Usually called a gully or gully pit.

Causeway.—A narrow road or street paved with stone. Generally applied to a raised road or a short road to a ford or ferry.

Cementation.—The binding power of any material to adhere together after having been broken into very small pieces.

Cementitious.—The binding property of any material.

Centigrade.—Consisting of 100 degrees; graduated into 100 divisions or equal parts. Specifically: Of or pertaining to the centigrade thermometer; as, 10 deg. centigrade (or 10 deg. C.).

Centimetre.—A French measure of length = .3937 of an inch.

Cesspit.—Sometimes used to denote a gully-pit or catchpit.

Chain.—A measuring, or "Gunter's" chain, 66 ft. in length and divided into 100 units.

Chaise.—An almost obsolete word for a certain type of vehicle.

Channel.—The gutter, or kennel, at the side of the carriageway. See also "Water table."

Charge.—To fill a vessel; or, used as a noun, the contents of a vessel.

Chart.—A plan, or tabulated form. A marine map.

Chase.—A groove or cut.

Chasm.—A deep and wide rift or fissure.

Checker.—Or "Chequer." To mark with little squares. Sometimes used to designate the scarifying or chequering of a road surface.

Cheek Crusher.—A stone breaker, with jaws or cheeks, as distinguished from a roller or drum crusher.

Chert.—A road-making rock, coming under the trade name of "flint," as settled by the Engineering Standards Committee.

Chips or Chippings.—Small fragments of stone, irregular in shape, with fine, short edges.

Chip Pavement.—A pavement composed of irregular stone spalls in the form of a mosaic.

Chock-a-Block.—Driven tight together.

Chord.—The straight line drawn from one end of an arc of a circle to the other end of the arc.

Chute.—A trough or channel for delivering water or other matters down an incline.

Cinders.—The residue remaining after burning coal in an ordinary fire, somewhat softer than ashes.

Circuitous.—Applied to a roundabout way or road.

Circulation.—Used to apply to the movement of traffic of vehicles on roads.

Circumferentor.—An obsolete instrument for taking angles in road surveying.

Circumfuse.—To spread around or pour over a surface. (Such as tar on a road).

Clare's Compounds.—A trade name given to various special bituminous compounds for making tar-macadam, or for spraying, etc.

Clay.—Fine-grained, non-indurated sedimentary deposit, plastic when wet.

Clay Puddle.—Clay or earth tempered with water and thoroughly worked up into a plastic condition. (See "Puddle.")

Cleavage.—The manner in which stones or similar materials split or divide.

Cleave.—To split.

Clinker.—Hard, vitrified, or burnt scoria or slag, etc. Sometimes rather loosely used to describe cinders.

Clod.—A lump or mass of earth or clay.

Coach.—Often applied indiscriminately to a vehicle, but generally understood to refer to a four-in-hand.

Coagulate.—To curdle or congeal.

Coalesce.—To grow together or unite.

Coal Tar.—See "Tar."

Coat.—A single application of tar or other material to the surface of a road.

Coating.—A covering or spreading of a material, such as stones on a road; also the application of tar or other material on the surface of a road. The word is used indiscriminately with "coat," as, for instance, top-coating, or top coat, etc.

Cobble.—A large pebble or rounded stone formerly used for paving carriageways or footwalks, but now obsolete.

Cob-Wall.—A wall built of clay mixed with straw.

Cocks.—Sometimes used instead of "calkins" on horses' shoes. (A local term).

Cofferdam.—A dam made of a double row of piles set close together with clay rammed between the rows of piles.

Cogs.—Sometimes used instead of "calkins."

Cohesion.—The force which binds the particles of any material together.

Colonnade.—A series of columns in a row. Generally applied to a covered, long portico with shops underneath.

Compo.—Another name for mortar.

Composite Paving.—A generic term applied to artificial paving.

Compressed Asphalte.—Natural rock-asphalte ground into powder, heated and rammed to form a road surface.

Concave.—A hollow or cavity; the reverse of convex.

Concrete.—Stones, gravel, or other materials mixed together with cement, water and sand. The term is sometimes employed in referring to tar-macadam as tar-concrete.

Conduit.—A pipe, tube, or other channel for the conveyance of water or other fluid.

Conglomerate.—A road-making rock, coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Consolidate.—To make solid, to unite or press together, as in rolling the surface of a road.

Contour.—The outline of a figure or body. Generally applied to the cross-section or cross-fall of the surface of a carriageway.

Convex.—Rising or swelling into a rounded form. The reverse of "concave."

Coping.—The top or cover of a wall.

Copse.—A small wood or coppice.

Corduroy.—A term given to the surface of a carriageway that has become ribbed or corrugated.

Cormastic.—The trade name of a special method of construction of the upper crust of a carriageway.

Corrugated.—Bent into folds or wrinkles.

Counterfort.—Projection of masonry or brickwork at the back of a retaining wall to strengthen it.

(To be continued.)

Rapid Building Progress at Calgary

Constructional Features of the More Important Undertakings Upon Which Operations are Being Pushed Vigorously

Correspondence of The Contract Record

Calgary, November 5, 1913.

RENEWED activity has been in evidence in the building business in Calgary and the prospects are that the coming year will be as good as 1912. Besides the many new buildings under way, there are several large structures being finished, these giving employment to a great deal of skilled labor.

The new C. P. R. hotel, to be known as The Piedmont, is now in course of completion, giving employment to about three hundred mechanics. Both the large new buildings for the Herald Publishing Company and the Calgary Furniture Store are far enough advanced to give employment to an equal number of men. These three buildings alone represent a total expenditure of over $2,000,000. A great deal of activity is apparent in the offices of the local architects and quite a number of new structures have been commenced during the past two weeks. In addition to the new work, construction has been commenced anew on the six-storey office building for Senator James A. Lougheed. The building will cost close to $450,000 before completion and will be the first portion of a ten-storey block that, when completed, will occupy 150 feet along Eighth Avenue West, in the heart of Calgary's business district. The architects and builders are H. L. Stevens & Company, of Vancouver. The same firm of architects are preparing the plans and will construct a theatre on Eighth Avenue for Starland, Limited, owners of theatres in many western cities. As far as is planned at present, the building will have a frontage of 75 feet, and will house a theatre for vaudeville and motion picture circuits, having a capacity of 1,200 persons. The structure will be reinforced concrete, with terra cotta exterior, and will cost in the neighborhood of $200,000.

Noteworthy Industrial Buildings

There are many small business blocks now under way, all of which serve to give employment to practically all the labor available at present in the city. Among the more important buildings on which work has just commenced is the hotel and business block for P. O. Sullivan, to cost about $70,000. The building has a frontage on Seventh Avenue of 75 feet and will be three storeys high above the basement floor. The construction will be a reinforced concrete frame with laminated timber floors and the partitions. The exterior will be faced with enamelled brick manufactured locally by the Crandell Pressed Brick Company, Limited, of Calgary. The architect is J. B. Henderson, of Calgary. McDougall & Forster, Limited, of Calgary, have the contract. The Union Building Company, Limited, have been awarded the contract for the erection of a creamery building for P. Pallensen, of Calgary, at a cost of $18,000. The building will be of slow-burning construction, with brick veneer exterior and will contain creamery machinery for the business of the owner. Laing & Smyth, of Calgary, are the architects. Among the other buildings started is a warehouse for the Alaska Bedding Company, Limited, of Canada, being built by Carter-Halls-Aldinger Company, Limited, of Winnipeg.

The Hudson's Bay Company are now occupying their new premises and have sold their former store to the Royal Bank of Canada. The latter have commenced alterations to the old building before entering it themselves. The alterations consist in fitting the fifty feet adjoining the corner for occupancy by the local branch of the Royal Bank, the remaining fifty feet on the ground floor to be altered for the Woolworth Company, of New York, for a five and ten cent store. The second floor will be renovated and altered for office rental. Purdy & Henderson, of New York and Vancouver, have the contract, amounting to about $25,000. The architect is Kenneth G. Rea, of Montreal.

One of the largest industrial schemes now contemplated will be the flour mill and elevator for the Calgary Flour Mills Limited, a new company with a Dominion charter. They contemplate the erection at once of a flour mill having a daily capacity of 3,000 barrels at the beginning, to be increased later to give a maximum capacity of 6,000 barrels daily. A site aggregating 15 acres has been selected in East Calgary, where the mill will be served by all three railroads. In the same part of the city, it is the intention of the city of Calgary, co-operating with the railroads in establishing great central stockyards, for which a by-law has already been passed authorizing the expenditure of half a million dollars for the purpose of buying the site. The entrance of the Grand Trunk Pacific and of the Canadian Northern Railways through that part of the city will facilitate the rapid development of a greater Industrial Calgary. Recently the Canadian Malting Company, Limited, of Toronto, established a malting plant with elevators in this part of the city, and almost before the completion of the original plant, it was found necessary to double the capacity of the malt house, with a corresponding increase in the storage elevators.

Cold Storage Plant under construction at Calgary

As described in a former number of the Contract Record, the first construction consisted of thirty-two bins, having a total capacity of 400,000 bushels storage, with the required distributing tower, weighing hoppers, etc., serving the malt house. The bins in general consisted of a nest of twenty-two circular bins, ten of which are 21 feet in diameter, with 7-inch thick shells, and twelve are 13 ft. 10 in. in diameter, with 6-in. shells. The new installation consists of ten bins 21 feet in diameter, with 7-inch shells, forming a nest triangular in shape, to conform to the owners' property boundaries, giving a total of sixteen new bins having a capacity of 260,000 bushels storage. A total of 3,500 cubic yards of concrete were placed for foundations and bin walls. The contractors, the Canadian Stewart Company, Limited, of Chicago and Montreal, used their own patented moving forms in the construction of the circular tank walls, enabling them to complete the tanks proper, 90 feet high, 21 feet in diameter, in 16 working days of 24 hours. The weather conditions were excellent, enabling them to concrete as much as 8 ft. 6 in. vertical rise in 24 hours. All of the tanks have hopper bottoms, formed by concrete slabs on earth fill over the foundation slabs and feed on to 30-inch belt conveyors. A penthouse over the bins enables the tanks to be charged from two 30-inch belt conveyors. A third belt conveyor of the same size supplies the malt house from the storage. The double conveyors serving the elevator have a run of 575 lineal feet. The malt house has a capacity of over one million bushels a year, and is of reinforced concrete and solid brick wall construction. A second 250 h.p. Goldie-McCullough engine has been installed, making a total of 500 h.p. available. The boilers are gas fired, and the kilns of the malt house have been altered this year to be gas fired also. The conveyors are all operated by rope transmission. The plant has been erected complete according to plans and specifications of the Saladin Pneumatic Malting Construction Company, for whom Otto Luebkert, of Chicago, is the architect. The total cost will be in the neighborhood of $750,000.

The Canadian Northern has given evidence of increased activity in entering the city, and are now calling for tenders for the construction of temporary freight sheds and a temporary station building. These buildings will be placed in the heart of the future freight yard pending the erection of the steel for the crossings required to gain an entrance to the town. In East Calgary there will be an overhead crossing above the main canal of the Canadian Pacific Irrigation System and over the main line of the Canadian Pacific Railway and also a six-span bridge over the Bow River. Within their terminal there will be a subway crossing and a two-span crossing over the Elbow River at their proposed depot site. The steel for these bridges has just arrived and it is expected to have gangs at work before cold weather sets in. The Grand Trunk Pacific have their line graded and steel laid into the city and are only awaiting a settlement with the government for the purchase of the site of the barracks of the Northwest Mounted Police. In the meantime, they are proceeding with their permanent way construction, and have already commenced to build signal towers for interlocking control of their yards. The C. P. R. have only this year installed interlocking switching, but have about completed the control of the ninety odd miles of yards and terminals in the city limits.

Addition to Grain Elevator for Canada Malting Co., Limited, Calgary

The Canadian Pacific irrigation dam, at Bassano, was closed temporarily and had all but filled to the spillway when two of the temporary wooden gates failed, necessitating the emptying of the dam to the sills in order to replace the gates. It is expected to place the permanent gates this winter so that the entire system may be in full operation next year. In conjunction with the western section of this scheme, the railway has commenced construction on the diversion weir at the headgates for the main canal in East Calgary. Hayden & Skene, Calgary and Vancouver, have the contract and are about to commence construction at once. The same contractors completed the reinforced concrete headgates for this canal in the early spring. Considerable progress has been made in the main structures of the eastern section, such as the aqueduct, which will be 2,500 feet long, the main syphon and the completion of practically all the minor structures.

A great deal of interest has been aroused by the rapid progress in the construction of the new cold storage plant for P. Burns & Company, Limited, of Calgary and Vancouver. L. R. Burn, of Calgary, has the contract for the erection of the building, at a cost to exceed $225,000. The building is 198 feet long, parallel to the main tracks of the Canadian Pacific Railway and is 125 feet wide and six storeys high including the basement. But four months have elapsed since the contract was let, and the building is now ready for the owners, who will install all piping and ice machinery and provide and place all cork insulation. The excavation had been completed under a separate contract, as the building occupies the site of the building destroyed by fire in January of this year. Nevertheless, the contractor placed all of the 7,000 cubic yards of reinforced concrete in fifty-five working days, a delay of fifteen days awaiting the arrival of reinforcing steel, making an elapsed time of seventy days required for concreting. An average of 250 men were continually at work, daily, with an additional gang of 60 men on each night for concreting and laying steel. The forms were all timber and about 90 carpenters were employed at all times, the lumber being used twice. The concreting plant consisted of a one cubic yard Koehring mixer, charged by a loading hopper from the ground, the concrete being hoisted several feet above the floor and thence flowing down to a hopper placed on the floor, from whence the concrete was taken in carts to the more distant portions of the building. The hoist tower was an ordinary timber one, with an Insley bucket and hopper equipment. In addition, an Insley portable hoisting boom was used for handling forms and steel. A total of 410 tons of Havemeyer bars were used for the reinforcing steel in the flat slab system employed. The "system" used differs from others in that the square plate on top of the flaring column head has no reinforcing. The bands of small steel bars run from column to column in eight directions, as is usual and are supported over the column by a single heavy bar in the top of the plate, bent to a square. Columns are spaced 17 ft. by 17 ft. 6 in. and were placed in the proportion of 1:1½:3, the balance of the work being proportioned 1:2:4. A noteworthy feature of the building is the fact that the exterior walls, instead of being carried from floor to floor, as is usual in such framed buildings, are carried their entire height clear of the structural frame, in order to secure continuous insulation from the exterior. On the north side of the building is a covered shed over the two tracks of the C. P. R., that serve the building, while on the north side is the local shipping platform, protected from the weather by a steel, glazed canopy, cantilevered from the brick walls so as to eliminate columns. On these two sides, the exterior brick walls are carried on heavy reinforced concrete beams for the full height of four storeys; on the other two sides the brickwork is carried by reinforced concrete footing walls, monolithic with exterior column footings. The exterior is of local red pressed brick, 1,200,000 being placed at the rate of about 80,000 per day. E. H. Nichols is the engineer for the contractor and F. G. Carpenter for the owners. The building was designed in the office of Gardener & Lim-berg, of Chicago, who control the particular type of reinforced concrete construction described.

The Protestant Public School Board now has under construction two large stone schools, and are about to let the contract for four cottage schools. R. A. Brocklebank has about completed the placing of all reinforced concrete floors and stone walls for the 15-room school in Bridgeland, the finished building to cost about $190,000. Work is well under way on another such school in Balmoral sub-division—a 15-room school 170 feet long by 77 feet 6 inches deep, three storeys high, including the basement floor. The building stands in the centre of two city blocks, where it is intended to have a park and otherwise treat the site with the view of a "social center." In the basement, besides the heating plant, there will be a domestic science lecture room with adjoining kitchen, as well as manual training rooms and two playrooms. On the upper floor will be six class rooms, toilets and office, with a large assembly room intended to be used in the "social center" development. On the top floor will be fifteen class rooms, a library and two toilets. The exterior of the building will be of Calgary sandstone, of a better design than has been the rule in the local school architecture. Interior partitions are all solid brick walls, with reinforced concrete floors and stairs. The Kahn system of Floredome construction will be used, requiring about 300 cubic yards of concrete and about 200 tons of reinforcing steel. There will be, in addition to the main stairway at either end, an enclosed fire stair at the rear of the building. There will be a clock tower surmounting the slate mansard roof, the center of the dial being 70 feet above the grade in front. The building will be heated by a plenum hot air system, requiring two boilers. The general contract is being carried out by J. A. McPhail, of Calgary, the total cost to be above $200,000. These schools were designed in the office of the School Board, under Mr. H. McClelland, in charge of the Building Department.

J. McDiarmid & Company, Limited, of Winnipeg, have the contract for the Customs Examining Warehouse, and are making very good progress in the building. At the present writing, all of the structural steel has been erected, the reinforced concrete floors are being placed and the exterior walls are building. The structure will be as nearly fireproof as it is possible to make such buildings, the structural steel being fireproofed with concrete, the interior partitions being of concrete, with steel sash glazed with wire-glass, all floors being of reinforced concrete. In plan, the building is 200 feet long, 112 ft. 2 in. deep and is four storeys high above the basement. In the basement are the necessary mechanical equipment for the building, including boilers and transformers; on the ground floor there will be offices and the principal examining room. On the three upper floors there will be additional examining rooms, with the necessary offices and toilets. The main staircase will be in the middle of the front of the building, together with the elevators. There will be four electric freight elevators installed now, with provision for two others and one electric passenger elevator will be installed. The exterior will be of Calgary sandstone on the ground floor, with red pressed brick above with cut stone trimmings. The Manitoba Bridge & Iron Works, Limited, of Winnipeg, supplied 1,440 tons of structural steel for this building. In the erection the general contractors used a 10-ton derrick, with 40-foot mast and 70-foot steel boom, besides other smaller stiff-leg derricks. It is intended to add other storeys to the building in the future, so that the steelwork is apparently heavy for the present structure. The architect is David Ewart, Dominion Architect. Leo Dowler, of Calgary, is the local supervising architect for the government. The cost of the warehouse will be about $500,000.

Mr. J. L. Lang has been appointed assistant to the City Engineer of Galt, Mr. C. D. Campbell.

National Municipal League Convenvention in Toronto

THE Nineteenth Annual Meeting of the National Municipal League and the Twenty-First National Conference for Good City Government will be held in the Council Chamber of the City Hall, Toronto, November 12-15. The first formal session of the League will be held in Convocation Hall, University of Toronto. Addresses of welcome will then be given by His Worship Mayor Hocken, Sir James Whitney, Premier of Ontario, and President Falconer of the University. The annual review of the Secretary, Mr. C. R. Woodruff, of Philadelphia, will deal with the question, "Of What Does Municipal Advance Consist?" The annual address of the President, Hon. W. D. Foulke, of Richmond, Ind., will be devoted to the subject, "Public Opinion." The session on Thursday, November 13, will be devoted largely to the internal business of the League, a feature of outstanding interest being the presentation of a report by the special committee on the commission form of government. The discussion will be opened by Dr. E. S. Bradford, of Washington, D.C., author of "Commission Government in American Cities," by Mr. S. M. Worthington, City Manager of Sumpter, S.C., and by Mr. A. E. Adams, Youngstown, Iowa. The whole subject will then be thrown open for discussion.

Canadian cities have so much to show in the way of substantial municipal development that the whole of the session of Friday, November 14, has been set aside for the consideration of what they have accomplished, with the city of Toronto and the province of Ontario as illustrations. Addresses will be given by the Hon. W. J. Hanna, Provincial Secretary; Hon. Adam Beck, Chairman of the Ontario Hydro-Electric Commission; Mr. G. Frank Beer, President of the Toronto Housing Company, Limited, and Mr. F. S. Spence, member of the Board of Harbor Commissioners for Toronto.

The convention dinner will be held at the King Edward Hotel on Friday, November 14, at seven o'clock.

Personal Mention

Mr. Gordon M. West, architect, has opened an office at 2 College street, Toronto.

Messrs. Bovell & Molesworth, architects, Toronto, have dissolved partnership. Mr. G. M. Molesworth will continue to practice at 2 College street.

Mr. Chas. H. Keefer, of Ottawa, has been nominated for the office of Director, representing district No. 2, in the American Society of Civil Engineers.

Geo. Croft, a contractor of Cobourg, Ont., who was doing some concrete work in progress at the harbour there, was found drowned near the scene of operations last week.

Mr. Russell G. Swan has been appointed chief engineer of the British Columbia Hydrographic Survey of the Department of the Interior. Mr. Swan will be located at Vancouver.

Mr. John McGregor, of Reid, McGregor & Reid, contractors, Montreal, has been elected an alderman of Montreal West, defeating by five votes Mr. F. Peden, of Peden & McLaren, architects, Montreal.

Mr. R. F. Uniacke, Bridge Engineer of the N. T. R., delivered an illustrated lecture on the construction of the railroad at a recent meeting of the Canadian Railway Club, held at the Windsor Hotel, Montreal.

Mr. L. G. Denis, hydro-electric engineer for the Canadian Conservation Commission, recently returned to Ottawa after making a 1000-mile trip by canoe for the purpose of investigating water-power possibilities in northern Manitoba.

Tenth Annual Convention American Road Builders' Association

HIGHWAY improvement is a subject which has come to be recognized as one of the most important questions of the day, and interest in it is becoming more widespread as its economic features are better understood. Many millions of dollars are being expended annually for the improvement of rural roads and city streets, and many more millions will be spent each year in the future. The problem of how this money should be spent in order to secure the best results involves questions of vital concern, requiring careful study on the part of those upon whom the responsibility is placed. It is for the careful consideration of these questions that a convention is held each year under the auspices of the American Road Builders' Association.

Although over a month has yet to pass before the Philadelphia convention of the Association, it is already evident that the calling to order of the meeting on the forenoon of December 9 will mark the opening of the most successful of its long series of notable conventions. The program prepared and the speakers so far selected promise technical sessions of unusual interest and value. Applications for exhibition space already received show that the exposition of road building machinery and materials will be one of the most complete ever assembled, and the widespread interest being taken by officials, engineers and contractors connected with road work indicates an attendance of actual road builders larger than has ever been present at a similar meeting.

As previously noted, the technical sessions will be arranged in much the same manner as last year and the year before. The general subject of highway work is to be considered under three heads—organization, construction and maintenance. The particular phases of each of these subdivisions will be covered by papers presented by men chosen because of their training and experience, and the presentation of each paper will be followed by a discussion by several especially selected speakers and then thrown open to the meeting.

Among those who are to take part in the proceedings, either by reading papers or in discussions following the presentation of papers, are the following: Chas. J. Bennett, State Highway Commissioner of Connecticut; E. M. Bigelow, State Highway Commissioner of Pennsylvania; A. H. Blanchard, Professor of Highway Engineering, Columbia University, New York, N.Y.; Henry L. Bowlby, State Highway Engineer of Oregon; Frank W. Buffum, State Highway Commissioner of Missouri; John N. Carlisle, State Highway Commissioner of New York; Wm. H. Connell, Chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; Geo. W. Cooley, State Engineer of Minnesota; F. L. Cranford, Road Contractor, Brooklyn, N.Y.; Major W. W. Crosby, Chief Engineer, Maryland Geological Survey; A. W. Dean, Chief Engineer, Massachusetts Highway Commission; Fred E. Ellis, Road Contractor, Peabody, Mass.; A. B. Fletcher, State Highway Engineer of California; S. D. Foster, Chief Engineer, Pennsylvania State Highway Department; R. B. Gage, Chemist, State Highway Department of New Jersey; John S. Gillespie, Road Commissioner of Allegheny County, Pa.; L. R. Grabill, Superintendent of Suburban Roads, District of Columbia; H. C. Hill, Engineer, Lane Construction Co., Meriden, Conn.; A. R. Hirst, State Highway Engineer of Wisconsin; Prevost Hubbard, Consulting Chemist, Institute of Industrial Research, Washington, D.C.; Jos. W. Hunter, Deputy Commissioner, Bureau of Township Highways, Pensylvania State Highway Department; A. N. Johnson, State Highway Engineer of Illinois; C. A. Kenyon, President, Indiana Good Roads Association; Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York, N.Y.; James H. MacDonald, former State Highway Commissioner of Connecticut; T. H. MacDonald, State Highway Engineer of Iowa; W. A. McLean, Chief Engineer of Highways and Commissioner of the Ontario Public Roads and Highways Commission, Toronto, Ont.; Mr. Robert A. Meeker, State Highway Engineer of New Jersey; Harold Parker, Vice-President, Hassam Paving Company, Worcester, Mass.; Robert J. Potts, Professor of Highway Engineering, Agricultural and Mechanical College of Texas, College Station, Tex.; Dr. Joseph Hyde Pratt, State Geologist of North Carolina; Jean de Pulligny, Engineer-in-Chief, Board of Public Works of France, and Director of the French Mission of Engineers to the United States; John J. Ryan, Secretary, Road Builders' Association, Albany, N.Y.; Frank F. Rogers, State Highway Commissioner of Michigan, Chas. W. Ross, Street Commissioner, Newton, Mass.; Paul D. Sargent, Chief Engineer, Maine State Highway Commission; Herman H. Schmidt, Chief Engineer, Bureau of Highways, Borough of Brooklyn, New York, N.Y.; Henry G. Shirley, Chief Engineer, Maryland State Roads Commission; Francis P. Smith, Consulting Chemist and Paving Engineer, New York, N.Y.; Robert C. Terrell, Commissioner of Public Roads of Kentucky; Geo. W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York, N.Y.; Wm. D. Uhler, Assistant Engineer, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; P. St. J. Wilson, State Highway Commissioner of Virginia.

The exhibition, which will be the fifth of the series held in conjunction with the A. R. B. A. conventions, bids fair to be one of the largest and most complete expositions of machinery, materials and methods ever held. It will comprise machinery for road work and street paving, materials for roads and pavements, models illustrating methods of highway construction and maintenance, maps, charts and photographs, and a variety of educational features. In addition to the usual commercial exhibits of road and street machinery and material manufacturers and dealers, it is planned to have interesting and instructive displays by states, municipalities and educational institutions. The Province of Ontario will be represented by an exhibit.

Saskatoon Association of Architects

The annual convention of the Saskatchewan Association of Architects was held in Saskatoon on October 25th last. The meeting was well attended and many important subjects came up for discussion, notable among which were technical education and architectural competitions. It was decided to petition the government for better facilities for technical education and to appoint a committee to approve of the conditions drawn up in respect to architectural competitions.

The reports submitted disclosed the fact that there are 103 registered members of the Association. Federation with the Royal Architectural Institute of Canada has been effected and the Association has become affiliated with the University of Saskatchewan.

The visiting architects were entertained at a luncheon given by the Saskatchewan Chapter and the convention came to a close with the annual banquet, which was held in the Saskatchewan Club.

The election of officers resulted as follows: President, Mr. W. G. Van Egmond, Regina; Vice-Presidents: Mr. R. G. Bunyard, Moose Jaw, and Mr. A. G. Creighton, Prince Albert; Secretary-Treasurer, Mr. F. C. Clemesha. Members of council: Professor A. R. Greig and Mr. David Webster, Saskatoon; and Mr. A. F. Favell, North Battleford. Examining Board: Professor A. R. Greig, Saskatoon; Mr. T. B. Daniel, Saskatoon; Mr. F. C. Clemesha, Regina; Mr. A. L. Favell, North Battleford, and Mr. R. M. Thompson, Saskatoon.

C.P.R. Grade Separation at Toronto

The C. P. R. is carrying out the grade separation work on its line across the northern part of Toronto in compliance with the Railway Commissioners' order, which called for the elevation of its tracks as well as those of the Canadian Northern line which is projected to enter Toronto from the west along a route following that of the C. P. R. most of the way through that part of the city.

The viaduct is to be built for five tracks, and will be about two to three miles long, covering the more congested part of the route. Of these five tracks, the northerly one will be used as a service track by the C. N. R., as that line connects at both ends with the C. P. R. service. Of the three central tracks, the two northerly are to be built at once, and will be used jointly for through service. The fifth track is not to be built at present, but provision is made for it as occasion may require.

One subway only has been built to date, that at Avenue road. The others will be proceeded with as ordered. The Avenue road subway is 66 feet wide, with a roadway clearance of 14 feet. It is of concrete substructure construction, with the former street level about five feet. McPherson avenue enters the subway from the west on the north of the tracks, requiring a slight street diversion with a retaining wall. Along that side all street approaches are on a five per cent. grade.

The subway is crossed on steel plate girders. Work on this subway has been carried forward without interruption to train service by leaving one track at grade and building the concrete abutments on both sides of the track, finally carrying the service across on a trestle bridge at the new elevation and building in the open space in the abutments. The elevation work between the subways has been carried forward in a similar manner, leaving the southerly track open at grade, and building a trestle in the north side, on which traffic was diverted. The portion that so far has been elevated is the section from Summerhill avenue, near Davenport road, including Yonge street crossing, which is now being carried on a temporary timber trestle. The two northerly tracks are completed and the others are being pushed forward. On this section the elevation is about 12 feet above the former grade.

New York's New Canal

The exact condition of the barge canal in New York was explained recently in an illustrated lecture by State Engineer John A. Bensel before the New York State Waterways Association Convention.

"At present more than 250 miles of the barge canal is actually completed to the dimension size and all of the more important structures are more than 80 per cent. finished," he said. "During the last year construction work to the amount of $13,000,000 has been done. The total work to date amounts to about $64,000,000. On the remaining contracts yet to be finished the sum of about $82,000,000 will be expended.

"Work on the terminals in New York, Brooklyn, Utica, Buffalo, Albany, Syracuse, Oswego, Schenectady, Amsterdam, Troy, Ithaca and other cities is progressing with great rapidity. About thirty-five contracts have been let, and one terminal, that at Albany, has been put into use in a commercial way."

The British firm of Baldry, Yerburgh and Hutchinson, Limited, contractors, of Westminster, London, have been awarded the contract for the construction of the second section of the Welland Canal at $5,500,000. This company is one of the oldest established firms of contractors in Great Britain. Although they have successfully carried out large contracts on the other side, such as those for the construction of the Canada and the Herculaneum Docks in Liverpool for the Mersey Dock and Harbor Board, and others for most of the great British railways, this will be the first time that they have undertaken work in the Dominion of Canada. A large number of men will be engaged on this new undertaking for the next three years. The headquarters for the present will probably be at St. Catharines. All the latest mechanical appliances will be installed, and the firm will hope to secure contracts for more of the six sections yet to be awarded. The total cost of the whole undertaking will be about $52,000,000. Robert Yerburgh, M.P. for Chester, in the British House of Commons, is one of the partners. Mr. Hutchinson, the active member on this side, will be assisted by Mr. A. E. Rigby.

Mainly Constructional

The News in Brief—From Coast to Coast

For the next five years three million dollars per annum will be expended by the Montreal Harbour Commissioners on harbour works.

The Hamilton Home Construction Company, Limited, is a new concern, with head office at Hamilton, incorporated with a capital of $100,000.

At Prince Albert, Sask., the value of the building permits to date amounts to approximately $1,500,000, compared with some $2,000,000 for the corresponding period of 1912.

The Toms Contracting Company, Limited, is a new concern, with head office at Toronto, incorporated with a capital of $40,000, to carry on business as brick manufacturers and dealers in building materials.

During October Montreal building permits totalled $6,765,300, an increase of $3,918,892 over the corresponding month last year. For the nine months the value was $22,581,466, a gain of $6,407,744 over 1912.

The Montreal Builders' Exchange have issued a year book compiled by the secretary, Mr. R. L. Werry. It contains considerable information of a general and local character, including data on estimating for various kinds of work. The year book is of very handy form, and is illustrated.

Plans for a system of overflow sewers designed to relieve the flooding which occurs during times of heavy rainfall were passed at a special meeting of the works committee of Hamilton, Ont., recently. It is estimated that the system will cost in the neighborhood of $650,000. It is intended to discharge this storm water into the bay, it being practically impossible to treat it, but the affluent will be of such a diluted nature that no harm can come from it.

Plans for buildings to cost $1,987,027 were approved by the Toronto City Architect during the month of October, representing an increase of nearly half a million dollars in comparison with the figures for October a year ago. For the first ten months of 1913 permits for the erection of buildings at an estimated cost of $24,247,631 were issued by the Department as against permits representing $23,814,003 worth of buildings for the corresponding period of 1912.

The city of Edmonton, Alta., has been enjoying considerable building activity of late. The building expenditure to date amounts to nearly ten million dollars and includes many substantial business buildings and costly residences. The number of permits issued is upwards of fifteen hundred. The most noteworthy building enterprise is the Chateau MacDonald, described in a recent issue of the Contract Record. This building in itself represents an expenditure of two million dollars.

Judgment for $3,600 has been awarded by Mr. Justice Panneton, of the Superior Court, Montreal, to the Lewis

Building Company against Dame Marie Leduc, whose business consists of demolishing buildings. The Lewis Company, the owners of a new ten-storey office building, contracted with defendant to pull down the old structure, there being a penalty clause of $200 per day. There was a delay of thirty-six days, and on action being taken the defendant consented to judgment for $3,600.

According to a despatch from Paris, France is planning an expenditure of over three hundred million dollars for harbour and internal navigation improvements. The cost is to be distributed over the next fifty-six years, although the actual work will be completed in the near future. Over forty-one million dollars of the total expenditure is involved in projects now under way.

The growth of St. John is reflected in the building returns for the past month and for the year ending October 31. The inspector, Mr. James Carleton, reports that during the month of October there were issued 15 building permits for structures of the value of $835,200, against 21 certificates in October, 1912, for buildings of the value of $52,800. The certificates for the year ending October 31 were for buildings of an aggregate value of $1,838,660, and for the year ending October 31, 1912, only $520,700.

One of the most important road schemes in Eastern Canada is that recently launched for an expenditure of $1,000,000 in Essex county, Ontario. The by-law will be voted on next January, after which each city and town will vote separately on the amount to be given the good roads fund. The by-law calls for concrete roadways covering no less than 150 miles, and connecting all important communities. An interesting feature of the plan is the provision of a continuous route of good roads. In the completed project no interruptions of bad road stretches will appear.

It is officially announced that a large extension of McGill University is contemplated. Plans are being prepared for three new buildings—a $300,000 gymnasium, dormitories to cost between two and three million dollars, and a government armory, the latter to be built and equipped by the Government. The gymnasium will probably be started in the spring, and the dormitories as soon as the University can get the money. The Minister of Militia has promised that the armory will be ready by next year. All the buildings will be on Macdonald Park, the new campus, at the foot of the mountain.

A deputation from several Montreal business institutions, including the Builders' Exchange (represented by Messrs. T. Gilday and R. L. Werry) and the Architects' Association of the Province of Quebec (represented by Mr. J. Perrault) on November 4 interviewed the Montreal Civic Controllers and suggested the establishment of a fire prevention bureau. This should be under the charge of the chief of the fire department, and should consist of an inspector in each of the thirty-seven fire stations which at present exist in Montreal. The Controllers asked the deputation to put their wishes into the form of a draft by-law.

Plans for the proposed new east wing of the court house building at Vancouver are being prepared by Messrs. Dalton & Eveleigh. It is understood that the work will cost in the neighborhood of $300,000. The principal purpose of the new wing will be to provide proper accommodation for the land registry office and perhaps a court and suite of rooms for the judges of the court of appeal. The requirements make it impossible to duplicate the west wing, but the general form and character of the main building and west wing will be followed. The government has not reached a final determination on the details of the plan and tenders have not yet been invited.

The Canadian Stewart Company, Limited, of Montreal and Chicago, have the contract for an addition to the warehouse of the Canadian Consolidated Rubber Company, Limited, on Tenth Avenue West, Calgary. The existing building has a frontage of 57 feet 11 inches, and the addition will have a frontage of 75 feet, making the building nearly 133 feet in front. It is 110 feet deep and will have five storeys and a basement. The exterior walls are of solid brick construction, on concrete foundations, the interior being of mill construction, with 2 x 6 laminated floors throughout. The roof will be covered with a 5-ply tar and gravel roofing. The estimated cost is $100,000.

Mr. F. S. Baker, of Toronto, in an open letter to the Mayor, appeals for an amendment of the Ontario Architects' Act to such a degree that it will ensure the efficient registration of the architectural profession. This is apropos of the appointment of a new City Architect—an unnecessary official, Mr. Baker maintains, if the architectural profession were properly qualified and answerable to the public for the safety of their structures. At present, Mr. Baker says, the city architect's staff, which is a very large one, is employed in checking plans and specifications prepared by architects who are presumably qualified. This he considers an expensive and unnecessary duplication.

The town of Aurora, Ont., has decided to install an equipment of motor-driven turbine pumps for protection against fire. It will include two four-stage high lift turbine pumps of Mather and Platt design, built by Canadian Allis-Chalmers Limited. Each of these fire pumps will be capable of delivering four hundred imperial gallons a minute, against a total head of 325 feet, operating at 1,460 r.p.m. They will be direct-connected at one end to an alternating current motor, and at the other end to a direct current motor in order to conform with the Underwriters requirements that there must be two distinct sources of power for this purpose. The electrical apparatus, including a four-panel switchboard, will be built by the Canadian General Electric Company, Limited.

The council of the Institution of Civil Engineers (Great Britain) have made the following awards for papers published in the "Proceedings," without discussion, during the session 1912-1913: A Telford Gold Medal to Mr. James Mackenzie (Johannesburg); Telford Premiums to Messrs. H. Hawgood (Los Angeles), J. K. Robertson (Bombay), G. S. Perry (Sydney, N.S.W.), and Gervaise Purcell, B.A. (Los Angeles); and the Crampton Prize to Mr. William Mason, M.Sc. (Liverpool). The council have made the following awards in respect of students' papers read before provincial associations of students during the past season: The James Forrest Medal and a Miller Prize to Mr. P. M. Chadwick, B.Sc. (Birmingham), and Miller Prizes to Messrs. A. J. S. Pippard (Bristol), T. P. Geen (Bristol), C. E. Holloway, B.Sc. (Bristol), J. W. Burns (Glasgow) and B. A. E. Heilig (Birmingham).

Canadian Railroad Development

The Canadian Pacific Railway is planning on rebuilding the main lines entering Toronto, Ont., and placing all wires within the municipality under ground.

The Great Northern Railway has purchased considerable land in the vicinity of Calgary and Lethbridge with the object of extending a line into the wheat regions.

The Canadian Northern Railway is planning to begin double-tracking its line between Winnipeg and Fort Frances as soon as its transcontinental line is completed.

The British Columbia Electric Railway, Vancouver, B.C., has negotiations under way with the Great Northern Railway for purchase of abandoned right-of-way of Cloverdale-Blaine line from Hazelmore to the Canadian boundary at Blaine, Wash.

The first section of the transcontinental railway declared completed and ready for traffic is the fifty-mile stretch from the Quebec bridge west on the north shore, built by the contracting firm of Messrs. M. P. & J. T. Davis.

When the Grand Trunk Pacific is completed the new and old company will have, between them, 10,000 miles of track. At present the C. P. R. has over 12,000 miles of track, and has at least 1,500 additional under way in the northwest and the portions of Ontario which it has invaded.

Final location for the Canadian Northern Railway from Athabasca to Peace River Crossing has been completed and will be placed before the Department of Railways for final approval at once. It is understood that the line will continue from Athabasca to a point about six miles up river, where it will cross and follow the north side of the river to Sawridge, continuing along the north shore of Lesser Slave Lake to Grouard and on to Peace River Crossing. Another branch is contemplated from a point just north of Athabasca to tap the Grande Prairie country and will probably connect with the company's line from Edmonton at Sturgeon Lake.

A new freight shed for the Grand Trunk Railway has been completed at Point St. Charles, Montreal. It is 1,200 feet long by 60 feet wide, and will be used entirely for Montreal freight in bond, it having been decided to concentrate all the railway's bonded business in the building. The walls are of brick on concrete foundations. The roof, between the walls, is supported by steel columns and covered with tar and gravel. There are seventy-six bays in the shed, and the length is divided by fire walls at proper distances apart. The building is parallel with Wellington street and has been set back thirty feet therefrom. This space of thirty feet has been paved as a teamway with granite blocks. The cost is $185,000.

The new G. T. P. floating dry dock at Prince Rupert, B.C., will be one of the largest and best equipped in the world and will be electrically-operated throughout. The contract for the electrical equipment which has been awarded by the G. T. R. to the Canadian General Electric Company, Limited, includes two 200 h.p. and four 100 h.p. variable speed induction motors, with full automatic control, for operating the pumps on the deck. The power will be produced by two 1,250 kv.a. Curtis steam turbines with complete condensing apparatus. The exciters for the main turbine-generators will consist of three 35 kw. turbine driven generators, and one motor generator set. The foundry, machine shops, and ship yards will be equipped with motor driven tools, requiring motors ranging from 60 to 10 h.p. The contract for electrical equipment also includes all necessary power and light transformers.

While Sir Thomas Shaughnessy was in Chicago recently he had a look at the new terminals which the "Soo" line, in affiliation with the C. P. R., is building there. This is an immense structure, covering no less than eleven blocks of city space in the heart of the city. This is to be the central receiving and distributing station for the "Soo" lines. The work involves a considerable amount of reinforced concrete, probably more than any other similar work. Over 1,000 yards of concrete are being placed by a single shift in a day, and concreting has been in progress since January 7. Four great distributing towers, each over 300 feet high, serve the work. Seven car loads of Portland cement are received at the works every day, and the storage piles of sand and stone cover one acre. The terminal consists of a deck structure, continuing uninterrupted across the streets, permitting the use of the area beneath the deck for storage and freight handling, except the streets left open for traffic. The terminal faces the projected 12th street boulevard on the north and extends south between Canal and Clinton streets as far as 15th street, where it turns west, connecting with the Baltimore & Ohio Chicago Terminal Railway tracks at Halstead street. There is to be an in-freight house of four storeys with 600,000 square feet additional storage area beneath the tracks. The structure is of reinforced concrete throughout. Construction was started in August, 1912, and at the present time about 460,000 square feet of track slab have been completed. The ground covered is 18 acres, and the area of the working space is 34 acres. This will give an idea of the size of the structure when completed. It has been rendered necessary by the vast increase in the business of the "Soo" lines, which are now being operated under the guidance and control virtually of the C. P. R.

The last bolt of the new double-track C. P. R. bridge across the St. Lawrence was driven on November 4 by Mr. McNicoll, vice-president of the company, thus completing one of the largest undertakings of the C. P. R. The double-tracking has taken about five years and has cost $4,000,000. Mr. McNicoll placed a silver bolt in position in the presence of a party of officials of the C. P. R. and Dominion Bridge Company, the work having been carried out by the latter company. The party included Mr. McNicoll, vice-president of the C. P. R.; Mr. A. B. Motley, chief engineer of bridges; Mr. J. M. R. Fairbairn, chief engineer; Mr. A. D. McTier, general manager of eastern lines; Mr. C. N. Montserrat; Mr. Phelps Johnson, general superintendent of the Dominion Bridge Company, and Mr. G. H. Duggan, chief engineer of that company. After the placing of the bolt the first train passed over the new span.

Trade Publications

From Canadian Allis-Chalmers, Limited, we have received a publication descriptive of the McKiernan-Terry Rotating Hammer Drills. It is claimed that in nearly all cases the tool of this make may be used more profitably than any other type for sinking, stoping or drifting. The drill is of the self-rotating, hammer type and within the range of the work for which it is designed will drill more ground with less power than a piston machine. The lines embraced in this manufacture are rock drills, pile hammers, hammer drills, atlas ball-bearing jacks, core drills, air compressors, mining and quarrying machinery.

Catalogue No. 900 of the Orenstein-Arthur Koppel Company, for whom the Canadian Fairbanks-Morse Company, Limited, 444 St. James Street, Montreal, are the Canadian agents, has just reached us. The catalogue conveys a comprehensive idea of the Koppel Company's products, comprising rails, portable track switches, turn-tables, cars, steam and electric locomotives. The catalogue is well illustrated and highly educative along the above-mentioned lines. The noteworthy features of design and construction are too numerous to mention within the restricted space of this review. Copies of the catalogue may be obtained upon application to the Canadian Fairbanks-Morse Company, Montreal.

"Wizard" Rock Drills for which the Canadian Allis-Chalmers Company, Limited, Toronto, are Canadian agents, are described in an interesting pamphlet just to hand. These drills are manufactured by the McKiernan-Terry Drill Company, who claim to combine in their drills all the refinements of design, material and workmanship. This pamphlet contains a detailed description of the Corliss Valve drill. In this drill a quick and easy valve action and the liberal area of the ports, provide a means for changing rapidly from pressure to exhaust and so impart instantaneous motion to the piston which causes it to operate at a much higher velocity than is possible for other types of tappet drills. It is economical and powerful in service and is adapted to exacting conditions.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Ont.
Town Council (Waterworks and Elec. Light Dept.), Sec., D. C. Davis, contemplate purchasing Duplex steam pump, size 17 x 10 x 12, required, slight variation in dimensions not detrimental.

Brockville, Ont.
Boiler house, cost $17,000, contemplated by Municipal Council (Water & Light Dept.). Chairman, C. S. Cossitt. Manager, E. J. Philip. New boilers, etc., to be purchased for pumping station. Report has been submitted to Railway Commission for approval. Estimated cost $52,000.

Estevan, Sask.
Council will instal sewer system on 1st, 2nd, 3rd, 4th, 5th, 6th, 8th 12th and Valley Sts. Sec.-Treas., P. J. Stephens.

Council will lay cement sidewalks on 14 streets. Sec.-Treas., P. J. Stephens.

Ottawa, Ont.
Pavement, cost $30,000, Bronson Ave., planned by City Council between Laurier Ave. and Gladstone Ave. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

City Council plan repaving between Sparks and Gladstone (about 1 mile long) with asphalt, probably widening the sidewalks to 10 ft. Mayor, J. A. Ellis. City engineer, Arch. Currie.

Tenders received by Chairman Water Works Commission until Nov. 14th, for 50 Corporation Hydrants. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

Toronto, Ont.
Board of Control plan concrete walks on 19 streets, estimated cost $33,000. Asphalt on Eastmount, Hain, Oakwood and Tyrell, estimated cost $14,152. Rocmac on Hain, cost $2,932. Mayor, H. C. Hocken.

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders received until November 18th. Asphalt on Alma, Arlington, Carns, Rushton, Wells Hill ave. Bitulithic on Arlington, concrete on Plymouth. Grading on Aldergrove, Bain, Glenmore, Morley, Springmount, Spears.

Sewers on Ascot, Benlamond, Springmount, Dufferin-Midway Drainage System (Gerrard and Hiawatha), planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Nov. 18th.

Tenders received by Engineer, Frank Barber, C.E., 57 Adelaide E., until Nov. 15th for sewer on Bathurst St.

Commr. of Works, R. C. Harris, recommends grading on following streets, Beresford, Fourth, Walder, Rosedale Heights. Estimated cost $6.500. Board of Control. Mayor, H. C. Hocken.

Commr. of Works, R. C. Harris, recommends sidewalks on Annette, Coxwell, DeSavery, Glebe, Glen, Hatfield, Millwood, Manor, Osler, Pears, Penrose, Oswald, Paton, Servington, Thurloe, Tullis, Wharram, Rushton. Estimated cost $30,000. Board of Control. Mayor, H. C. Hocken.

Board of Control plan 24 ft. asphalt pavement on Rose Ave. Estimated cost $9,407. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Board of Control plan tile pipe sewers on Hemlock and Lauder Lane, west of Markham, south from Ulster. Estimated cost $9,684. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Board of Control plan concrete sidewalks on Broadway, Eastern, Humberside, King and Rowland. Estimated cost $2,196. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Commr. of Works, R. C. Harris, recommends asphalt on Cruickshank, cost $2,221, and concrete walks on Gilmour, Coxwell and Danforth Ave., cost $6,000.

Concrete sidewalk planned. Clark, W. A. Clarke, 40 Jarvis St. Council was petitioned to lay 4 ft. walk on Baby Point Rd. and Baby Point Cres. By-law for sidewalk on Howland Park Ave. passed 1st reading.

CONTRACTS AWARDED

Brockville, Ont.
Pavement, cost $5,000, Market Square, planned by Town Council. Mayor, Jno. McKenzie. Clerk, Geo. Dewey. Engineer, Geo. Bryson. General contractors, Godson Contracting Co., Ltd., Manning Chmbrs., Toronto.

Edmonton, Alta.
Bitulithic pavement, Jasper Ave., planned by City Council. Engineer, A. J. Latornel. General contractors, National Paving & Constr. Co., Clark and 1st St.

London, Ont.
Sewers planned by City Council. Mayor, C. M. R. Graham. W. J. Johnston & Co., 602 Princess Ave., William St. (1st Sec.), $1,170; (2nd Sec.), $825. Harding Constr. Co., London, Adelaide St., $2,028, and Oxford St., $3,500. C. Leathorn, 862 Elias St., Burwell St., $862. Work to start as soon as possible.

Swift Current, Sask.
Sewers and water main planned by Town Council. Sec.-Treas., G. D. Arnott. Engineer, G. D. Mackie. General contractors, McManus Contracting Co., Moose Jaw, at $10,600, for sewer tile, and $6,622 for water pipe.

Weyburn, Sask.
Wells and laterals, cost $50,000, planned by City Council. Mayor, M. C. Taggart. Sec.-Treas., J. D. Murray. Work being done by day labor. Wells about completed, laterals not to be started until next spring.

Railroads, Bridges and Wharves

Ainsworth, B.C.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 17th. Plans, specifications, etc., at offices of J. P. Forde, Dist. Engineer, Revelstoke, B.C., C. C. Worsfold, Dist. Engineer, New Westminster, Postmaster, Ainsworth, and at Dept., Ottawa.

Bengough, Sask.
C. N. O. Rly. has approved location of 3rd class station here.

Calgary, Alta.
Subway, cost $98,000, 4th St., planned by City Council. Clerk, J. M. Miller. By-law to be submitted to ratepayers.

Callender, Ont.
Extension to wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until Dec. 1st. Plans at Ottawa, Confed. Life Bldg., Toronto, Dist. Engineer, Midland, and Post Office at Callender. Wharf 120 ft. long, with 100 ft. "L" 20 ft. wide. Substructure timber cut work filled with stone. Timber superstructure.

Deseronto, Ont.
C. N. O. Rly. has approved location of station at Deseronto, Twp. Tyendinaga, Co. Hastings, Ont., at mileage 134 from East Don.

Empress, Sask.
C. P. Rly. has approved location of station at Empress, on Swift Current Northwesterly Branch.

Gull Harbour, Man.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. No action taken. New tenders to be called.

Heustis Landing N.B.
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Dec. 1st. Plans, etc., at offices of Dist. Engineers, Fredericton, N.B.; St. John, N.B.; Postmaster, Heurstis Landing, and at Dept., Ottawa.

Hope, B.C.
Kettle Valley Rly. Co. has been authorized to construct bridge over Fraser River.

Huntingdon Twp., Ont.
G. T. Rly., has been authorized to construct siding into premises of Quinlan & Robertson, on lot 10, Con. 9.

North Bay, Ont.
C. N. O. Rly. has approved plan No. D. 29-1 of subway to be constructed at Wylde St.

Province of Ont.
G. T. Rly. has been authorized to construct siding into premises of St. Marys Portland Cement Co., Ltd., being part of lot No. 22, Con. 17, Twp. Blanchard, and to connect spur with existing siding and spurs serving applicant's plant and rescinding Order No. 19365 May 21st, 1913; also authorized to construct bridge No. 58, at mileage 146.42 from Black Rock, carrying 20th Dist. of its railway across

Bayfield Creek at a point 2.11 miles east of Clinton Station, Twp. Tuckersmith, Co. Huron, Ont.

Ottawa, Ont.
Tenders received by L. K. Jones, Ottawa, Dom. Govt. Dept. of Railways and Canals, until Nov. 12th, for improving Lower Entrance to Lock No. 20 Ontario - St. Lawrence Canals, Cornwall Canal. Plans, etc., at office of Chief Engineer of above Dept., Ottawa, Supt. Engineer of the Ontario-St. Lawrence, Cornwall, Ont.

Penetang, Ont.
G. T. R. has been authorized to construct siding into premises of Gidley Boat Co.

Qualicum, B.C.
Esquimalt & Nanaimo Rly. has approved location of station at Qualicum Beach on Comox Extension of its railway, Vancouver Island.

Richards Landing Ont. (St. Josephs Island)
Wharf. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Dec. 2nd. Plans, etc., at office of Dist. Engineer, Sault Ste. Marie, J. G. Sing, Confed. Life Bldg., Toronto, Postmaster, Richards Landing, and at Dept., Ottawa. Wharf 180 ft. long, 18 ft. wide, timber crib substructure, concrete, block superstructure.

Seagrave, Ont.
G. T. Rly. has approved location of station at Seagrave, Twp. Reach. To replace one recently destroyed by fire.

Steelton, Ont.
Street car service planned by the International Transit Co., Sault Ste. Marie. All work to be done by owners. Rails supplied by the Lake Superior Corporation, Sault Ste. Marie.

Stratford, Ont.
Covering Erie Creek planned by City Council. Mayor, C. N. Greenwood. Clerk, R. R. Lang. Recommended by Board of Works that the City Engineer be authorized to prepare plans and estimates for above work.

G. T. Rly. has been authorized to construct bridges No. 44 and 47 over Wellington St. and John St.

Toronto, Ont.
Harbor work planned by Dom. Govt. Dept. of Public Works. General contractors, Can. Stewart Co., C. P. R. Bldg. General Contractors open for tenders on pile driving, capping crib work and concrete walls, for ship channel, Toronto Harbor.

Harbor equipment. Can. Stewart Co., C. P. R. Bldg., are in market for tugs, derrick boats, floating pile drivers, barges and floating equipment, for work in Toronto Harbor.

Bridge planned by Municipal Council of Locust Hill. 450 ft. span. Estimated cost $22,000, steel, or $28,000 concrete.

Board of Control, has been authorized to construct bridges at Strachan Ave. over tracks of C. P. R. and G. T. R. Mayor, H. C. Hocken. Commr. of Works, R. C. Harris.

Tyee, B.C.
G. T. P. Rly. has approved station site at Tyee, mileage 26.5, Prince Rupert East in lot 27, Rge. 5, Coast District, B.C.

Vercheres, Que.
Quebec, Montreal & Southern Rly. Co. has been authorized to construct siding for Mount Royal Brick Co., Ltd., Parish of Varennes Co.

Winnipeg, Man., St. Boniface
C. P. Rly. has been authorized to construct spur for Continental Oil Co., Ltd., Winnipeg, from a point on westerly limit of its line in lot M, plan 252.

CONTRACTS AWARDED

Amherst, N.S.
Extension to wharf, cost $16,440, planned Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Maple Leaf Lumber Co., Amherst (Pres., Percy C. Black). No sub-contracts to be let. Further information from President, or J. I. Loy, Amherst. Pile drivers and hoisters required by General Contractors, also derricks, wire and cable. Extension 250 x 84, piles foundation, solid pile facing.

Edmonton, Alta.
Bridge, cost $10,000, Wentworth St., planned by City Council. Engineer, A. J. Latornel. General contractors, National Paving & Constr. Co., Clark and 1st St.

Ft. William, Ont.
Addition to car barns, cost $40,000, Walsh, planned by City Council. Architect, City Engineer. General contractor, P. J. Donahue, Cameron Block, S. May St.

Newington, Que.
Engine house extension. Owners and general contractors, Quebec Central Rly. Co. General manager, J. H. Walsh, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. Mechanical Engineer, Geo. Robins. Q. C. R. Shops. Work done by day labor. One storey, 5 stalls, 150 ft. rear, 65 ft. front, 70 ft. deep, walls, asbestos corrugated boardmill construction.

North Cobalt, Ont.
Car barns, cost $25,000, Lakeview Ave., for Nipissing Central Rly., North Cobalt. Architects, Smith, Kerry & Chace, Confederation Life Bldg., Toronto. General contractors, Suttcliffe & Neelands, New Liskeard. One storey, 65 x 180, felt and gravel roofing.

Province of Quebec
Bridge, cost $2,900, over S. Branch of Yamaska River, planned by Twp. of Brome. Sec.-Treas., Geo. F. Hall. Concrete work being done by day labor. Steel, MacKinnon, Holmes Co., Sherbrooke. One span, 30 x 17, concrete and steel.

Sussex, N.B.
Station planned by Dom. Govt., Dept. of Railways & Canals. Secretary, L. K. Jones, Ottawa. General contractors, British American Construction Company, Prince William Street. Foundations in.

Winnipeg, Man.
Station, St. Boniface (Desmeurins St.), for C. N. Rly., Winnipeg. Architect, R. B. Pratt, C. N. R. Arch., Union Depot, Winnipeg. General contractors, Benoit & Co., St. Boniface. Excavating done.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
Office and lodge building planned for I. O. O. F. Building will be started in 1914. Site on Nelson and Market St. To apply for charter under name of Oddfellows Temple, Ltd. Capital $90,000.

Calgary, Alta.
Hospital, cost $30,000, contemplated by City Council. City Clerk, J. M. Miller. Site not yet selected. Tenders to be called early in the spring.

Cross Lake, Man.
Boarding school planned by Dom. Govt. Dept. of Indian Affairs. Deputy Supt. General, Duncan C. Scott, Ottawa. Tenders received by Supt. till noon Jan. 2nd. Plans, specifications, etc., at Indian Office, Winnipeg. Offices of Indian Agent, Portage la Prairie, Agent of Dominion Lands, Brandon, and at Post Office, Kenora.

Daysland, Alta.
School equipment required by Public School Board. Further information from Sec.-Treas. of School Board.

East Hamilton, Ont.
Post office, cost $40,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

Edmonton, Alta.
City market, cost $10,000, 1st St., planned by City Council. Mayor, Mr. Short, Civic Office. Clerk, C. Cox, Civic Office. Architect, A. H. Wheeler, Civic Office. Work to start at once. Three storeys, 65 x 150, brick and stone construction.

Drill hall. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 18th. Plans, specifications, etc., at office of A. Beaton, Clerk of Works, Edmonton, H. E. Matthews, Superintending Architect of the Dom. Public Bldgs., Winnipeg, and at Dept., Ottawa.

Fredericton, N.B.
School, Smyth St., planned by School Board. Sec., Chas. Sampson. Architect, F. Neil Brodie, 42 Princess St., St. John. Committee appointed, Dr. Van Wart, chairman, and Messrs. Weddall and Sterling, to inspect Fisher Memorial School, Woodstock, before plans are drawn. Building to start in spring.

Gananoque, Ont.
Alteration to Town Hall planned by the Town Council. Mayor, W. N. Rogers. Architect, B. Dillon, Brockville, Ont.

Glace Bay., N.S.
Hospital, cost $60,000, subtenders open Architect, Leslie R. Fairn, Aylesford. General contractors, Chappell Bros., Sydney. Carpenter, Mr. Mills, c/o General Contractors. Roofing, Shaw & Mason. Plans, etc., at office of Sec. of Com., J. T. Martell, who will receive tenders until Nov. 19th for low pressure steam heating system with air line and automatic heat control with ventilation. Three stys.

Halifax, N.S.
Tenders received by Dom. Govt., Department of Public Works, Secretary, R. C. Desrochers, Ottawa, until Nov. 24th, for alterations and addition to Post Office and Savings Bank fittings. Plans, etc., at office of W. Bishop, Supt. Dom. Buildings, Halifax, and at Dept., Ottawa.

Hamilton, Ont.
Hospital, Mountain Top, planned. Chairman, T. H. Pratt. Local architects, Stewart & Witton. Adv. architect, E. F.

Stevens (Stevens & Lee), 2 College St., Toronto.

Homer, Ont.
Church, cost $10,000, for St. George English Congregation. Matter being considered by Anglican Synod of Niagara. Plans will be prepared.

Kingston, Ont.
Church contemplated for R. C. denomination. Archbishop Spratt has purchased site, cor. of Thomas and Russell streets.

College buildings contemplated by Regiopolis College Board. Present buildings sold. New building to be built up town.

Milltown, N.B.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 27th. Plans, etc., at office of D. H. Waterbury, Supt. of Bldgs., Post Office Bldg., St. John, N.B., Postmaster Milltown, and at Dept., Ottawa.

Montreal, Que.
Alterations to convent, cost $27,000, St. Catherine Road, planned for Soeurs Missionares de l'Immaculee Conception, 314 St. Catherine Rd. Architect, Chas. Chausse, 17 Pagnuelo ave. Specifications for painting held up. Contract to be awarded in about two weeks.

Dormitories, McGill and Sherbrooke, contemplated for McGill College. Principal Peterson, Montreal. Plans will be prepared.

Theatre, cost $20,000, Park and Bernard, for Mr. Joly, St. Viateur W. Architect, Z. Trudel, 238 St. Andre St. Plans drawn.

Children's hospital, cost $35,000, for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg., Montreal. Contracts will be awarded in a few days.

Church, Decarie Blvd., for St. Lukes Congregation. Rev. W. R. Cruikshanks, 115 Drummond St. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg., receiving tenders now for foundation work. Tenders for General Contractor to be called in about a week.

Postal Station "G," Clarke and Prince Arthur, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Ross & MacDonald, 1 Belmont St., Montreal.

Ottawa, Ont.
Synagogue, Bank, contemplated. Address, J. R. Fogle, 384 Bank St. Plans not yet drawn.

Port Colborne, Ont.
Electric wiring and interior fittings, public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 20th. Plans, etc., at office of Thos. Hasting, Clerk of Works, Station "F," Yonge St., Toronto, Caretaker of building, Port Colborne, and at Dept., Ottawa.

Regina, Sask.
Tenders for school supplies for the year 1914, received up till noon Nov. 24. Full particulars from Sec.-Treas., J. H. Cunningham, Alexandra School, Hamilton Street.

St. Catharines, Ont.
Parish hall and residence, cost $8,000, contemplated by St. Barnabas Anglican Congregation. Permission granted by Synod to enlarge Parish Hall, $4,500, and erect Rectory, $3,500.

St. John, N.B.
Church, cost $8,000, East, contemplated by the Anglican Synod. Will not build till next year.

Sarnia, Ont.
School, cost $30,000, Devine St., planned. Chairman, A. N. Hayes, M.D., 142 Christina. Building that was burned to be rebuilt and additional rooms added. All interior fittings required.

Stonewall, Man.
Public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Nov. 24th. Supt. Architect of Public Bldgs., H. E. Matthews. Plans, etc., at office of Post Master, Stonewall, and at Dept., Ottawa.

Summerside, P.E.I.
Addition and alterations to public building. Tenders received by Sec., R. C. Desrochers, Ottawa, Dom. Govt. Dept. of Public Works, until Dec. 1st. Plans, etc., at office of J. J. HcDuff, Supt. Dom. Bldgs., Charlottetown, P.E.I., R. MacSween, caretaker, Public Bldg., Summerside, and at Dept., Ottawa.

Toronto, Ont.
Church planned by Trustee Board of Mt. Dennis Pres. Church. Interested, Mr. James Syme, McPherson avenue. Meetings now being held in public school.

Addition to club quarters, University Ave., planned for Toronto Musical Protective Union No. 149. Special committee proposes spending $10,000 on improving building.

Catholic School Board are considering enlarging St. Francis School on Manning Ave. Sec., Joseph Cadaret, 24 Duke street.

The J. Singer Estate, Queen W. Company have purchased 3-storey building, 37 x 100, upper floors will be altered for lodge rooms and club quarters. Owners will do work by day labor. Work to start about Nov. 15th.

Welland, Ont.
Church, cost $40,000, Hellens Ave. and Griffith St., for R. C. Church Congregation. Architect, A. W. Holmes, 10 Bloor St. E., Toronto. Contract to be awarded in about 10 days.

Windsor, Ont.
Veterinary hospital and residence, cost $5,000, Pelissier, contemplated for Dr. A. E. Bowman, V.S. Architect not chosen.

Winnipeg, Man.
Church, cost $50,000, Cathedral Ave., planned for St. Johns Presbyterians, Cathedral Ave. Pastor, J. P. Jones, Bannerman Ave. Architect, R. C. Smith, Somerset Bldg. Contract will be awarded for the remainder of building next year.

CONTRACTS AWARDED

Beaconsfield, Que.
Alterations to club house, cost $55,000, for Beaconsfield Golf Club (R. J. Tooke, Montreal). Architects, Brown & Vallance, Can. Life Bldg., Montreal. General contractors, Atkinson, Glassco & Lawrence, 45 St. Alexander St., Montreal. Work to start at once.

Bracebridge, Ont.
Post office, cost $35,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Simcoe Constr. Co., 16 King St. W., Toronto. Painting and glazing, Joseph Bryon. Plumbing and heating, W. F. Martin. Three storeys, brick and steel construction.

Brantford, Ont.
Church tower and chimes, cost $45,000, for Grace Anglican Church. Rector, Rev. G. C. MacKenzie. Committee, A. J. Wilkes, K.C., W. F. Cockshutt, M.P., A. K. Bunnell. Architect, G. B. Cleveland (Darling & Pearson, Toronto), 2 Leader Lane, Toronto. Foundations, Schultz Bros. Co., Ltd., Brantford, $3,000. Chimes presented by Major R. W. Leonard, St. Catharines. 103 ft. high, 45 x 45, stone and concrete foundation, stone construction.

Brockville, Ont.
Arena, cost $11,853, Gilmour, for Brockville Arena Co., Ltd. President, M. Atkinson. Sec.-Treas., L. C. Dargavel. Architect, A. Stuart Allaster. General contractors, Parslow & Horton. One storey, 220 x 109. Foundations in.

Cobalt, Ont.
Town Hall, cost $15,000. Mayor, A. Z. Trudel. Town clerk, R. L. O'Gorman. Architects, Angus & Angus, North Bay. General contractors, Hill, Clark & Francis Ltd., New Liskeard. Walls started.

Edmonton, Alta.
Bath, cost $28,000, planned by a Syndicate. Pres., W. H. Heiler. Manager, Jno. Dawson. Director, H. A. Dickey, 678 21st St. Architect, E. Underwood, Chisholm Block, Jasper Ave. W. General contractor, B. Karran, 24th Street. Plumbing and heating, F. MacLean, Mutching Block, Jasper Ave. E.

Ft. William, Ont.
Addition to orphanage, cost $25,000, Franklyn, planned by Roman Catholic Denomination. Architect, H. R. Halton, Port Arthur. General contractor, C. Mathieu, Fort William. There will be an assembly hall or chapel in connection with above. Seats probably wanted.

Haileybury, Ont.
Court house, cost $62,000, Main, for Prov. Govt. Dept. of Public Works. Sec., H. F. McNaughten, Toronto. General contractors, P. H. Secord & Son, Brantford, Ont. Work has been suspended until spring, when building will be completed. Foundations in.

Hamilton, Ont.
Stores and apartments, cost $10,000, for T. W. Hand, 584 King St. W.. Architects, J. A. Ardes & Walter Scott, Federal Life Bldg. Steel, Hamilton Steel Construction Co., Lottridge St. Roofing, M. V. Maclean, 314 Hess St. S. Painting, A. Kemp, 36 Fairholt Rd. Heating and plumbing, Dickinson & Allan, Barton & Emerald. Electrical, Culley & Breay, 27 King St. W.

Kingston, Ont.
Rifle Ranges planned by Dom. Govt., Dept. of Militia & Defence. Secretary, E. E. Jarvis, Ottawa. General contractor, A. C. T. McMaster, 74 Victor ave., Toronto, $6,400. Work to be finished by June, 1914.

Montreal, Que.
Interior fittings, cost $6,000, Postal Station "B," St. Catherine W. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, J. T. Ewart, Dept. of Public Works. General con-

tractor, J. T. Schell, Alexandria, Ont. Marble, Smith Marble & Constr. Co., 145 Van Horne Ave. General Contractor doing all other trades.

Ottawa, Ont.
School, cost $85,000, Bronson, planned by Public School Board. Architect, W. B. Garvock, Creighton St. School. Carpenter, Taylor & Lackey, 1st Ave. Walls started.

Alterations to hall, residence and conservatory, cost $4,000, for W. E. Matthews, Clemok Ave. Architect, J. P. MacLaren, 104 Sparks St. General contractors, Johnston & White. Mason, T. C. James, 104 Flora. Heating and plumbing not let yet. Conservatory, Lord & Burnham Co. Brick veneer construction, concrete foundation.

Church, cost $40,000, Metcalfe St., for Christian Scientists, Metcalfe St. Architect, J. P. McLaren, 104 Sparks St. Painting, Geo. King, 121 Slater St. Electrical, Marchand & Donnelly, Sparks St.

School, cost $140,000, Rosemount, planned by Ottawa School Board. Sec., Crawford Ross, Elgin St. Architect, W. B. Garvock, Creighton St. School. Carpenter, Alex. Christie, Elgin St.

Regina, Sask.
Lodge Hall, cost $10,000, Retallack, for Sons of England Institute. Sec.-treas., E. Peachey, P. O. Box 1175. General contractor, Roger Edwards, 1667 Athol street. Occupants, Sons of England Institute.

Garbage transfer station; cost $15,000, planned by City Council. M. H. O., Dr. M. R. Bow. Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis Co., Ltd., 901 Somerset Bldg., Winnipeg. 2½-storeys, brick and reinforced concrete construction.

St. John, N.B.
Observatory, cost $25,000, Douglas ave., for Dom. Govt., Dept. of Meteorological Service. Architect, Garnet Wilson, 50 Princess street. General contractors, British American Construction Co., Prince William street.

Sandwich, Ont.
Addition to Registry Office, cost $20,000, Bedford and Huron, planned by Essex County Council. Chairman, Enos McCausland, Essex. Architect, James Pennington, Windsor. Masonry, Thompson Bros., Windsor. One storey, 50 x 50. Excavating started.

Toronto, Ont.
Theatre, cost $6,000, 1067 Bathurst St. Owner and general contractor, J. Burford, 14 Vermont ave. Two storeys, 28 x 110, brick foundation, brick and steel construction, felt and gravel roofing. Store fronts and fixtures, seating.

Church, cost $30,000, Jones Ave., for St. Clements Anglican Congregation. Architects, Sharp & Brown, 18 Wellington E. Mason, W. A. Bulley, 458 Pape Ave. Carpenter, J. Lambert, 312 Westmoreland Ave. Walls up.

Westboro, Ont.
Church, cost $11,000, for Presbyterian Congregation. Pastor, Rev. W. H. Cram. Architect, J. P. MacLaren, 104 Sparks St., Ottawa. Painting and heating, J. Stewart, Westboro.

West London, Ont.
School, cost $25,000, planned by Board of Education. Chairman, E. R. Dennis. Architects, Watt & Blackwell, Bank of Toronto Bldg. General contractor, Walter Dann, 795 Lorne ave. Two storeys, white brick construction. Foundations in.

Winnipeg, Man.
Addition and alterations to theatre (Strand), Main St., for Stein, Mayer & Stein Vanderbuilt Circuit, Chicago, Ill. Architects and general contractors, Northern Constr. Co., Union Bank Bldg.

Business Buildings and Industrial Plants

Amherstburg, Ont.
Garage, cost $7,000, contemplated for Amherstburg Garage Co., Dalhousie St. Concrete blocks and red pressed brick construction. Plans will be prepared.

Brantford, Ont.
Three stores, offices and lodge, cost $60,000, Nelson and Market streets, for I.O.O.F. Chairman of Committee, Chas. W. Cowherd, Supt. Cockshutt Plow Co., Ltd. Members of committee, Thomas Doodyatt, Jas. A. Spence, T. L. Wood and Chas. Parker. Plans in progress.

Blenheim, Ont.
Addition to factory contemplated for British Canadian Canners. Manager, T. A. Agnew. Architect to be selected.

Dundas, Ont.
Bank building for Royal Bank of Canada, H. O. Montreal. Architect, J. Walker, c/o Owner. Concrete and brick construction, Roman stone. Plans prepared.

Edmonton, Alta.
The Winnipeg Ceiling & Roofing Co., Ltd., Winnipeg, plan to enlarge their plant. Manager, W. J. McMartin, Edmonton Metal Works. Machines for corrugating iron and other manufacturing work required.

Grimsby, Ont.
Plant planned for The Pelee Island Wine & Vineyard Co. Pres., Major J. S. Hamilton, Brantford. Factory, 3 storeys, 150 x 60, cooper shop and storage building, 100 x 30, engine and boiler house, stone, brick or cement and fireproof construction, cost of buildings, $30,000, plant $30,000. Railway switches to be laid.

Kingston, Ont.
Iron and tube plant planned for Kingston Iron & Tube Co. $75,000 bonds guaranteed. By-law passed and company will start plant at once.

Markham, Ont.
Abattoir contemplated by F. T. Newton. Site purchased and plans will be prepared.

Montreal, Que.
Restaurant, alterations, St. Catherine W. and Bleury, for North Eastern Lunch Co. (Mr. Craig, St. Catherine W. and Mansfield Sts.). Architect, Mr. Heggie, 573 Lasalle Rd., Verdun, will call for tenders. Tile and marble work let.

Dairy contemplated for Gunn Langlois & Co., Ltd., 241 St. Paul. Plans will be prepared.

Store and ice cream parlor, cost $15,000, planned for Geo. Nicholas & Co., 322 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg. Contract will not be awarded till spring.

Petrolia, Ont.
Addition to factory, cost $70,000, contemplated for Petrolia Waggon Works. Architect to be selected. White brick construction. Machinery required.

Business block, cost $15,000, contemplated for H. Rotsky, Wonderland Theatre. Architect to be selected. Two stys., white brick construction. Plans will be prepared.

Sarnia, Ont.
Bank, remodelling, Front, for Industrial Mortgage & Savings Co., 283 N. Front St. Manager, D. N. Sinclair. Office fixtures, etc., required. Plans in progress.

Sault Ste. Marie, Ont.
Lumber mills. The Andrews Lumber Co., Ltd. Owners are operating 60 miles north of the Sault at Alona Bay. Capital of company $150,000, dock is being built of solid rock, 1,000 ft. long, with "L" across one end 125 ft. long x 25 ft. wide, and "L" 35 ft. wide. Owners are also building circular mill (re-saw to be installed later), tie, shingle and lath, mills output to be about 4,000,000 ft. hardwood, 3,000 to 5,000 cords spruce pulpwood, 25,000 to 35,000 cedar ties, 5,000 to 10,000 cedar poles, and about 50,000 cu. ft. white pine board timber.

Scott Junction, Que.
The Beauce Pulp & Lumber Co., 68 Peter St., Quebec, are considering plans for new mill, to replace one destroyed by fire.

Sherbrooke, Que.
Elbram Stone Company are negotiating with city for concessions with view to building factory for the manufacture of "Elbram Stone." Sec., D. Simoneau.

Stratford, Ont.
Addition to factory planned for The Avon Hosiery Co., 82 Erie St. Local manager, W. Pearson. Ratepayers voted on by-law to loan company $25,000.

The Stratford Mfg. Co., Ltd., manufacturers ladders, lawn swings, etc., has asked City Council for fixed assessment for 10 years and permission to close College St. in order to double size of plant.

Toronto, Ont.
Wood-working factory planned for Beverley Wood Specialty Co., 91 Niagara St. Company have applied to York Twp. Council to close Renora Cres., east from Blackthorn.

Garage, cost $18,000, 19 Agnes, for Cawthra Estate, 11 King St. E. Tenders received by Architects, Bond & Smith, 15 Wilton Ave. Old buildings on site to be torn down at once. Two storeys, 50 x 102, reinforced concrete construction, concrete foundation.

Tile drain for warehouse, for C. H. Elton, 465 Adelaide W. Tenders received by Owner for 600 ft. of 9 in. tile drain.

Warehouse, Sydenham, for S. B. Hinter, c/oArchitect, E. G. Wilson, 77 Victoria St. Tenders received by Architect. Four storeys, brick and mill construction, brick foundation, felt and gravel roofing.

Wabanum, Alta.
Branch factory contemplated for Hunt Manufacturing Co., Walla Walla, Washington, U.S.A. Manufacturers of threshing machines and agricultural implements.

Winnipeg, Man.
Factory planned for Berliner Gramaphone Co., 415 St. Catherine W., Montreal. Architect, E. M. Berliner, Wash-

(Continued on page 71)

Tenders and For Sale Department

Bridge Tenders

Tenders will be received by the undersigned at the Court House up to 2 p.m. on **Tuesday, November 25th, 1913**, for 40 ft. concrete girder bridge for county line between Waterloo and Wellington. Alternate tenders will be received for steel bridge. For further information apply to

BOWMAN & CONNOR,
Civil Engineers,
46 Berlin, Ont.

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913**, for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ED. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension to Wharf at Callendar, Ont.," will be received at this office until 4 p.m., on **Monday, December 1, 1913**, for the construction of an Extension to Wharf at Callendar, District of Parry Sound, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont., Midland, Ont., and on application to the Postmaster at Callendar, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 30, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—4976 45-46

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
45-46 Aylmer, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf and Warehouse at Richard's Landing, Ont.," will be received at this office until 4 p.m. on **Tuesday, December 2, 1913**, for the construction of a Wharf and Warehouse at Richard's Landing, St. Joseph Island, Algoma District, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineers' Office, Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Richard's Landing, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, October 31, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—48268. 45-46

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
45-46 Woodstock, Ont.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Thursday, November 18th, 1913**, for the construction of the following works:

SEWERS

Ascot Ave., from Dufferin Street to W.S. of St. Clair Ave.
Benlamond Ave., from Main Street to West End.
Springmount Ave., from Oakwood Ave. to Mount Royal Ave.
Midway Drainage System, Gerrard and Hiawatha via Hiawatha.
Fairford and Ashdale to 520 feet N. of Fairford.
Dufferin St., from 500 feet North of St. Clair Ave. to 90 feet North of Morrison Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the corporation of the City of Toronto), or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, November 5th, 1913. 46

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED

from

Experienced Contractors

for

Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

Tenders for Construction of Sidewalk

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Saturday, November 15th, 1913,** for the construction of concrete sidewalk on Baby Point Crescent, in the Township of York.

Plans, specifications and all necessary information may be seen at the office of Frank Barber, C.E., 57 Adelaide St. East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, November 11, 1913. 46

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. 46

Wanted by a large firm of builders and contractors who are opening a branch in Eastern Canada, Catalogues and Price Lists for Builders' Supplies, Construction plant, lumber, etc. Also applications from sub-contractors for the various trades. Apply Box 908, Contract Record, Toronto. 46

Manager or Assistant Manager

Position wanted in either capacity by high grade man with established or organizing Paving Company operating in Canada. Successful Promoter and Organizer with thorough knowledge of Sheet Asphalt, Asphaltic Concrete and Concrete Pavement mixtures and talking points of same, also good Estimator. Would consider proposition from new company and sell stock for same. Prefer East though have extensive Western experience. Contract on salary and percentage basis considered. Correspondence arranging for interview solicited. Box 888, Contract Record, Toronto. 40-t.f.

Business Buildings and Industial Plants

(Continued from page 69)

ington, D.C. Nothing further will be done this year.

Windsor, Ont.

Bank and offices, Sandwich St. E., for Canadian Bank of Commerce. Manager, A. E. Taylor. Site purchased and plans will be prepared.

Bank building, Ouellette Ave. and Chatham St., for Merchants Bank of Canada. Manager, Geo. Carruthers. Site purchased and plans will be prepared.

Store building, cost $8,000, Pitt E., contemplated for Simon Meretsky. Architect not chosen. Brick construction.

CONTRACTS AWARDED

Assiniboia, Sask.

Hotel, cost $22,000. Owner and general contractor, Jos. Thompson, Viceroy, Sask. Architect, Geo. J. G. Jarrett, Weyburn. Three storeys, 50 x 85, brick veneer construction, cement foundation, maple and B. C. fir floors. Felt and gravel roofing. Excavating done.

Brandon. Man.

Warehouse, cost $8,925, for Provincial Govt., Dept. of Public Works. Minister, Hon. Colin Campbell, Winnipeg. Architect, V. W. Horwood, Winnipeg. General contractors, The Willows Co., Ltd., Brandon. One storey, 30 x 62, corrugated iron roofing. Walls up.

Bradford, Ont.

Factory planned for Watson-Smith Co., Ltd., 161 Geary Ave., Toronto. Foundations, Mr. Sparling Meaford. Brick, Geo. MacDonald. Brick work to be completed by Nov. 30th.

Brantford, Ont.

Store and offices, cost $3,800, Dalhousie, for Joseph Hall, 223 Darling St. General contractor, J. W. Fogal, 252 Dalhousie. Plumbing and electrical not let. Two storeys, 24 x 50, concrete foundation, pressed brick construction, felt and gravel roofing.

Calgary, Alta.

Warehouse, cost $10,000, 10th Ave. Owners and general contractors, Gray & Campbell, Ltd. Supt., J. J. McQuire, 1735 11th Ave. W. Architect J. J. O'Gara, McLean Block. Heating and electrical not let yet. Work done under supervision of Architect. Two storeys, 50 x 20, brick veneer and mill construction. Foundations in.

Cobalt, Ont.

Bank building, cost $9,000, Prospect Ave., for Bank of Ottawa. Manager, Samuel Smythe. Architect, J. P. MacLaren, 104 Sparks St., Ottawa. General contractors, Hill, Clark & Francis, New Liskeard. Two storeys, 24 x 64, concrete foundation, reinforced concrete and pressed brick construction, felt and gravel roofing.

Store and hall, cost $6,000, 22½ Lang St., for Gordon Davies Co., Ltd. Architect, W. R. Graham. General contractor, John Hazelton. Two storeys, 35 x 70, brick front, concrete block construction, concrete foundation, fronts and fixtures, refrigerating machinery. Excavating started.

Concentrator, cost $60,000. Owners and general contractors, Northern Customs Concentrators, Ltd. All machinery except heavy stamp mortars is being built by The Wabi Iron Works, New Liskeard. Corrugated iron roofing. Walls up.

Hamilton, Ont.

Factory, cost $18,000, Bay and Vine Sts., for Duncan Lithographing Co., McNab St. S. General contractor, W. H. Yeates, Jr., 24 Leeming St. Two stys., brick and steel construction, concrete foundation. Excavating done.

Foundry, cost $125,000, Aberdeen Ave., for Canadian Westinghouse Co., Ltd. Manager, Paul J. Myler. Architects, Prack & Perrine, 36 James St. S. General contractors, H. G. Christman Co., 32 Main St. E. Two storeys, main building, 304 x 70. Foundations in.

Store, cost $5,000, King St., for B. H. Webster, Wentworth and King Sts. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. General contractor, Stanley Kerr, 408 Garth St. One sty., 24 x 80. Excavating started.

Store, cost $3,700, Cannon St. Owners and general contractors, Harris & Fleming, 23 Fullerton Ave. Two storeys, 24 x 60, concrete foundation, brick construction, felt and gravel roofing, store fronts and fixtures. Permit issued.

Warehouse, cost $40,000, Bay Front, planned by Hamilton Harbour Commission. Chairman, Geo. J. Guy, 8 James St. N. General contractor, W. H. Yeates, Jr., 24 Leeming St. Reinforced concrete construction, concrete and stone foundation. Excavating done.

Ingersoll, Ont.

Soap factory, cost $11,000, for Standish Mfg. Co., Ingersoll, and 11 Colborne St., Toronto. General contractors, Nagle & Mills, Ingersoll, will sublet other trades. Excavating done.

London, Ont.

Addition to Metropolitan Hotel, cost $14,500. W. J. Wright, proprietor. Architect, J. V. Munroe, Bank of Toronto Bldg. General contractors and carpenters, Tambling & Jones, 282 Horton St. Mason, Scott Murray, King St. Roofing, J. Brownlee, 385 Talbot. Plastering, Jno. Fenn, 752 William St. Heating and plumbing, F. C. Hunt, 533 Richmond St. Electrical, Benson-Willcox Electric Co., 264 Dundas St. Three storeys, 50 x 35.

London East, Ont.

Two stores, cost $16,000, Dundas, for Heughan & Co., 1004 Dundas St. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. General contractors, John Hayman & Sons, London, will do all work. Two storeys.

Montreal, Que.

Shed, cost $4,800, Amity, for Catholic Scholar Board of Montreal, 85 St. Catherine W. Architects, Venne & Labelle, 5 Beaver Hall Sq. General contractor, J. B. Martineau, 479 Orleans.

Stores and flats, cost $8,500, for A. Girard, 285 Iberville St. General contractor, L. Peltier, 255 Cartier St. Three storeys, 45 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Stores, etc., cost $750,000, St. Catherine and St. Denis, for U. H. Dandurand, St. James and St. Lawrence. Architects, Ross & MacDonald, 1 Belmont St. General contractor, C. E. Deakin, 41 Mayor St. Marble, Montreal Marble Works, c/o General Contractor. Walls up.

New Hamburg, Ont.

Addition to factory, cost $15,000, for Silversmiths Co., Ltd. Mason, A. & J. Wunder, Berlin. Concrete, M. A. Fraser, New Hamburg. Three storeys, 70 x 40, brick construction, concrete foundation.

Newington, Que.

Paint shop, cost $12,000. Owners and general contractors, Quebec Central Rly. Co. General manager, J. H. Walsh, Sherbrooke. Architect, H. G. James, Whiting Block, Sherbrooke. Mechanical Engineer, Geo. Robins, Q. C. R. Shops. Work done by day labor. Iron and steel, Jenckes Machine Co., Sherbrooke. One sty. and monitor, 175 x 62, cement foundation, structural steel and red brick construction, felt and gravel roofing.

Ottawa, Ont.

Factory, cost $14,000, Aberdeen. Owner and architect, M. J. O'Brien, Raglan St., Renfrew. General contractor, A. E. Spooner, Windsor House. Two storeys, Walls started.

Addition and alterations to stores, cost $5,000, Rideau, for E. C. Grant and H. P. Fleming, Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, Alex. Christie, 359 Elgin St.

Business block, cost $100,000, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Mason, T. C. James, 140 Flora St. Excavating started.

Addition to stores, cost $250,000, Rideau and Essex St., for A. E. Rae Co., Ltd., Rideau St. Architects, Ross & MacDonald, 1 Belmont St., Montreal. General contractors, Doran & Delvin, Sussex St. Walls partly up.

Addition to warehouse, cost $10,000, for S. J. Major, Ltd., York St. Architect, C. P. Meredith, 126 Sparks St. General contractor, T. C. James, 104 Flora. One storey addition, brick and reinforced concrete construction, electric lighting.

Regina, Sask.

Addition to warehouse for Regina Plumbing & Heating Co., Ltd., Hamilton St. Architects, Storey & Van Egmond, Credit Foncier Bldg. General contractors, Minkley & Traub. Three storeys, stone and brick construction, felt and gravel roofing, electric lighting. Foundations in.

Stable, cost $23,900, Albert, planned by City Council. Architect, R. W. Allen, City Engineer's Office. General contractors, Frid Lewis & Co., Ltd., 901 Somerset Bldg., Winnipeg. Plumbing and heating, Paulin & Swayze, 1778 Rose St. Interior fittings, Economy Foundry Co., 619 Somerset Bldg., Winnipeg. Two storeys, stone, frame and brick construction.

Sault Ste. Marie, Ont.

Stores and offices, cost $8,500, for T. T. Barnes, Queen St. Architects, Moran & McPhail, Queen St. General contractors, Ableson & Wright. Plumbing, F. H. Barnes, 344 Queen St. Two storeys and basement, 58 x 27½, brick construction, stone foundation. Excavating done.

Stores and residence, cost $12,000, Queen St., for S. W. Fawcett, 148 Church St. Architects, Moran & McPhail, Queen St. General contractors, Ableson & Wright. Two storeys and basement, 60 x 27½.

St. John, N.B.

Grain elevator, cost $500,000, West, for C. P. R. Co. General manager, F. R. Hodge, Montreal. General contractors, Jno. S. Metcalf Co., Montreal.

Bank, cost $50,000, Market Sq., for Bank of British North America. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St.

Stratford, Ont.

Addition to factory, cost $25,000, Erie, for Can. General Electric Co., King and Simcoe Sts., Toronto. Local manager, W. Preston. Architect, J. S. Russell, 21 Downie St. General contractor, J. L. Youngs. Work done by day labor. Three storeys, 50 x 161. Foundations in.

Toronto, Ont.

Stores and residences, cost $16,000, 1395 Queen St. W. Owners and general contractors, Weistmiller & Mackenzie Bros., 1431 Queen W. Owners superintend all construction. Three storeys, 70 x 56, brick and steel construction, stone foundation, felt and gravel roofing, store fronts and fixtures. Foundations started.

Windsor, Ont.

Factory (2nd building), cost $50,000, Tecumseh Road, for Remington Arms Co. Engineer, W. G. Haycock. General contractors, Wells & Grey. One storey, 144 x 96, brick and steel construction, concrete foundation. Excavating done.

Alterations to Chinese restaurant, cost $3,500, Sandwich St. W., for King Lee, Chatham. Architects, G. Jacques & Co. General contractor, Rollo Westcott.

Winnipeg, Man.

Bank building, cost $25,000, Main St. N., for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust and Loan Bldg. General contractor, Geo. A. Fuller, Union Bank Bldg.

Factory, cost $3,000, Selkirk avenue. Owners and general contractors, Manitoba Vinegar Mfg. Co., Selkirk ave. Two storeys, 40 x 70, frame construction, felt and gravel roofing, steam heating. Foundations in.

Residences

Montreal, Que.

12 flats, cost $10,000, Rosemount (2nd Ave.), for Trudeau & Laframboise, 182 St. Catherine E. Architects, Audet & Charbonneau, 15 St. James St. Plans to be drawn this winter and tenders called in spring.

10 cottages, cost $40,000, Cote St. Michael (Back River Road). Architect, S. Frappier, 2238 Park Ave. Plans will be ready to call for tenders about Nov. 20th. Tenders received for two cottages at once. Concrete foundation, frame construction, felt and gravel roofing.

Residence, cost $5,000, Outremont (Outremont), for P. P. Boileau. Architect, S. Frappin, 2238 Park Ave., Montreal. General contractor, C. Mathieu, Fort William. Plans will be ready to call for tenders about Dec. 1st. Two storeys, 29 x 52, concrete foundation, stone and brick construction.

Residences, cost $20,000, Outremont (Querbes St.), for M. Dagenais, 1055 Laurier Ave. W. Architect, L. R. Montbriant, 230 St. Andre St., Montreal. Plans ready.

Five flats, cost $7,000, Majuenesse St., for Mrs. Helen Turgeon, 1048 Cremajie. Three storeys, 45 x 47, concrete foundation, felt and gravel roofing. Permits issued.

Residence, cost $23,000, Westmount (Carleton), for J. E. Dalrymple, 4684 Western Ave. Architect, A. K. Hutchon, 702 New Birks Bldg. Owner is now receiving tenders for general contract.

Residence, cost $25,000 Outremont St. Catherines Rd.), for A. A. Grothe, 141 Villeneuve W. Architect, Chas. Chausse, 17 Pagnuelo Ave. Foundation, Martineau Pisson & Laurence, Berri St. Foundation to be put in this fall. Other contracts to be awarded in spring. Three storeys, 41 x 50, concrete foundation, waterproofed, stone and brick construction, felt and gravel roofing.

Six flats, cost $7,000, Rozel, for Wilfrid Girard, 75 Shearer. Three storeys, 51 x 40, concrete foundation, felt and gravel roofing. Plans ready.

Montreal West, Que.

Semi-detached cottages, cost $10,000, for W. S. P. Burns, care Architects, Benoit & Girard, 215 St. Catherine W. Two storeys, 56 x 32, concrete foundation, brick veneer construction. Plans in progress.

Ottawa, Ont.

Residence, cost $4,900, Ossington, for H. L. Morrison, 41 Somerset St. 2½ storeys, stone foundation, brick veneer construction. Plans in progress.

Residences, cost $4,500 each, Munro St. Owners and architects, Messrs. Willis & McDonald, Munro St. 2½ storeys, concrete and stone foundation, brick veneer construction, felt and gravel roofing. Plans in progress.

Residence, cost $5,000, Rideau. Owner and architect, S. Coplan, 282 Murray. Stone foundation, brick veneer construction. Plans ready.

Two residences, cost $10,000, Stewart, Owner and architect, S. Copland, 282 Murray. Stone foundation, brick veneer construction, shingle and felt and gravel roofing. Excavating started.

Residence, cost $7,500, Powell. Owner and architect, A. E. Shaver, 45 Powell Ave. 2½-storeys, 32 x 38, brick veneer and rough-cast construction, stone foundation. Plans in progress.

Residence, cost $7,000, Driveway. Owner and architect, A. E. Shaver, 45 Powell Ave. Stone foundation, rough-cast and brick veneer construction. Plans in progress.

Residence, cost $12,000, Clemow, for John Foley, Central Chmbrs. Solid brick construction, stone and concrete foundation. Plans in progress.

Residence and garage, cost $15,000, Clemow. Owner and architect, W. E. Noffke, Central Chambers. 2½-storeys, 39 x 48, brick veneer construction, stone and concrete foundation. Plans drawn.

Residence, cost $5,500, Regent, for Geo. Wilson, 341 Gloucester St. 2½-storeys, 34 x 46, double brick veneer construction, stone foundation. Plans will be prepared.

Regina, Sask.

Rectory, cost $7,500, 14th and Winnipeg, for Grace Church. Pastor, E. C. Earb, 2360 Smith St. Architects, Clemensha & Partnell, Scarth St. 2½-storeys, 9 rooms, red pressed brick construction, brick foundation. Plans drawn.

Apartment block, cost $40,000, 14th and Robinson, for G. F. Warde, Modern Apartment Block. Five storeys, brick and stone construction, brick foundation. Plans ready.

Twp. Sandwich East, Ont.

Residence, cost $14,000, Walker Road, for Frank Walker, Walkerville, Ont. Tenders received by Architects, Stohl & Kinsey, Walkerville, until Nov. 20th. 2½-storeys, 30 x 60, frame construction, cement foundation.

Toronto, Ont.

Residence, cost $5,000, Thorburn, for J. M. Cowan (in trust), 65 Adelaide E.

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If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

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A. Angstrom - Montreal Representative - 509 Canadian Express Building

Two storeys, 32 x 44, brick construction, stone foundation, felt and gravel roofing. Plans drawn.

Windsor, Ont.

Two-family flat, cost $7,500, Giles Ave., for Peter Osterhout. Architects, Leybourne & Whitney. Two storeys, frame and stucco construction. Plans in progress.

Residence, cost $15,000, Victoria, for C. A. Smith. Architect, J. C. Pennington. Two storeys, 68 x 34, hollow tile construction. Plans in progress.

Winnipeg, Man.

Residences, cost $200,000, contemplated by a Syndicate. Interested, C. W. N. Kennedy, Kennedy Bldg. Houses to be erected to cost from $1,500 to $2,000 each. Owners intend building 102 in 1914 and 102 before 1916.

CONTRACTS AWARDED

Hamilton, Ont.

Three residences, cost $10,000 each, Inglewood Drive, for S. McPhie & L. Donaldson, 701 Bank of Hamilton Bldg. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Carpenter, Donaldson & Patterson, 229 Bay St. S. Foundations in.

Medicine Hat, Alta.

Residence, cost $4,600, Barclay St., for W. A. Radcliffe (Manager, Dominion Bank). Architects, Bourne & Morrison, Huckvale Block. General contractor, Jno. E. Stacey, 815 Alberta St. Two storeys, 28 x 32, frame construction Foundations in.

Montreal, Que.

24 flats, cost $24,000, Westmount (Western Ave.) Owners, architects and gen. contractors, G. N. Clermont & Co., 97 St. James St., Montreal. Work done by day labor. Three storeys, 195 x 50, felt and gravel roofing, stone and brick construction, lime and sand plaster. Foundations in.

Residence, cost $25,000, Outremont (St. Catherine Rd.), for J. W. Jalbert, 189 Villeneuve W. Architect, Chas. Chausse, 17 Pagnuelo Ave. Foundation, Martineau Pisson & Laurence, Berri St. Foundation to be put in this fall. Other contracts to be awarded in spring. Three storeys, 38 x 54, concrete foundation, waterproofed, stone construction, felt and gravel roofing. Excavating done.

Residence, cost $16,000, Westmount (Mountain St.), for Ryan Tetley, 78 Crescent St., Montreal. Architect, H. Strang, 4550 St. Catherine. Mason, Chas. Robillard, 2397 Drolet St. Heating and plumbing, Hart & O'Brien, 241 Mentena St. Other contracts to be let shortly. Two storeys, 57 x 51. Excavating done.

Ottawa, Ont.

Residence, cost $5,500, 3rd Ave., for Wm. Moxley, c/o Builder and general contractor, A. C. Burton, 509 McLeod St. Brick veneer construction, stone foundation.

Quebec, Que.

Residence, cost $14,000, Moncalmville (De Bougainville), for Ulric L'Heureux, Ste. Foye. General contractor, mason, carpenter, plastering, painting and interior fittings, J. Breton, 175 St. Olivier. Roofing, heating, plumbing and electrical, P. Paradis, 236 d'Aiguillon. Three stys., 50 x 30, concrete foundation, Scotch brick construction. Excavating done.

Residence, cost $8,000, Lockwell, for Mrs. A. Parent, 62 Desprairies. General contractor, C. A. Vezina, 61 Desprairies. Mason, carpenter and plastering, Ed. Belanger, 185 Ste. Marguerite. Other contracts not yet awarded. Two storeys and basement, 36 x 34, kitchen 20 x 12, concrete foundation, red and Scotch brick construction.

Toronto, Ont.

Four pair residences, cost $16,000, Castlefield ave. Owner, general contractor, masonry and carpentry, Citizens Home Construction Co., 2261 Yonge St. Architect, W. H. Mallory, 31 Queen W. Supt. of construction, Jno. Whitehead, 28 Carlton. Roofing, plastering, painting, heating, plumbing, electrical, to be sublet. 32 x 40, brick construction, brick foundation.

Residence, cost $4,900, Roehampton Ave., for A. S. Anderson, 14 Glenwood. General contractor, E. C. Brown, 87 Sherwood Ave. Two storeys, 24 x 36, brick construction, brick foundation. Excavating started.

Vaudreuil, Que.

Residence, cost $25,000, for L. Chaput, 2 De Bresoles St., Montreal. Architects, Viau & Venne, 76 St. Gabriel St., Montreal. General contractor, Mr. Hamilton, Vaudreuil. Three storeys, 40 x 50. Ex-

Winnipeg, Man.

Residence, cost $8,000, Elm St. Owners and general contractors, Purcer Bros., 509 McIntyre Block. Two storeys, 28 x 30, frame construction. Foundations in.

Residence, cost $6,000, Oak. Owners and general contractors, Andrews & Sons, Portage and Victor. Two storeys, 28 x 30, frame construction, stone foundation. Excavating done.

Power Plants, Electricity and Telephones

Brantford, Ont.

The Municipal Councils of Grandview, Elmo Place, Paris Hill and Parkdale, have petitioned the Ontario Hydro Commission for power.

Brockville, Ont.

Manager, E. J. Philip proposes to instal new retorts and other equipment at the local gas plant. Estimated cost $40,000. Town Council (Water and Light Dept.). Chairman, C. S. Cossitt.

Elora, Ont.

Hydro power contemplated by Village Council. Clerk, Henry Clarke. Council given power to spend $10,000. Transformer station will be located between Fergus and Elora. By-law carried.

Fergus, Ont.

Council has been given power to spend $16,000 on a complete Hydro-electric System. Transformer station will be located between Fergus and Elora. Clerk, James Beattie.

Ottawa, Ont.

Theatre, cost $40,000, for H. Brouse, Bank St. Architect, H. Herbert George, Castle Bldg., Queen St. Mason, A. Tubbe, 72 Lees Ave. Plans for interior decoration required by architect, also designs. Excavating done.

Strome, Alta.

Stores burned. Owners, Douglas Bros., general store, loss $27,000, insurance, $15,000; Strome Pharmacy, E. H. Hayman, $7,000, insurance, $3,000; Strome Restaurant, P. Dick, $6,000, insurance, $4,000; Miss B. C. Hite, millinery store, $3,000; F. C. Freeman, pool room, $3,000.

St. Catharines, Ont.

Sub-station, etc., cost $116,000, planned. Clerk, J. A. Pay. Engineer, W. P. Near, City Hall. Transformer houses and transformers required, to be provided by the Council.

Swift Current, Sask.

Power house, cost $9,310, planned by Town Council. Sec.-Treas., G. D. Arnott. Elec. Supt., A. V. Ross. Engineer, G. D. Mackie. General contractors, Gillstorm Contracting Co., Cheadle St. W.

Toronto, Ont.

Chapel, 97 St. Joseph St., for Roman Catholic denomination. Architect, A. W. Holmes, 10 Bloor St. E. Mason, J. McGlue, 285 Sherbourne. Carpenter, T. J. Sullivan, 552 Ontario St. Two storeys, 35 x 75, brick construction and foundation. Chapel to be erected in connection with Newman Hall. Excavating started.

Winnipeg, Man.

Residence, cost $4,000, Polson ave. Owner and general contractor, D. Silvert, 315 Flora ave. Two storeys, 24 x 28, frame construction. Foundations in.

Tenders received by Board till Dec. 11th, for year's supply of d.c. and a.c. electric induction meters. Specifications, etc., at office of Engineer. J. G. Glassco, 54 King Street.

At the forthcoming municipal elections the ratepayers will be asked to vote on a by-law to raise one million dollars for extensions to the light and power system. Of this amount the new transmission line will cost approximately $500,000. The type of transmission line recommended is a combination of braced and flexible towers with approximately twelve flexibles between each two, braced and spaced four hundred feet apart, thus placing a braced tower at each mile. The type of tower to be used will not be decided upon until the tenders are in. Tenderers will be asked to submit alternative bids and the type adopted will depend largely upon the result of specified tests. Tenders for the towers will not be called until the spring, but contractors will shortly be asked to tender upon the work of piling and other labor in connection with the preparation of the right-of-way. This tower line is to be carried along the right-of-way of the present 60,000-volt line, which is approximately 75 miles long and will be designed to carry two 110,000-volt lines with suspension type insulators.

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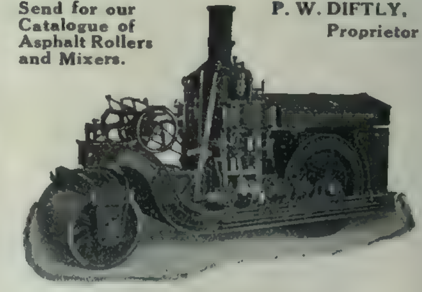

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1303 Peach Street, - Erie, Pa.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.25
3 "	21.43	3 "	29.07

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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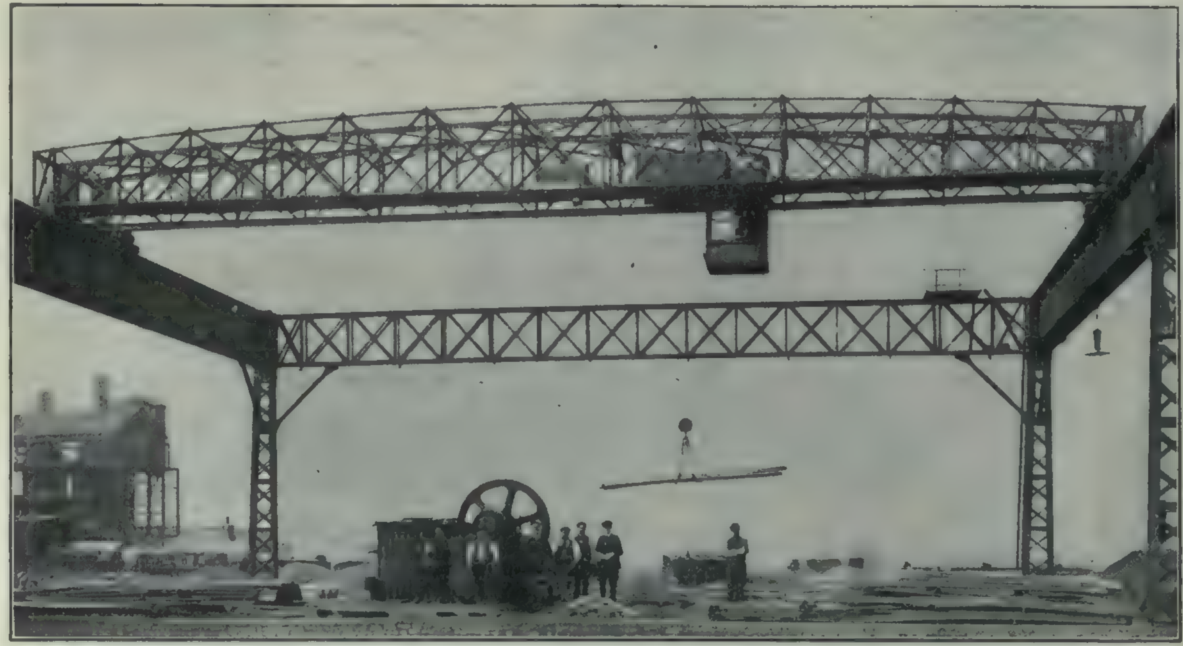

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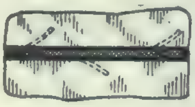

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Alphabetical Index of Advertisers
Page 16

Vol. 27 **November 19, 1913** **No. 47**

The Gratuitous Bid and the Quantity System

THE editorial articles, "The Gratuitous Bid" and "Competitive Tendering," published in our last issue, have elicited from Mr. H. Bryan Gilbert, of London, Ont., a letter (published elsewhere in this issue) which constitutes a strong plea for the adoption of the Quantity System. The keynote of Mr. Gilbert's remarks is that neither the contractor nor the owner profits by the under-estimated bid; that if a number of men go to the trouble of pricing a bill of quantities and one of them, perhaps by virtue of an omission, comes out easily the lowest and obtains the job, the workmanship and material will suffer, whereas with uniform data distributed to the tenderers the successful tenderer is likely to be the closest figurer and the most able contractor.

Discussion of quantity surveying comes up perennially, but in view of the fact that the system has strong claims and that it appears to be growing in favor Mr. Gilbert's letter can hardly be passed unnoticed. As showing the trend of events on the other side of the border, it is interesting to note that an American Institute of Quantity Surveyors has just been organized at San Francisco and that local councils are being established in various cities throughout the United States with a view of impressing engineers, architects and contractors with the merits of the system.

Additional proof of the increasing consideration which quantity surveying is receiving in the United States is furnished by the attention which it is receiving editorially from recognized authorities in the field of technical journalism. We are reminded by the "Engineering News" that in Great Britain, "bills of quantity" always accompany the advertisement of bids for the erection of a building or the construction of any large work. Such a bill is furnished by the owner, architect, or engineer to the prospective contractor and professes to be a correct list of the quantities of work to be done and material to be provided. The contractor makes his bid, either with unit prices or as a lump sum, from this bill as a basis of quantity and with his own estimate of prices. In case he adopts the unit-price method any extras are, of course, taken care of automatically. If a lump-sum bid is made, the "bill of quantity," unless specified to the contrary in the contract, is merely supposed to be an estimate similar in that respect to the limited estimate of quantities sometimes made by the designing engineer or architect in American practice, but differing in that the estimate is very complete, and is made by a disinterested but qualified person known as a "quantity surveyor," whose profession it is to make just such estimates. The estimates then become close approximations of the amount of work to be done and can safely be used by the contractor in making up his bid. Of course, as a precaution he may go over the plans and specifications for his own satisfaction, for the estimate made by the quantity surveyor is not guaranteed and does not bind the owner unless the contract is so drawn. It nevertheless has the weight of disinterested authority, since the reputation of the man making it and consequently his professional standing depend on the accuracy of his estimates. Lump-sum bids made upon it, however, stand or fall by the contract and specifications and are not governed by the estimates.

In this country the "quantity surveyor" is not known. When occasionally the architect or engineer does condescend to present a list of quantities he specifically warns the contractor that the quantities are of little use. As a result each bidder on work is forced to go to the expense of making a detailed estimate of the quantities involved in the contract and the cost of this general estimating is not only assessed on the owner, but is also distributed among the many bidders as an economic loss. Furthermore, it often happens that the successful bidder has made only the roughest kind of estimate of the amount and on finding his bid under the cost of work attempts any and all kinds of skinning on the work in order to come out even or ahead of the game.

While in the largest kinds of engineering construction it is probable that the system of quantity surveying would be of little value, because the bidders on large work will undoubtedly wish to make their own estimates, in smaller contracts and in building work particularly, where it is easy to estimate from plans and specifications the exact amount to be used, the quantity-surveying system is a very good one.

How Engineering Societies Can Educate the Public

THE possibilities for educational work by an engineering society, comments Engineering and Contracting, naturally divide into two essentially different forms, namely, the education of the individual members of the organization by association with the other members and by participating in, listening to or reading the technical proceedings of the society, and, secondly, the influence of the society as a body in moulding public opinion. The first function mentioned is well understood by many engineers at this time, but the opportunities for doing effective educational work of the second type mentioned, often of equal importance with the first, is very generally overlooked or neglected.

In this issue we publish a brief statement of the influence of the engineering society in educating its members. This statement is addressed primarily to young engineers, but it is equally applicable to the engineer of experience who has not become a member of an engineering society.

However, it is to the opportunities available to engineering societies for educating the public that we wish to call particular attention at this time. Anyone who reads the proceedings of our various societies year after year must be impressed by the fact that an unbridged gulf now exists between the educators and those whom they seek to educate. The foregoing statement does not relate to matters of interest to engineers only, such as the majority of the technical studies presented before the societies, but to the subjects from time to time discussed which are or ought to be of interest to the public. An example of the last mentioned type of subject will be given.

Within the past year or two practically every civil and municipal engineering society in the country has had presented before it and has published in its proceedings at least one paper calling attention to the neglect of sewage treatment plants by municipalities. This matter has been very clearly set forth in all of these papers. It has been well understood for several years by engineers. What good, then, has been accomplished by repeating the familiar story in the proceedings of technical societies. It is not likely that conditions have been bettered as yet as a result of the points brought out in the papers mentioned for the reason that the public does not know what the papers contained. The problem before the engineering society in educating the public through the medium of its proceedings is to bring those proceedings to the attention of the public. We believe that this can best be done through the medium of the daily newspapers.

Many of the best newspapers are now glad to publish matter of this kind. It is true that they do not seem to go very far in search of such matter, but it is equally true that they will give some space to it if it is sent to them in proper form for publication. The Cleveland Engineering Society and the Brooklyn Engineer's Club, and perhaps other similar organizations, now enjoy the co-operation of the daily papers in the public discussions of various questions upon which the members of the societies are especially well qualified to express opinions. The experience of the Cleveland society is of interest, and will be briefly stated.

In the fall of 1912 the society appointed a publicity committee. This committee prepared articles for the daily papers, written in popular style but dignified in tone and free from any suggestion of sensationalism. It soon became evident that the newspapers were glad to receive and publish such authoritative communications. The chairman of the committee concludes that both the public and the engineering profession would benefit from organized efforts, on the part of the engineering societies throughout the country, to get in touch with the public through the newspapers.

What has been done in Cleveland can be done in other cities by local engineering societies or clubs. If the big metropolitan dailies will make room for matter of this character it seems a certainty that the papers in the secondary cities and small towns will do the same, for the latter papers usually are less fortunate than the big dailies in the quantity of acceptable matter available for publication.

Obviously many people can be reached in a day through the newspapers who could not be reached in a lifetime through the ordinary form of publishing the proceedings of technical societies. The present form of publishing the full proceedings is essential to the first form of educational work within reach of the society, that within its own membership and among engineers generally, but it is almost useless as a popular educational agency. To reach the public surely and quickly the newspapers must be used.

Road Progress in Quebec

THE Quebec Government have decided to appoint a Minister of Roads, in order to allow the Minister of Agriculture, who is now responsible for the road department, to devote his attention to agriculture alone. In the Address from the Throne, read at the opening of the Quebec Legislature, it was stated that the impetus given by the Government to the improvement of the roads had produced results far exceeding expectations. Not only has satisfactory progress been made in the work on the great highways which it has undertaken but the municipalities have awakened to the importance of energetic initiative on their part, and many of them have availed themselves of the Good Roads Act.

The Hon. J. E. Caron, reporting on the same subject, states that of the $10,000,000 provided by the act of 1912, the municipalities have applied for $8,197,448, which is guaranteed by the Government, which pays half the interest and the municipalities the other half. Mr. Caron estimates that in five years there will have been constructed under this act 2,000 miles of macadamized roads in the province. A striking contrast is afforded by the statement that in 1894-5 but $75 was spent by the Government for the improvement of roads, while in 1913 from July to October 15, the Government disbursed on good roads the sum of $1,592,392.

Up to October 15, 1913, 376 municipalities applied for aid under the act of 1912, of which number 166 complied with all conditions and were granted funds, the others are negotiating. In 1913 400 rural municipalities placed their roads in charge of municipal corporations, and according to estimates made about 15,000 miles of roads are now under this system of maintenance. In 1913, under the law of 1911 and 1912, there were 225 miles of macadamized roads made and 60 miles of gravel roads. Since 1908, 189 iron bridges have been built, and 40 new ones are in course of construction.

The Canadian Steel Industry

IT would almost appear that, if the present rate of progress in steel manufacture continues, Canada will be able soon, not only to supply her own wants as regards steel, but also be able to enter the markets of the world. Prior to 1902, Canada made very little steel. The output advanced from 26,084 gross tons in 1901 to 182,037 gross tons in 1902. Five years later, in 1907, it had reached 646,754 tons, and five years later still, in 1912, it increased to 853,031 tons, the largest output in its history. It is quite probable that in the present year Canada will make nearly 1,000,000 tons of steel, or more than the United States made in 1879. The steel output of Canada is largely in the form of ingots, over 96 per cent. of the total in 1912 being in this form, and less than 4 per cent. in the form of direct castings. The two largest centres for steel in the Dominion are Ontario and Nova Scotia. In 1909 Nova Scotia led Ontario by 28,201 tons, in 1910 by 11,943, and in 1911 by 20,623 tons. In 1912, however, Ontario forged ahead by 1,321 tons. Nova Scotia has within its borders the new and modern plant of the Dominion Steel Corporation, while Ontario has within its boundaries the large and modern plant of the Algoma Steel Corporation. Naturally, the output of finished rolled forms of iron and steel in Canada increased in the same ratio as steel ingots and castings. In 1902 the total rolled output was 161,485 tons. In 1907 it had increased to 600,179 tons, and in 1912 to 861,224 tons, the maximum. Much the larger part of the total was steel—about 87.5 per cent. in 1912. Rails formed almost one-half of the total rolled output of the Dominion in 1912—over 49.2 per cent. It was not till 1902 that Canada began to manufacture steel rails on a large scale. In that year it made 33,950 tons. Its output in previous years had seldom exceeded 800 or 900 tons. In 1912 the rail output reached 423,885 tons, its best yearly record.—"Engineering," London.

Scientific Principles of Estimating

By F. Tissington*

A GREAT deal of paper and ink have been used up on this subject, and therefore the probabilities of the writer being able to state any new facts are correspondingly small. However it was thought that the practical experience derived from some twelve or fourteen years' work might be of some help to the younger members of the engineering profession.

Most of the subject matter relates entirely to the structural steelwork line, but the general principles involved can be readily applied to practically any branch of engineering work.

In the first place the ultimate goal to try for is the acquisition of orders, and, secondly, that they are obtained without the expenditure of more money than is absolutely necessary.

Generally speaking it is a difficult matter to induce a buyer to part with more cash than the lowest bidder asks for a particular service. Occasionally you will come across the man who will pay a higher price where he thinks he will get a corresponding advantage, but this only happens as a rule with special work or machines and will not apply to anything in the nature of a standard article.

The whole question therefore resolves itself into one of price, and providing this is right there is very little necessity to keep up a big outside staff.

In a general sense estimating is the art or science (?) of guessing, and the man who is a good hand at the latter is a good estimator.

As long as you have the human element entering into the work you will not be able to get rid of this guessing aspect, but the more it can be eliminated the nearer you approach to the real scientific estimate.

All new estimates are made up from the estimator's knowledge obtained from previous similar work, therefore the desirability of keeping accurate records is at once apparent.

This is the gist of the whole matter, and according to the way this information is first obtained and tabulated depends entirely the efficiency of the department. Naturally of prime importance are the orders actually carried out, but estimates which have not matured are also of value in a comparative sense.

From this it appears that the first thing to arrive at is an efficient cost system and this must be designed to suit the particular works. One of the greatest stumbling blocks is the obtaining of correct information from the men in the works of the actual time they have been employed on a particular order, and this requires special thought for every works.

The following are a few of the writer's experiences which may serve to point out what to avoid or adopt.

(1) A firm manufacturing steel buildings and general structural work. The majority of the work could be divided into a number of distinct classes, such as (a) roof trusses; (b) open sheds; (c) closed sheds; (d) bridges, etc.

The number of enquiries received for these lines probably ran to about five or six per day, and they were dealt with without any reference at all to previous work done, although quite an elaborate cost system was in vogue.

During the course of twelve months quite a large number of enquiries of a similar nature would be received.

The weight of the metal in the structure would be arrived at by each man jumping at the sections with the consequence that sometimes they were too light and at others too heavy.

The writer found this was due to the fact that owing to the large number of enquiries coming in there was no time to investigate each case properly if they were all to be quoted for.

The first step decided on was to make once and for all a standard series of roof trusses within the limits of the usual work. These were completed for three different styles of roof coverings in steps of two feet from 18 ft. to 54 ft., and for three different spacings of the trusses apart.

This was really carried out in a scientific manner and could be relied upon, thus giving a close figure for the weight of the material.

Next it was decided to tabulate all the estimates except those of a special character, dividing them up into about eight or ten classes, and recording all the principal features such as total weight, price per ton for manufacture, point of delivery, price for erection, basis price of raw material, outline dimensions, price per square and cubic foot for buildings, and reference to estimate and drawing number so that they could be turned up if necessary.

After this scheme had been in operation a little while the value began to be apparent, as frequently it was found to be possible to quote direct from the record, say, on the basis of a price per square or cubic foot, or a price per pound.

This scheme was particularly useful in those cases where the work did not appeal to the firm, but at the same time wished to quote a figure in order that they should not be debarred from future work, and as the process involved did not occupy much time it enabled them to devote a larger proportion of time to the desirable enquiries.

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*Chief Draughtsman, McKinnon, Holmes & Company, Sherbrooke, Que.

The results of the cost system mentioned previously were also tabulated in a similar manner, and the final result as may be imagined raised the proportion of orders obtained to quotations sent out by quite a large percentage.

(2) Another works manufacturing a miscellaneous character of mechanical work was treated in a similar manner. In this case all castings were obtained from another works and as these formed quite a large proportion of the output it was a comparatively easy matter with a little system to get accurate results on this portion of the work.

Patterns were standardized as far as possible and a good system of reference marks adopted, these being printed in the castings so that it was easy to check them off. All invoices for castings were demanded with separate weights for each particular type so that they could be entered up into the pattern register and on the drawings. This enabled the estimating to be very close as in a general way the calculation of the weight of a casting if at all irregular is quite a tedious job, and also more or less uncertain. Changes on patterns could be readily estimated taking the actual weight of the original pattern as a basis.

The time occupied in machining or fitting the work up in the shop was taken on the card system. That is, each man would be provided with a card for a particular order which he immediately punched in the clock and as soon as this job was completed the card would be punched again, and with each new order a new card would be issued so that it was practically impossible for any of the men to enter their time up to the wrong contract.

These cards were handled by the cost clerk and the resulting information handed over to the estimator.

Another important feature in estimating is the percentage of overhead charges, or burden that a particular class of work should carry. This item includes management, clerical and drawing office staff, outside representation, foremen, power, light, heat, interest on capital, wear and tear of machinery, etc.

The usual procedure is to take the average of these amounts for the previous three or five years working and divide this total by the average tonnage.

This practice hardly seems a good one to the writer. The general effect appears to be that the burden on plain, simple, straightforward work is too heavy and on the more complicated orders too light, and it results in a general way in obtaining work mostly of the latter class.

Perhaps the better method is to make monthly averages instead and take note of the class of work being done during each period. This would enable a much nearer estimate to be made of the conditions likely to result for a particular order.

In works running several departments it is desirable that the running expenses for each should be kept separately.

The last point I wish to call attention to is connected with the purchase of material or manufactured parts made or supplied by other firms.

Many a good estimate has been wrecked by a final jump in the dark for the cost of something which might have been properly enquired for if the necessary steps had been taken when the enquiry came in instead of waiting till the last minute and finding it impossible to get the information on such short notice.

In addition a good system of tabulation for the results of these tentative enquiries and for actual purchases made will more than repay for the time expended.

To sum up the whole thing in a few words:—"Systematise in a scientific way," and having accomplished this you will be surprised to find how smoothly everything works.

Methods of Contract Estimating

In many cases it has been the custom of contractors when tendering for contracts to figure in their own method the cost of their several departments of work in building operations, says a writer in The National Builder. The result frequently has been that there is a great disparity between the amounts of the tenders returned; and being generally lump sum offers, the owners or parties building have no assurance or way of satisfying themselves that the estimates have been carefully and accurately prepared. There are various methods of measuring adopted, according to the locality in which the building is proposed to be erected. In some localities the builders or contractors measure their work according to certain rules known to themselves; but this practice does not give a basis that would be applicable in every locality. Now, a system of measurement that can be uniformly adopted and practiced in any locality is one which would be of great value in giving data for finding the various items of details. Such a system has already been introduced into America, but is not yet uniformly adopted. In some future articles this system may be explained and illustrated.

There is another method known as "cubing" which is sometimes adopted. But it requires considerable experience in the estimator to come to anything like an approximate cost of the work measured and computed by this method. Usually the extreme length of the building multiplied by the extreme width and then by the height from the bottom of foundation to wallhead will give the cubic content in feet. Where there is a pedimented roof, usually the length and breadth of the building is multiplied by half the height to find cubical content. After the cubical content is obtained, the price per cubic foot is calculated upon the basis of the total cost of a building of a similar character, ascertained at the price per cubic foot.

Another simple method of ascertaining the cost of a building is by taking the contents of each flat or storey. Thus, we take the superficial content of the flooring, the lath and straps on walls, the lath on ceilings, the number of windows and doors with their trimmings, and the sundries of each flat separate. The items of each flat are calculated at current rates, and if the flats are similar in construction they can be multiplied by the number.

These are some of the methods that may be adopted to ascertain an approximate estimate of what a building will cost; but the most reliable method is by the adoption of a uniform system of measurement having well-defined and formulated rules that will give justice to both owner and contractor alike.

A report from Calgary states that a syndicate of local and Minneapolis capitalists, of which O. C. Devenish is the head, will shortly commence the erection of the largest flour mill in the British Empire. It will be built in four units, to cost $1,400,000 each, and when all the units are completed, will have a capacity of 6,000 barrels of flour per day.

The Design of Imhoff Sewage Plants*

Preliminary Screens and Proportioning of Grit Chambers—Settling Compartment, Velocity of Flow, Detention Period—Pumping Sludge and Drying Beds

THE methods of design of Imhoff sewage tanks presented in this article are based upon seven years of practical experience in the Emscher District of Germany. For the conditions that exist in this district these methods have undoubtedly proved satisfactory. Twenty-two Imhoff plants, consisting of one hundred and twenty tanks, have already been constructed in the district under varying conditions and four more plants with thirty tanks are to be constructed this year. There are now in Germany about one hundred plants using this system.

The data herein given should not be used indiscriminately. Each individual case must be carefully studied beforehand and the design so modified as to fit that case. This can be done intelligently in most cases only in the light of expert experience.

Fundamental Data

First to be considered in the design of any disposal plant is the question of whether the sewerage system is upon the combined or upon the separate plan. If it is upon the combined plan more sludge will come to the plant than under the separate system, and this sludge will contain an appreciable quantity of detritus. It is necessary, therefore, to take due account of this increased sludge and of the detritus in designing the size of the sludge chamber and in determining whether or not a grit chamber should be placed before the tanks.

Important, too, is the matter of storm flows. Usually where Imhoff tanks are installed under the combined system a storm-water overflow is provided and so arranged that a given number of times the dry-weather flow is permitted to enter the plant, while the remaining excess overflows directly into the stream, or, as has been found desirable in some cases, it is caused to enter a storm-water basin. This basin has, for example, in the case of Essen Nord, a detention period of twenty minutes for storm flows of six times the dry-weather flow, at which time half of this sixfold flow enters the Imhoff tanks and the other half the stormater basin. In the exceptional cases where the storm flow is even greater than sixfold dry-weather flow the dilution is considered sufficiently great to permit the excess to flow directly into the stream. After the storm the sludge from the storm-water basin is pumped back into the influent channel, taking the usual course through the settling tanks.

Where the separate system is in use the amount of sludge received is considerably less and the amount of detritus is reduced to a minimum. Hence under this system the sludge-room capacity is lessened correspondingly and a grit chamber is generally omitted.

The next factor considered in the design of the plant is the amount and character of the sewage; which latter affects greatly the time necessary for optimum sedimentation and the amount of this sedimentation. If the sewage is very dilute and contains no coagulating chemicals the detention period is made longer than if the sewage is very concentrated and contains such chemicals as iron wastes. Again, the production of hydrates due to the presence of chemical wastes generally increases the amount of sludge sufficiently to affect the size of the sludge chamber.

It is the practice in Germany to determine the amount of sludge expected in a given plant upon the basis of population rather than upon the volumes of sewage, and this basis of estimation has been found in most cases to be much the more accurate of the two. The population figure used in the design is generally that expected in five years.

It is important in any construction work to study the local conditions. If the ground material is of such a character that the ground-water table may be easily lowered, then the plant may be so designed as to permit of open-pit construction. If however, the material is quicksand, or other conditions make the lowering of the ground-water table during construction difficult, then it may be advisable to sink the tanks as caissons.

Deep vs. Shallow Tanks

It is logical to conclude that in order to attain the same degree of decomposition with shallower tanks it is simply necessary to increase the time of decomposition. In order to increase the time of decomposition, however, the sludge room must be made larger. Hence the tendency will be to expand it laterally, and this, with present designs, leads to a greater cross-section area of sludge room per unit of slot feeding fresh sludge—in other words, the thoroughness with which the incoming particles of fresh sludge are distributed over the cross-section of sludge room is lessened.

The fall necessary in Imhoff plants between the influent and effluent channels may be placed as low as 1 to 2 ft. in cases where grit chambers are not used. Where grit chambers are used, however, and it is desired to drain the retained grit by gravity, a total fall of from 3 to 4 ft. in the plant is necessary. To avoid this additional fall, however, the grit drainage water may be pumped out.

Preliminary Screens

The object of the preliminary screens is to prevent the larger solid substances from getting into the sludge room and clogging the sludge pipe. The clearance used in these coarse screens is usually 2 to 2½ in. The reason for such large clearance is to prevent the retention of faecal matters which should logically enter the tanks.

The total width of the screen chamber is usually made 1½ to 2 times the width of the influent channel, so as to minimize friction and consequent damming. Therefore it is considered advisable, especially in large plants, in order to maintain the necessary velocity to prevent sedimentation, either to raise the invert under the screens, so as to reduce the cross-section to that in the influent channel, or to increase the slope under the invert.

The inclination of the screens is about 1 vertical to 3or 4 horizontal. This is a greater inclination than has been the practice elsewhere; but this greater inclination has many advantages. First, it insures a lessened encroachment upon the fluid cross-section, since the more the bars are inclined toward the horizontal the less is their vertical cross-section. Again, the useful superficial area of the screens is increased by this greater inclination. Then again, the flow of sewage tends to shove the entrained matter toward the upper part of the screen and thus minimizes clogging. Finally, the cleaning of the screen is facilitated by the greater inclination.

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*Abstract of a series of articles by Leslie C. Frank, Assistant Engineer, Baltimore Sewerage Commission, in the Engineering Record.

The cross-section of the bars depends upon the necessity for stability and upon the need of minimizing clogging. In this district the cross-section shown in the drawing has been much used, as it provides a maximum stability, due to the bulbous head, and insures minimum clogging, due to the narrow web.

The lateral brace bars are generally placed at the invert end of the screen, at a point somewhat above the water surface, and at the upper end of the screen. None should be placed within the fluid cross-section, as then the entrained matters are not easily removed.

A screen by-pass is usually provided in the larger plants of the Emscher district, as shown in the drawing. Its purpose is to prevent flooding of the plant if the screen proper should accidentally become superclogged, which may happen during a rainstorm at night, when there may be no attendants at the plant. The screen is simply hand cleaned as often as necessary with a suitable rake.

Grit Chamber

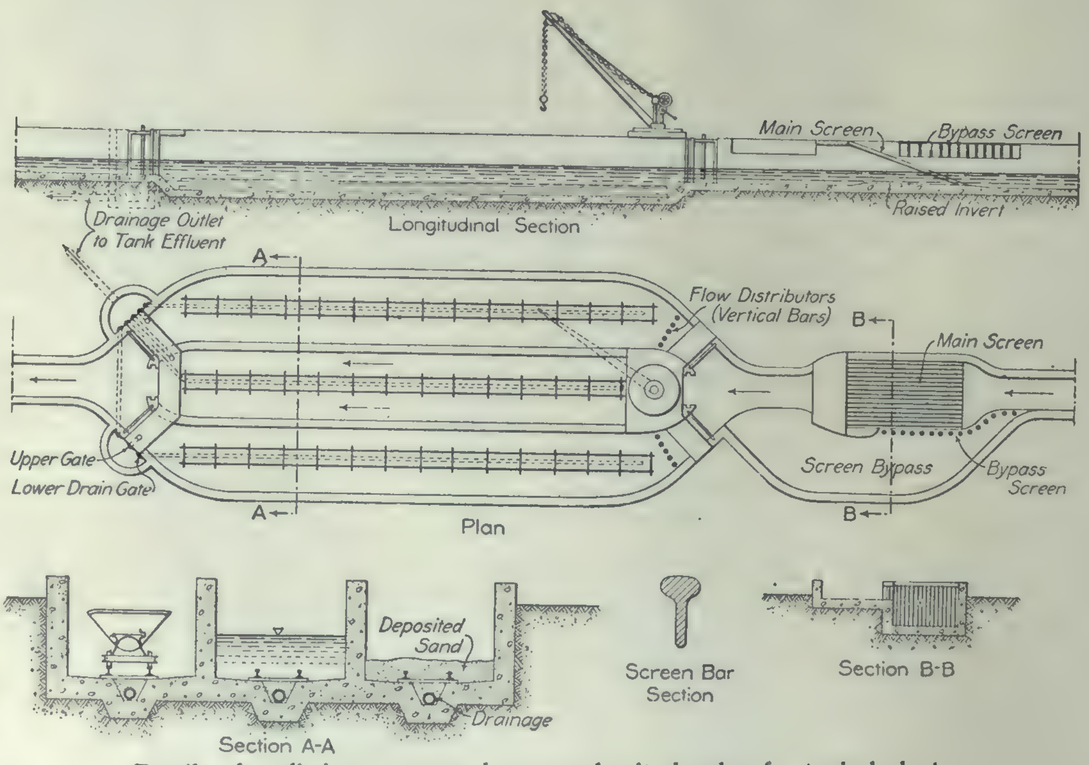
The object of the grit chamber is to retain the harmless mineral suspended content—chiefly street grit—of the sewage. Such suspended mineral matter would merely lessen the capacity of the sludge chamber if it is not previously removed from the sewage, and in addition it is liable, when arriving in considerable volumes, to result in stoppage of the sludge-discharge system. Such harmful volumes of grit do not generally appear where the separate system of sewerage is in use, as has been previously mentioned, and therefore in this case the grit chamber is usually omitted. Neither are grit chambers included in the case of small plants on the combined system where the conditions are such as to insure small amounts of grit.

In the sewer the heavier sand particles are being rolled along the bottom and the lighter ones repeatedly thrown back into the lower part of the fluid cross-section. In the grit chamber the velocity of flow should be so reduced that these lighter particles are no longer thrown back, but tend to roll along the bottom or remain quiet. Such an average velocity has been found by experience to be about 1 ft. per second.

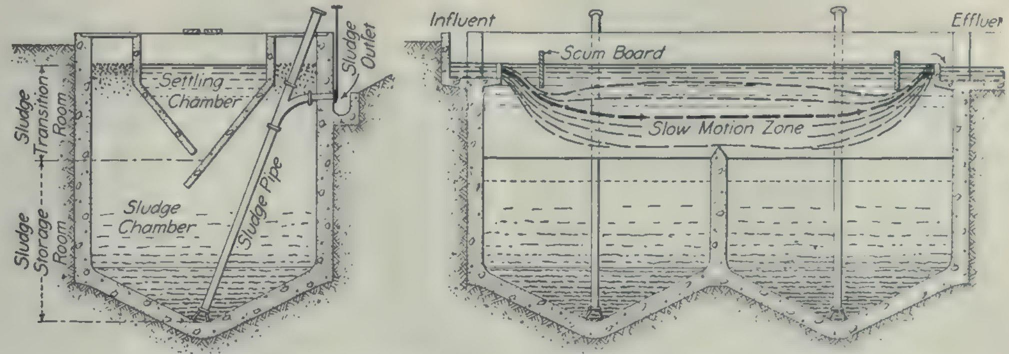
The depth of the grit chamber is limited by the necessity of preventing the deposit of organic sludge. From this standpoint the difference between a grit chamber and a sedimentation chamber in theory may be regarded to be the fact that in the sedimentation chamber there is provided a lower "slow-motion zone" in which the settling organic sludge particles may be entrapped, while in the grit chamber this slow-motion zone is simply omitted so as to prevent such entrapping. Therefore a properly constructed grit chamber should be essentially shallow.

The length of the chamber should be such as to insure the deposit of an optimum per cent. of the sand and to provide sufficient sand-storage volume to avoid the necessity for too frequent cleaning.

The invert of each grit chamber unit is usually provided with a longitudinally placed drainage pipe, closed at the outlet end by a valve. This drainage pipe is placed in a depression in the grit chamber invert and surrounded, up to the level of the invert, with graded slag or gravel, the top layer being sand. The pipe is usually ordinary agricultural drain tile, placed loosely end to end. The grit chamber is composed of several units (generally three). The extra units are provided



Details of preliminary screens, bypass and grit chamber for typical plant.



Longitudinal-horizontal-flow tank of average European proportions.

for two main reasons—(1) to permit taking a unit out of operation while it is being cleaned and still retain the grit chamber function; (2) so that during storm flows more than one unit may be taken in operation. Otherwise the velocity of flow in that one unit would be so increased as to flush the sand it had previously retained into the tanks. In the past where grit chambers have been designed for maximum storm flow it was found that putrescible sludge settled out with the grit during ordinary flows, and where grit chambers were designed for ordinary flows maximum storm flows flushed out the sand. It is advisable, therefore, to provide a number of units, each one designed for ordinary flows.

In the invert of the larger grit chambers are usually placed tracks for hand cars. In emptying the grit chamber the hand cars are loaded with grit and then shoved to the end of the chamber, where the container is lifted out by means of a hand crane.

The Imhoff tanks proper consist of settling chambers suspended over sludge-digestion chambers, the sludge entering the sludge-digestion chamber through slots in the bottom of the settling chamber.

There are three different designs of sedimentation chambers. The first is a longitudinal-horizontal-flow tank, and is the one most in use. The second is a downward-and-upward-flow tank. The third is a radial-horizontal-flow tank. Neither of the last two designs has been adopted extensively as yet.

The downward-and-upward-flow tank was designed because it was thought that thereby a better cross-sectional distribution of flow might be secured, but the results of the operation of this tank on a large scale seem to indicate that its efficiency is not as good as that of the longitudinal-horizontal-flow tank.

Radial-Flow Tank

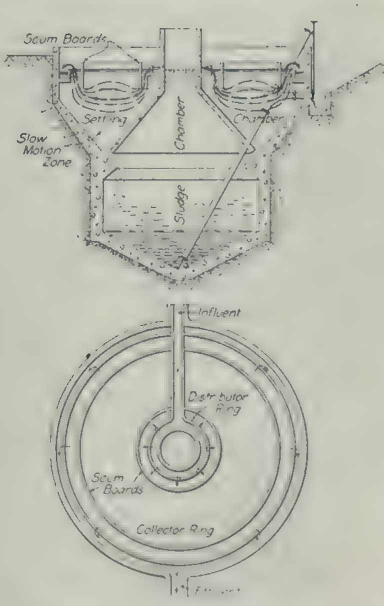
The first radial-horizontal-flow tank was constructed at Altenessen, and there are no operation data as yet. In this design the deeply penetrating baffle, causing downward and upward flow in the above-mentioned tank, has been removed and shallow scum-boards substituted therefor. A possible difficulty is that the radial direction of flow and consequent limitation of length of flow line may result in this flow line being too short to give the upper, rapidly moving currents sufficient opportunity to unload their sediment into the "slow-motion zone." It is obvious that the near surface velocities are not decreased in direct ratio to the decrease in length of tank, and hence these upper rapidly moving currents might have a detention period much too short for efficient sedimentation.

A real advantage in the radial-horizontal-flow type is that here the velocity of flow, in order to provide the proper detention period, must necessarily be very low, and this fact will probably permit a greater amount of overloading than in the case of long-flow-line tanks, before critical velocities are reached.

As the accompanying drawings show, the settling chamber is inclosed by thin walls suspended in the main tank. The size of the settling chamber depends principally upon the necessary detention period and upon the volume of sewage. Generally, in the Emscher District the average daily volume of sewage is considered to flow off in fourteen hours. In America this is often taken at eighteen hours. The reason for this assumption is, of course, the relatively small night flow. From the thus determined hourly sewage flow and the number of hours' detention period the necessary volume of settling chamber is derived.

The detention period depends upon the character of the sewage to be treated. If the sewage contains a large quantity of suspended matters or coagulating chemicals, for example, a small detention period will suffice.

It is also necessary to limit the length of the settling-chamber flow line, because if this is made too

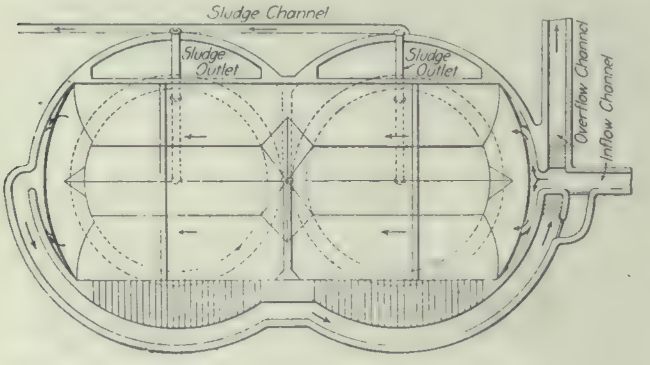


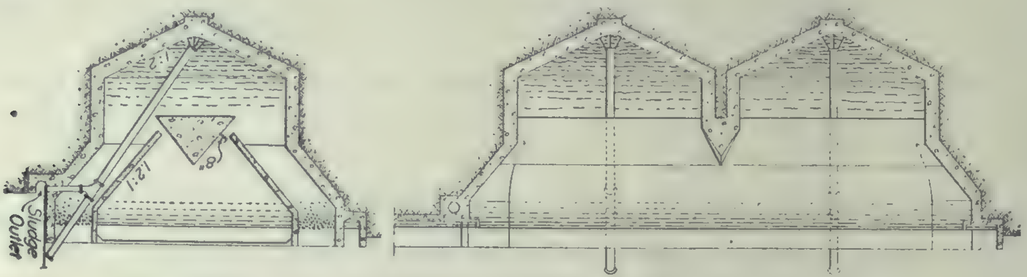
Radial-horizontal-flow tank.

long the velocity necessary to give the proper detention period will be high enough to induce whirling currents and thus hinder sedimentation. Experience has shown that an average velocity of from 0.1 to 0.13 ft. per second is a reasonable maximum limit above which whirling is liable to occur, but in the design of Imhoff tanks it has been the practice not to exceed for dry-weather flow 0.03 ft. per second, so that the upper limit of 0.1 ft. is just reached when the storm-water dilution is threefold.

Cross-Section of Tank

With the length determined the previously determined necessary tank volume will give the necessary tank cross-section. From the necessary cross-section the width and depth may be determined. In general, the width and depth of the tank should be governed by the necessity of proper distribution of flow. The movement of sewage in a settling tank has often been studied and described. One of the occompany drawings shows approximately the direction, location and relative intensity of stream lines in Imhoff tanks. It will be clear that the velocity of flow decreases toward the lower part of a properly designed tank. The velocity in the vicinity of the slot must be sufficiently low so as not to stir up the sludge particles accumulated there, and should constitute the previously mentioned slow-motion zone. For this reason deep-reaching baffle boards are not advisable, and experience in this district has fully demonstrated this. The tank, therefore, should not be to shallow as to encroach upon this slow-motion zone and thus inhibit the passage of the settling particles through the slot. On the other hand, the tank should not be so deep as to inhibit proper vertical distribution of flow. In the former case the maximum possible percentage of settleable solids will not be removed, and in the latter case part of the volume of the tank will be ineffective.





Longitudinal-horizontal-flow tank of average American proportions.

Inlets and Outlets

Since one of the most vital parts of settling-chamber design is the securing of a maximum efficiency of distribution over the chamber cross-section, the inlet and outlet ends of the chamber assume a corresponding importance. The current practice to reverse periodically the flow in Imhoff tanks of more than one sludge chamber, so as to obtain a uniform sludge in the various sludge chambers, makes it necessary in these cases that the channels serving the tanks be so constructed as to act alternately as influent and effluent channels. Hence their inverts must be at the same elevation. In addition, the weirs at the ends of the tanks must act alternately as inflow distributors and effluent weirs. Hence both of these weirs must be at the same elevation. Since the sewage flows over the effluent weir in a comparatively thin sheet the elevation of this weir practically determines the elevation of the sewage in the influent channel. This in turn determines with a given width of channel the fluid cross-section in the channel, and hence, for a given dry-weather flow, the velocity in the influent channel.

Uniform Flow

It has often been attempted in the past to design the influent and effluent ends of a sedimentation tank in such a way as to secure uniform velocities of flow throughout the fluid cross-section of the tank. As has been previously explained, however, the existence of a slow-motion zone at the bottom of the sedimentation chamber is imperative in order that the settling sludge particles may be trapped. The velocity should be considerably lower than the critical swirling velocity, and hence there is no reason why the velocities in the upper part of the tank may not be higher, within limits, than in the lower parts of the tank. It is simply necessary for the upper currents to have sufficient time to drop their load of suspended matter beyond the "pull" of the effluent device. Therefore the effluent device should logically be placed as high as possible—preferably a weir.

The minimum width of slot is governed by the necessity of preventing choking, and the maximum width of slot is governed by the necessity of preventing undue diffusion surface.

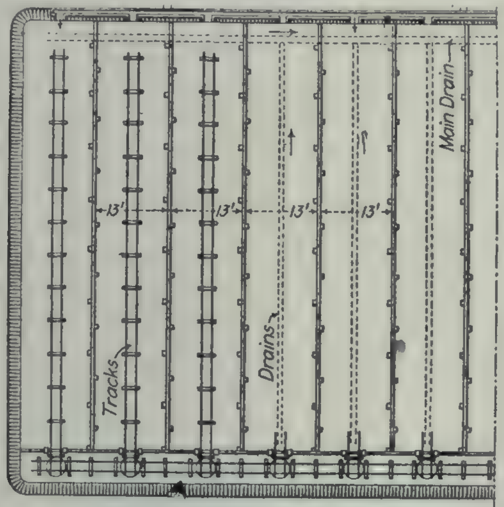
Scum Boards and Baffles

The penetration of scum boards under the water surface should not be so great as to render ineffective part of the upper volume of the chamber, or immoderately to increase the velocity in the lower slow-motion zone. In the Emscher District they are made to penetrate 12 to 16 in., and they usually project about 12 in. above the water surface.

Baffles are not considered advisable either in the upper or lower part of the sedimentation chamber. They have been tried, both from the standpoint of better flow distribution and in order to promote the production of the slow-motion zone. The conclusion has been that instead of this they decrease the cross-section of flow and tend to produce subcurrents, thereby hindering sedimentation rather than promoting it. It is true that some of the sewage flows through the tank in a much shorter period than the theoretical detention period.

Sludge Treatment

Sludge treatment, generally conceded to be the most difficult part of sewage disposal, differentiates Imhoff plants from other sewage disposal plants. Unfortunately, only little is known about the process occurring in the sludge room. Investigations are being made concerning the chemical and biological parts of the process. A universal conception of the physical part of the process is that there is normally a quantity of sludge lying at the bottom generating gas within its "live" particles. At irregular intervals part of the mass of the sludge may rise to the top in a body and remain there till it has given up sufficient of its gas to settle again. Hence, whether to accommodate the rising and falling particles or to provide room for the temporary floating position of a mass of the sludge, it is necessary to have above the plane of the slot in the sludge chamber a certain amount of "transition" space. The sludge chamber, therefore, may be regarded as composed of two parts—that part below the slot, or the sludge-storage room, and that part above the slot and adjacent to the settling chamber, which may be called the sludge-transition room.



Plan of Sludge-Drying Bed

The storage room is one of the most vital parts of an Imhoff plant. Upon its dimensions and shape depends the digestion period which the sludge will receive, and to a large extent the condition of the rotted sludge discharged. It is, therefore, particularly important that the data upon which the sludge-storage room is based in design be as far as possible dependable.

Depth and Sludge Digestion

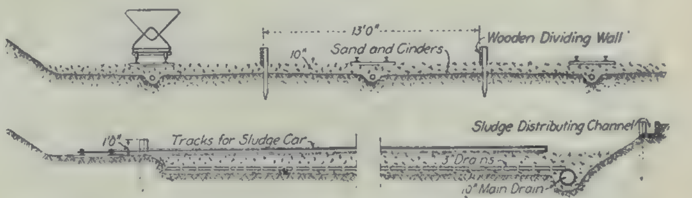
The depth of the sludge chamber seems to have an influence upon the sludge-digestion process. This influence has been but little understood, but it has been continually maintained that shallow tanks yield a poorer quality of sludge than deep tanks. A depth of tank which has most been used in the Emscher District is about 30 ft. from water surface to bottom of tank. A few have been made 24 and 27 ft. deep. In some cases, however, it may be advisable, for economic reasons, to adopt tanks as shallow as 20 ft., deliberately preparing to accept a somewhat poorer grade of sludge. It has not been proved that a tank of 20 ft. or even less in depth will not in many cases yield a sufficiently good sludge for all practical purposes, but it is now reasonably clear that a 30-ft. depth is sufficient.

The slope of the bottom of the sludge room should be at least 1 vertical to 2 horizontal. This is based on the assumption that flushing rings are inserted.

The sludge-transition room, or upper part of the sludge chamber, is designed to accommodate the sludge which is temporarily lighter than the sludge water and the scum. There are no data from which the minimum size of this room may be inferred. It is customary in Germany to make the transition room about one-half as large as the storage room. The surface must obviously be large enough to accommodate the scum properly, and, in addition, to permit of entrance by workmen into the lower part of the sludge chamber. In European practice a good average figure for the ratio between transition room surface and total sludge-room surface is 1:3 to 1:4. It is impossible to say with present available information how small a space will suffice; 1:10 has been used in a few cases with success.

Discharging Sludge

The discharge of sludge from the sludge chamber has been found to be most simply and cheaply accomplished by means of a pipe reaching nearly to the apex of the conical bottom of the tank and having its outlet far enough below the water level to provide sufficient hydraulic head to force out the sludge. The pipe is usually made about 8 in. in diameter, its outlet being from 4 to 6 ft. below the water level. The main part of the pipe is, whenever possible, made straight and projected to above the tank walls so as to permit of inspection and cleaning. The hydraulic gradient for a sludge pipe 8 in. in diameter should be about 12 to 16 per cent., in order to be reasonably sure of minimum clogging. Where less than this gradient is used stoppage is likely to occur.



Section of sludge bed showing dividing walls and tracks.

Sludge Disposal

Sludge taken from Imhoff plants is generally disposed of in Germany by drying upon underdrainage beds of porous material. Wherever possible, of course, the sludge is transported to these drying beds by gravity. The slope of open sludge channels is usually made about 2 per cent. The minimum width of the sludge channel is dependent upon the necessity of cleaning it after each charge of sludge is passed through. In case closed pipes are used for gravity flow, which is not recommended, they should be made of such size as not to increase the friction head; otherwise the 2 per cent. slope will have to be increased correspondingly.

Pumping Sludge

When the available fall is less than about 8.5 ft. it is generally necessary to lift the sludge to the drying beds. Various methods of sludge lifting present themselves for consideration. These are: Plunger pumps, centrifugal pumps, air-lift pumps, compressed-air chambers, and hand-membrane pumps. The important thing in sludge pumping seems to be the retention of the gases of decomposition. As has often been stated in articles upon the drying of decomposed sludge, the reason for the rapidity of the drying is that the expansion of the minute gas bubbles, upon being removed from a pressure of, say, 2 atmospheres at the bottom of the tank to a pressure of 1 atmosphere at the surface causes the sludge to be lighter than water. When the sludge is placed upon the sludge-drying bed, therefore, it soon floats on its own water content, and this water, being free, quickly passes away through the porous drying-bed material, leaving the sludge spadable in a few days. Therefore, whatever method of sludge lifting is employed it should be such as not to remove any of these gases of decomposition.

Plunger Pumps.—Plunger pumps have proved to be well adapted to sludge lifting where they are placed sufficiently low so that the sludge from the tanks may enter the pump by gravity, and not have to be sucked in; this suction tends to remove the gases. The pump should be so simple in construction as to insure minimum operation difficulties from the passage of solid particles of reasonable size. In order to avoid stoppage from larger particles a screen of about ½-in. clearance should be placed before the pump.

Centrifugal Pumps.—Centrifugal pumps are very efficient and easy to operate, but seem to have the disadvantage of stirring the sludge too violently and tending to prematurely disengage from each other and aggregate the gas and sludge particles, thus, as above indicated, retarding drying.

Air-Lift Pumps.—Aair-lift pumps have not as yet been used extensively. It is possible that under certain conditions air-lift pumps may be installed directly in the sludge room without an intervening sludge well. This has been tried in the Emscher District and found satisfactory. An advantage of air-lift pumps is believed to be the possible mingling of the compressed air particles with the sludge and thus promoting the drying operation.

Compression Chambers.—Another possible method of lifting sludge is by means of compression chambers. When the sludge from one or more sludge chambers is collected in an air-tight drum the admission of compressed air to the drum is a simple means of forcing the sludge to the drying beds. The great advantage of such a method is the practical elimination of clogging and the absolute non-interference with the gas content of the sludge.

Hand Membrane Pumps.—Hand membrane pumps are sometimes used in small plants. The pipes used in lifting sludge should be of such diameter that the velocity will be sufficiently great to avoid sedimentation.

Drying Beds

The sludge-drying beds used in the Emscher district have proved extremely well adapted to their purpose. The size of the drying beds depends upon the population to be served, climate, and character of the sludge.

The German drying beds are usually divided into units each 13 ft. wide and of sufficient length to permit of alteration in operation. The depth of the main drainage layer of the beds is usually about 8 in. and is graded from 4 in. material at the bottom to ¼ in. material at the top. On top of this layer is usually placed about 2 in. of ashes or sand, some of which generally remains sticking to the removed sludge cake, and thus has to be replaced from time to time, often by the sand from the grit chambers. As shown in the accompanying drawing there is placed in a depression down the middle of each unit a line of agricultural drain tile about 3 in. in diameter, connected to an 8 to 12 in. main collector. The slope of these drain tile is made about 1 to 200.

The division walls between the units of the drying bed were previously always made of planks nailed to short posts, but recently a number of plants have been constructed with concrete-slab division walls. Down the middle of each unit is also placed a narrow-gage track for small dump cars, to facilitate the removal of the dried-sludge cake.

The sludge-bed surface must, of course, be made horizontal so as to insure a sludge layer of uniform thickness. The thickness of sludge layer is about 10 in., and in drying this reduces to about 7 in.

Biological Purification

In conclusion it will be pertinent to comment upon the relation of Imhoff clarification plants to biological purification. In general, it may be stated that the design of Imhoff plants is not affected by the inclusion of biological purification. There may be cases in which the advisability of a somewhat longer detention period, or of the use of chemical precipitation, so as to relieve the filters as far as possible, should be investigated, but it is believed that these cases will be extremely rare.

Cases may occur in which an overflow weir should be placed between the preliminary clarification works and the filters in order to avoid the necessity of designing the filters for storm flow, or to prevent their temporary overloading. This depends upon whether the system of sewerage is upon the separate or upon the combined plan and whether or not the purification of the sewage is carried out from the standpoint of nuisance or from the standpoint of disease. If the sewerage system is on the separate plan, obviously no overflow weir will be used. If the system is on the combined plan and the purification of the sewage is carried out from the standpoint of disease prevention, then an overflow weir would be illogical, for during the times of storm flow the safety element would be absent. If, however, the biological purification of the sewage is carried out merely because nuisance may result during dry-weather flow even if the sewage has received preliminary clarification, then the inclusion of the overflow weir may be advisable.

Humus

Where biological filtration is employed the humus in the effluent is usually retained in final clarification tanks. This humus is generally putrescible, and, therefore, the tanks should be so arranged as to separate the sedimentation chamber from the sludge chamber, just as in the case of preliminary clarification.

It has been observed in experimental as well as practical plants in Germany that the humus retained in final clarification tanks does not decompose as rapidly as preliminary clarification sludge. The reason for this is not clearly understood, but it is believed in the Emscher District that it may be due to the fact that the rapid decomposition taking place in preliminary Imhoff sludge chambers is essentially anaerobic in character, whereas in the humus coming from trickling filters the aerobic bacteria are dominant and must be eliminated before the rapid anaerobic action can begin. Unless some means were adopted, therefore, to increase the rapidity of decomposition, the sludge chambers would have to be made abnormally large. This can be done by inoculating the humus with properly decomposing "preliminary" sludge. The Emscher Federation has done this at Holzwickede by making the preliminary and final Imhoff tanks interchangeable. This was possible because at Holzwickede the sewage has to be pumped into the sprinkling filter and so the preliminary and final tanks could be placed at the same elevation. Where trickling filters are operated by gravity the inoculation of the humus may be accomplished either by periodically admitting preliminary tank sludge to the final sludge chambers or by periodically pumping the retained humus back into the influent of the preliminary tanks.

Usually one hour's detention will suffice for final clarification tanks, as the sprinkling filter humus settles rapidly. The size of the sludge chamber depends altogether upon the method of treating the sludge. Generally the humus from trickling filters may be taken at one-quarter to one-half the amount of preliminary sludge.

Professor Starkey on Sewage Disposal

PROFESSOR T. A. Starkey, of McGill University, in the course of an address to the Montreal Society of Chemical Industry, dealt with various schemes for sewage disposal. In the preliminary steps for sewage disposal there were, he said, three systems—sedimentation tanks, chemical precipitation and septic tanks. All these preliminary treatments had one object in view, namely, the elimination of solid matter from the sewage. By accomplishing this, a clear liquid could be obtained, free from animal impurities, except those held in solution, which could easily be disposed of in the secondary beds by oxygen-breathing germs, called acrobes, which are found on the contact beds or percolating filters. In one case mentioned, the speaker told how this work of destroying the organic matter contained in the liquid fed them was accomplished by these acrobes in three and one-half minutes, the soluble matter contained in the sewage being turned into stable chemical salts, which impart no odor, flavor or other characteristic—appreciable to the ordinary senses—to the water in which they are contained. These germs, which are so powerful to destroy the organic matter of the sewage, were contained in that sewage itself, the contact beds or percolating filters being merely devices whereby to house the maximum number of these germs in the smallest space.

A recent scheme for the destruction of germs in sewage by the introduction of chloride of lime would have to follow, he said, after the liquid had been cleared of solids and organic matter, else it would also kill the germs which destroyed this matter. He did not recommend its use in Montreal, as, he said, the liquid which would pass off the contact beds, while full of germs, would contain so little food for these that they would in any event soon become eliminated.

He would judge from the character and analysis of the average Montreal sewage that a percolating filter, followed by a moderate elimination of sludge, would appear to be the most suitable system of dealing with local conditions. It was a matter of opinion as to whether or not the germs should then be killed off. In his opinion this was not necessary.

What will be Vancouver's second tallest building is rapidly taking form. The structure will be fifteen storeys in height and will cost over $700,000. The building is of steel frame construction. In finishing the building the novel system will be adopted of treating each two storeys as a separate building which will mean that many more men will be able to work at once than is generally the case and that every floor will be completed almost simultaneously. It is expected that the building will be ready for occupation by next July. Messrs. Russell, Babcock & Rice designed the building for Mr. Weart.

Effect of Salts on Strength of Concrete

TESTS to determine the effect of sodium chloride and calcium chloride, separately and together, upon 1:2:4 concrete were made at the University of Wisconsin during the winter and spring of 1912 by Messrs. H. E. Pulver and S. E. Johnson, instructors in mechanics. The test pieces were cured at temperatures of from 60 to 70 deg. Fahr. and below freezing. The results have been published in the "Wisconsin Engineer" by Mr. Pulver.

All mix was by volume and the salts were dissolved in the mixing water. The test pieces were 4-in. cubes, and those cured at a temperature below freezing were broken after fourteen and sixty days, while those cured at normal room temperatures were broken after fourteen, sixty and three hundred and sixty days. Four pieces were tested at each age for each batch of concrete. Atlas Portland cement was used, and to prevent variation in the quality it was mixed thoroughly in the beginning and a sufficient quantity stored in air-tight cans.

The test curves show that as the percentage of $NaCl$ is increased there is a nearly straight-line decrease in the strength of the concrete cured under normal conditions. The effect of $NaCl$ alone, when added to concrete cured at low temperature, is probably to reduce the freezing temperature, and hence retard the freezing of the concrete, thus permitting of its setting and hardening. The curves show an increase in strength for the addition of $NaCl$ up to 12 per cent., after which there is a decrease. It may be that beyond 12 per cent. the weakening of the concrete due to the excess of $NaCl$ more than offsets the strengthening due to the reduction of the freezing temperature.

When $CaCl_2$ alone is added to the concrete, cured either at normal or low temperatures, the effect is to increase the strength up to about 4 per cent. $CaCl_2$, at which point the maximum strength seems to be obtained. This increase in the strength of the concrete may be due to the acceleration of the setting of the cement by the $CaCl_2$. Serious disintegration was observed on the surfaces of the cubes cured at low temperatures with 6, 8 and 10 per cent. of the $CaCl_2$. This disintegration did not appear on any of the cubes cured at normal temperature or where $NaCl$ was used.

With concrete at low temperatures, the best effect seems to be obtained by using both $NaCl$ and $CaCl_2$ in the mixing water. It was noted that a 2 per cent. $CaCl_2$ and 9 per cent. $NaCl$ mixture appears to give the most satisfactory results. For concrete cured at low temperatures this mixture gives about as much strength as any of the mixtures tried, and for the concrete cured normally there was not a very great reduction in strength due to the addition of the salts in those percentages.

All tests were made with only one brand of cement. It is probable that there would be some variation in the results with other brands, but it is not thought that this variation would be great enough to affect the general conclusions. It is also possible that some brands of common salt might contain a sufficiently high percentage of calcium sulphate to affect the results to some extent.

Problems Involved in Driving Long and Deeply Overlaid Tunnels*

THE great improvement in tunnelling methods and machinery made in the last decade is responsible for the large development that has taken place in the railroad world in this and other countries. Mountain ranges which heretofore had defied the railroad pioneer are being pierced at their very base and must yield to the slow but irresistible work of the tunnel driver. In the Alpine region the Simplon and Loetschberg tunnels have proved that length combined with great overlying depth is no longer an insurmountable obstacle, and that a high rate of progress can be attained with the assistance of modern tunnelling methods, machinery and proper organization.

In the Jura Mountains no fewer than five tunnels, from 2 to 5 miles in length, have recently been driven. The Pyrenees, the natural barrier between France and Spain, have likewise been pierced by several long tunnels, and the Caucasus Mountains are to be tunnelled by a bore not less than 16.25 miles long.

In this country several large projects are now being elaborated and it is but a question of a few years before the Rockies and other ranges will be pierced by long and deeply overlaid tunnels, serving the purpose of eliminating heavy grades, sharp curvature, and the necessity of reaching high altitudes under most adverse conditions.

Size and Number of Bores

Probably the most difficult task that confronts the engineer in tunnelling is the selection of the method that will insure absolute success. Certain features having relatively little weight in connection with the projecting of short tunnels assume enormous proportions when brought into relation with long tunnels—for instance, the choice between single and double-track tunnels. All things being equal, conditions of traffic and safety usually dictate whether a short tunnel is to accommodate one or several tracks. This feature, however, ranks only second when a long and deep tunnel is involved. In such a case there are factors of greater importance—ventilation during and after construction, handling underground water, high rock temperature and enormous ground pressure. All these introduce conditions which require due consideration at the very outset.

The St. Gothard (49,147 ft. long), Arlberg (33,600 ft.) and Loetschberg (47,680 ft.), three double-track tunnels, were pierced under the usual conditions met with in driving deep tunnels. There were no uncommon difficulties as far as rock temperature, ground pressure and underground water were concerned, and this accounts for their successful completion.

It may be useless to point out that at the time it would have been impossible to drive the Simplon tunnel by a single bore of the size usually accommodating a single railroad track, and it is questionable, on account of the conditions encountered, whether a double-track tunnel could have been economically and successfully driven. In 1891, when due consideration was given the Simplon project, the idea of driving two parallel bores was brought up, in order to provide adequate ventilation during and after construction.

Since the completion of the first bore of this tunnel several authorities on the subject have expressed ideas and opinions as to proposed tunnelling methods, which will here be briefly reviewed. For double-track tunnels

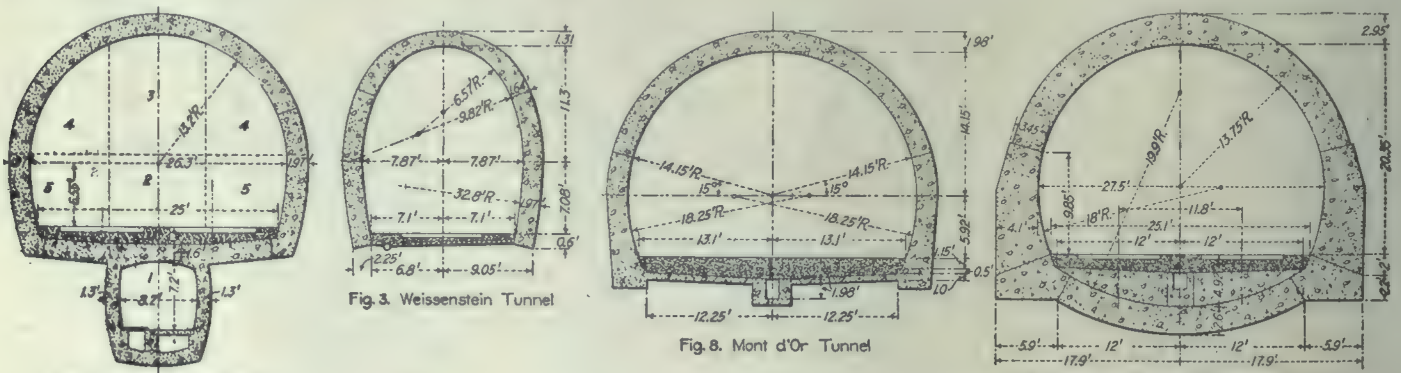


Fig. 1. Henning's Proposed Double Track Tunnel Section

Fig. 3. Weissenstein Tunnel

Fig. 8. Mont d'Or Tunnel

Fig. 10. Heavy Section, Hauenstein Tunnel

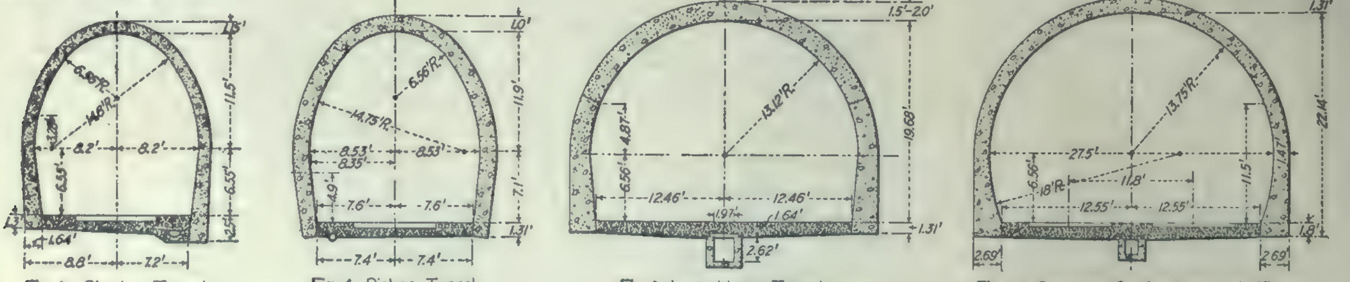


Fig. 2. Simplon Tunnel

Fig. 4. Ricken Tunnel

Fig. 9. Loetschberg Tunnel

Fig. 11. Standard Section, Hauenstein Tunnel

Cross-sections of some of the well-known European tunnels for single and double-track traffic.

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* By E. Luchli, Civil and Hydraulic Engineer, New York, in the Engineering Record.

Table 1—Cost of Tunnel per Lineal Foot, Without Installations

Length of tunnel, miles	$100	$102.5	$105	$108	$110.5	$113.5
1. Single-track tunnel 1, with invert	6.25	7.5	8.75	10	11.25	12.5
2. Parallel heading, partly lined	27	28.5	29	29.5	30.5	31.5
3. Transverse galleries, 1640 ft.	3	3	3	3	3	3
4. Total cost, first construction period	130	134	137	140.5	144	148
5. Completion of tunnel 2	78	80	82	85	87	89
6. Cost of tunnels 1 and 2	208	214	219	225.5	231	237
7. Cost of double-track tunnel with bottom heading	176.5	181.5	186.5	191.5	196	201
8. Increase in cost, 6 over 7	18	18	18	17.5	17.5	17.5

Total Cost of Tunnels, in Million Dollars, Without Installations

Length of tunnel, miles	6.25	7.5	8.75	10	11.25	12.5
1. Tunnel 1 and heading 2	4.27	5.27	6.32	7.38	8.5	9.73
2. Completion of tunnel 2	2.56	3.15	3.78	4.43	5.1	5.82
3. Total cost, tunnels 1 and 2	6.83	8.42	10.10	11.81	13.5	15.5
4. Double track tunnel with bottom heading	5.8	7.15	8.55	10.05	11.6	13.2
5. Difference in cost, 3 over 4	1.03	1.27	1.55	1.76	2.0	2.3

Professor Hennings suggests the method illustrated in Fig. 1, consisting of a tunnel section accommodating two tracks and of a bottom heading located below the main tunnel. The sequence of excavation is illustrated by numerals. The bottom heading is excavated first, and in advance of the other work; the top heading is then excavated by stoping, and the enlargement follows in successive steps. The saving effected over the cost of twin single-track tunnels of the Simplon type, Fig. 2, is claimed by Professor Hennings to be as given in Table I.

Twin tunnels would be driven on the assumption that one bore is completed first, together with a parallel heading, and that the second bore will be completed at a later date, when the traffic conditions increase so as to require the use of two tracks.

Lack of space does not permit showing in detail how the figures above were obtained. At first glance the proposition of Professor Hennings appears to be very attractive, but a chorus of opposing voices arose against this method, and Carl Brandau, a member of the contracting firm driving the Simplon tunnel, and well known for his connection with such undertakings, expressed his views as follows:

Carl Brandau's Views

1. A double-track tunnel does not offer for maintenance and traffic the same advantages as twin-single track tunnels do. 2. Superimposed headings are not as advantageous as two parallel headings during construction, as trains cannot be shifted from one heading to the other, and there is less room for materials, due to the absence of transverse galleries connecting the parallel headings. 3. It is absolutely necessary to line with masonry the roof of the bottom heading, and in most cases, also, the sides and invert, and these features involve costly and complicated constructions in pressure zones. 4. After the completion of the tunnel the bottom heading becomes practically useless, and yet is subjected to continual maintenance. 5. In general it can be safely stated that the saving of 18 per cent. over the cost of twin tunnels is but apparent, for as soon as the means of transportation during construction are no longer guaranteed, the very best driving methods become valueless.

A. Thommen proposes to drive double-track tunnels with the use of a parallel heading located about 65 to 100 ft. from the main heading, and connecting with it by transverse galleries; the main heading would then be enlarged to a double-track tunnel section. This method would, of course, be practicable, but costly, as the auxiliary heading, together with the connecting galleries, would become practically worthless after the completion of the main bore.

The method used in connection with the Loetschberg tunnel, the tile partition built from floor to roof of the tunnel for ventilation purposes has proved adequate and undoubtedly will do for tunnels up to 50,000 ft. long when the overlying depth is not excessive. Where high-rock temperature is to be expected, however, and where 1,000 cu. ft. of air per second are required for ventilation, together with a refrigerating system, lack of space would exclude the use of this method.

Thus it becomes evident that the size and number of bores to be adopted are by far one of the most important problems to deal with, as a change of method would be very costly, if not prohibitive with work under way.

There are no iron rules to guide the tunnel driver in the selection of methods best adapted to the excavation of long and deep tunnels. The capital invested in such undertakings requires the use of methods that will insure rapid and continuous progress, together with unquestionable security for the successful completion of the tunnel, regardless of whatever difficulties may be encountered.

After the somewhat costly experience gained in driving the Mont Cenis and St. Gothard tunnels with the top-heading system and side-drift method, more attention was paid to the use of bottom headings when the 33,600-ft. Arlberg tunnel was started in 1880. The unquestionable advantages gained by this method gave light to a new era in tunnelling, and since the completion of this tunnel the following bores have been or are being driven by the bottom-heading system: Simplon, 65,042 ft. long; Loetschberg, 47,680 ft.; Ricken, 28,200 ft.; Granges, 28,093 ft.; Arthur Pass, 28,060 ft.; Tauern, 28,040 ft.; Hauenstein, 26,683 ft.; Karawanken, 26,161 ft.; Wockein, 20,781 ft.; Mont d'Or, 20,021 ft.; Weissenstein, 12,136 ft.; and Wasserfluh, 11,666 ft.

When applied to the driving of long tunnels the bottom heading, besides enabling some 50 to 65 per cent. of the tunnel section to be stoped down into the bottom heading, serves the purpose of pilot and warns the tunnel driver against impending danger. It also verifies the predictions made by the geologist, if any have been made.

In order to obtain rapid and continuous progress it is of the utmost necessity to spread the field of operation over as large a zone as possible, so as to eliminate, as far as practiable, all chance of interruption. As only one point can be attacked in the heading at any one time, the heading is given such dimensions as will provide plenty of room for the mining operations to proceed advantageously, even under the most adverse conditions, and while its size should be reduced to a minimum, care is to be exercised that ample trackage facilities are provided and that the sectional area of the heading will be such as not to cause the air required for effective ventilation to acquire too high a velocity.

Experience has proved that under normal conditions a heading 7 ft. high and 10 ft. wide can be driven, with the assistance of power drills, at a continuous rate of progress of 20 ft. and over, and that without any special devices the enlargement and lining can be made to follow the heading progress, provided the field of operation is spread so as to minimize contingencies arising from unforeseen causes.

Here, also, features which in connection with short tunnels may rank second prove to be of vital importance in long tunnels. On the one hand the bottom heading carried far in advance of the other work, together with the enlargement spread over a large zone, minimizes delays caused by unfavorable ground conditions, inrush of water, etc. On the other hand, the organization of the working forces, together with the schedule of operations, becomes an important factor. For instance, a misunderstanding on the part of one of the mining crews, or a train hopelessly stalled between the portal and the first working point, would cause considerable havoc in all driving operations, and it is here that only the slow and sound evolution of progress can overcome difficulties that man's brains and will power can not master in a day.

Ventilation

A great gap has been filled in the field of ventilation since the driving of the Mont Cenis tunnel, where the only air available was obtained from the exhaust of the rock drills. The miners' anemia was high and the driving progress very slow. As a matter of fact, it would have been impossible to consume much explosive or to have many shifts working in the tunnel at the same time.

The same conditions prevailed when driving the St. Gothard tunnel, where only 70 sec.-ft. of air were made available for ventilating purposes. The miners' anemia was intense; on the south side of the tunnel as many as 60 per cent. of the men were more or less affected. During bad periods men would quit work after two months, although working only two out of three days, with five working hours only per day.

The poor ventilation, combined with the relatively high rock temperature, and the rudimentary sanitary conditions were a great hindrance to progress, and it is stated, for instance, that the contractors lost as many as 20 horses per month.

The sanitary conditions at the Arlberg tunnel, together with the introduction of a ventilating system capable of delivering from 100 to 200 cu. ft. of air per second, were a great help toward good progress. It is true that the overlying mass was small, thus causing the maximum rock temperature not to exceed 65 deg. Fahr., but the use of Brand water drills made it impossible to use the exhaust for ventilation.

Cooling Air

When in 1891 the Simplon project was taken up the maximum rock temperature expected to be encountered was 108 deg. Fahr. A very substantial system of ventilation was recommended by the commission of engineers charged to report on the feasibility of this project, and after the impracticability of using ventilating pipes for such an undertaking had been demonstrated theoretically, twin tunnels were recommended. The consistency of the results of this computation with practice was only too well proved when, during the driving period of this tunnel, the rock temperature rose up to 132 deg. Fahr. and necessitated an elaborate refrigerating system in addition to the ventilating plant of some 1,200 sec.-ft. capacity.

One cannot realize the meaning of an accidental shutdown of the ventilating plant in an undertaking of this kind. Imagine hundreds of men working some 30,000 ft. away from the portal, in an atmosphere saturated with humidity, vitiated by gases due to the consumption of hundreds of pounds of explosives, and in a temperature of 130 deg. Fahr.

The limit of efficiency of cooling the air in a deep

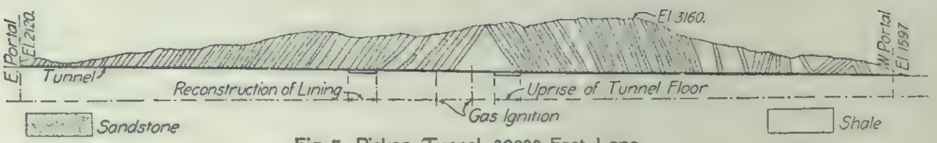


Fig. 5. Ricken Tunnel, 28200 Feet Long

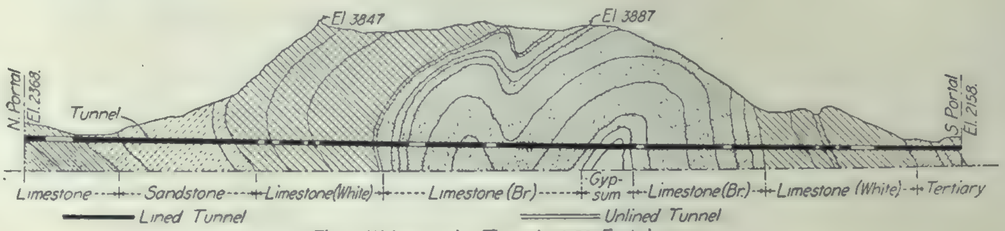


Fig. 6. Weissenstein Tunnel. 12136 Feet Long

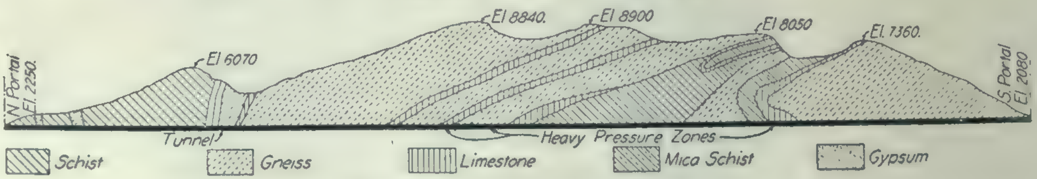


Fig. 7. Simplon Tunnel. 65042 Feet Long

Profiles on lines of Ricken, Weissenstein and Simplon tunnels.

Table 2—Ventilation Statistics for Six Long and Deep Tunnels

Name of tunnel	Simplon	St. Gothard	Loetschberg	Mt.Cenis	Arlberg	Ricken
Tunnel length, ft.	65,042	49,147	47,68$	42,145	33,600	28,200
Maximum elevation of range penetrated, ft.	9,320	9,380	9,650	9,675	6,660	3,620
Maximum overlying depth, ft.	7,000	5,570	5,550	5,430	2,360	1,740
Maximum rock temperature, deg. Fahr.	130	88	94	85	65	74
Approximate number of men in tunnel	800	400	600	250	700	140
Explosives used per 24 hr., lb.	1,100	660	900	440	770	500
Ventilating air, per sec. ft.	1,270	70	300-350	18-35	100-200	110-140

tunnel by introducing air from outside is rapidly reacher, especially during the summer months. In the Simplon tunnel this limit was reached when the rock temperature was about 100 deg. Fahr. It was then found necessary to use auxiliary methods, either to avoid heating the air used for ventilation or to cool it after heating. It is preferable to keep the air for ventilation at as low a temperature as possible, either by insulating the air-conveying pipes, if any, or by insulating the walls of the heading or tunnel with a thin coat of cold water by means of pulverizators or jets. Both systems are costly, especially the second one, unless cold water is available under natural pressure.

The problem of ventilating deep tunnels during and after construction has become a complicated one, requiring in itself the constant attention of an engineering staff and laboring force especially assigned to this work. The following figures published by Dr. Pommetti for the Simplon tunnel, north side, give only a small idea of the advantages gained by an efficient ventilating and refrigerating system: Out of a total of 3,445,754 man-shifts only 52,677 or 1.53 per cent., represented sickness. There were 37 deaths caused by illness and 10 by accident.

Table 2 gives the amount of air provided for ventilation during the driving of six long and deeply overlaid tunnels.

Ground Pressure and Tunnel Lining

The subject of ground pressure and tunnel lining has caused much ink to flow during the last thirty years, and yet after numerous observations made in mines, shafts, tunnels of all kinds, as well as in laboratories, no conclusion has yet been reached that has stood unquestioned for any great length of time.

This chief difficulty in designing tunnel linings lies in the lack of knowledge as to the intensity and direction of the rock pressure to be guarded against. In almost every tunnel geological formations and stratifications vary. Even after exhaustive studies of the geological formation of a range have been made uncertainty exists as to the behavior of the materials to be penetrated. Numerous are the failures of tunnel lining, either due to excessive and unequally distributed pressure or to lack of care in designing tunnel linings.

The opinions of geologists and engineers as to rock pressure in tunnel construction vary greatly. Culmann's theory is based on the supposition that pressure on tunnel linings is greatest at the roof of the tunnel and that the intensity of pressure depends on the overlying depth and cohesion of the rock.

Ritter's theory is opposed to that of Culmann. His pretension is that the pressure on the roof of a tunnel does not depend on the overlying depth but is equal to the weight of a body of material having the form of a semi-parabola, less the stress required to cause rupture by tension along the semi-perimeter of the parabola. The intensity of the pressure would then be independent of the depth overlying the tunnel, but would vary according to the width of the excavation.

Heim's studies are perhaps more elaborate and cover a broader field than any others ever made on this subject. His theory, however, met with little enthusiasm, especially on the part of tunnel drivers, who will not accept the theory that the ground pressure on the roof, sidewalls and invert acts as hydrostatic pressures do on a submerged body, yet with the difference that the ground pressure acts more or less slowly, on account of the variation in cohesion and friction of the materials caused by the unequal geological formation of mountain ranges. According to his theory the lining of the St. Gothard, with 5,000 feet of overlying depth, would require a lining having a thickness of 20 feet, a supposition which, of course, would make the driving of deep tunnels prohibitive.

However, Heim's conception of ground pressure is far from being erroneous. Observations made in the unlined parallel heading, as well as in some of the transverse galleries of the Simplon tunnel, indicate that several years after construction excessive pressure caused the side walls, invert and roof to crush, thus practically filling certain sections of the bores. It has also been observed that the intensity of the shelling of the rock often increased with the overlying depth. For instance, vertically stratified gneiss, with 2,300 ft. of burden, would not show any sign of disturbance, yet shelling of the same rock would take place with 4,000 ft. of overlying depth.

Shelling took place also in the Leggistein tunnel several years after its completion, and similar signs have been recorded on the roof, side walls and invert of tunnels driven through apparently solid rock, usually not affected by weathering, gases and heat. It is, therefore, possible that in certain instances the overlying depth may cause serious disturbances in a tunnel after, if not during, construction.

The contractors of the Ricken tunnel (Figs. 4 and 5), driven chiefly through shale and sandstone, met with much difficulty during construction. The ignition of coal gas was a serious hindrance to progress, and soon after completion serious movements occurred in several sections of the side walls, in some instances decreasing the width of the tunnel by 1 to 1½ ft. and necessitating the complete reconstruction of the masonry. In another instance the concrete invert was raised, yielding under the rock pressure. It had to be replaced by stone masonry over a length of 470 feet. The cost of repairs to the masonry, supplementary drainage system, interest charges increased by delays, etc., amounted to approximately \$194,000, and the opening of the tunnel to traffic was retarded fully two years.

The Weissenstein tunnel (Figs. 3 and 4), driven through limestone and sandstone, was lined more than 87 per cent. of its length. Movements of the side walls, varying from 1 to 3 in., took place soon after construction and continued during three years.

The difficulties due to rock pressure encountered in driving the Simplon tunnel (Figs. 2 and 7) hardly compare with those met in the driving of the tunnels above referred to. At a distance of 14,600 feet from the south portal, with some 4,000 feet of overlying gneiss having a shistose appearance, the ground pressure necessitated masonry lining 5.5 ft. thick over a length of 138 feet, at a cost of $1,520 per lineal foot of tunnel. The driving of this tunnel was constructed on a lump-sum basis.

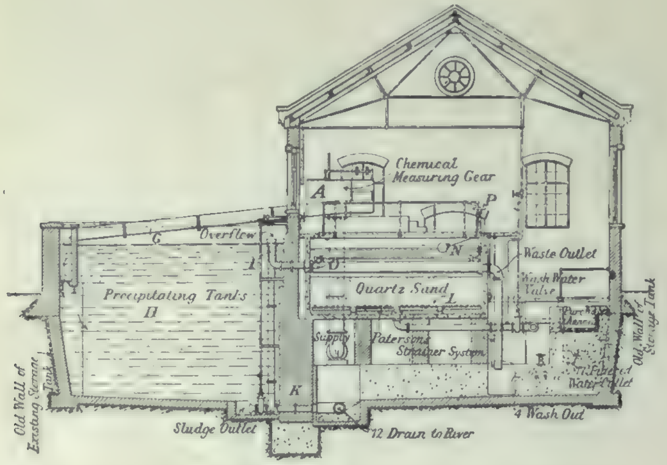
Figs. 8, 9, 10 and 11 give sections of some of the other tunnels to whihc reference has been made.

The foregoing facts demonstrate clearly the enormous risks incurred by contractors bidding a lump sum on long and deeply overlaid tunnels and the necessity of making elaborate and thorough studies of the problem involved in undertakings of this character.

A Rapid Filtration System

The Paterson Plant at the Cheltenham Water Works, England

It is recognized that filtration through slow sand-beds of sound construction, operated under efficient supervision, secures a degree of purification leaving little to be desired beyond the elimination of the disadvantages inherent in this system—namely, the inability to remove discolorations due to fire-clay, peat stains, and other causes. These cannot be removed on a large commercial scale without chemical treatment, and water so treated must not be passed directly on to slow sand-beds owing to the rapidity of choking up, which necessitate repeated paring of the surface film and washing. The principal screen for the interception of suspended matter and bacteria in the slow sand filter is this surface film, consisting of algoid and other vegetable growths, and requiring considerable time to form. In order to maintain the required output it is necessary to duplicate installations of moderate size, so that the cleaning may be effected without hastening the rate of filtration in the active beds; but this entails a large capital outlay and considerable waste of water for sand-washing and film formation. With the rapid filtration system these washing and filtering processes occupy only a few minutes, and by the Paterson method of compressed-air cleaning the amount of wash-water required is reduced to a minimum, as the water is not used during the agitating process, but only to wash the loosened impurities to the drain.



The Paterson rapid filtration plant of the Cheltenham water works.

The Paterson system claims to effect in a convenient manner the complete elimination of all discoloration, the neutralization of natural acidity, and the removal of suspended matter and harmful bacteria.

In standard practice the Paterson system differs essentially from the ordinary mechanical filter in so far as (a) the gravity system is adopted; (b) the filtering surface is not broken up by mechanical agitators; (c) two or three hours are allowed for the reaction to complete before the water passes on to the filters; (d) the rate of filtration area is more than double the recognized standard of existing rapid filters. The process, moreover, is carried out in three distinct stages—namely (1) the accurate measuring of the water and the addition and mixing of the coagulant (and, where necessary, sterilizing reagent) in precise ratio to the amount of water passing; (2) the subsidence of the treated water in a reaction and precipitating tank of sufficient capacity to allow the completion of the chemical reaction and the precipitation of the grosser impurities; (3) the final purification by rapid filtration through quartz sand.

At the Cheltenham plant the water, pumped from the River Severn, enters an automatic measuring and chemical supply tank, and discharges through two V notches, which accurately gauge the quantity of water passing. A float, riding on the surface of the water, controls the position of two tapered valves which supply the reagents in the precise ratio to the quantity of water delivered. The reagents (sulphate of alumina for the coagulation of the impurities and extraction of the coloring matter, and hypochlorite of lime for sterilization when required) are maintained at a constant head above the valves by ball-cocks connected, by pipes, to the pressure storage tanks in the basement. The contents of the chemical tanks are continually agitated by compressed air, which serves also to lift the reagents to the controlling apparatus. The chemical solutions are prepared in concrete tanks on the filter-house floor-level, the necessary agitation being furnished by compressed air.

As the water passes from the tank A, Fig. 1, it comes in contact with the reagents, with which it is thoroughly mixed as it passes down the mixing-trough G, which discharges into a reaction and precipitating tank H, having a capacity equal to about three hours' pumping, allowing time for the complete reaction of the alumina, and the precipitation of the grosser impurities. The partially purified water overflows through bell-mouthed draw-off pipes I into six Paterson rapid gravity filters. These filter-tanks are made of reinforced concrete, and contain 36 inches of special grade quartz-sand filtering medium resting on a stratum of pea-gravel. In each of these filters there is a centrally placed inlet distributing and a waste draw-off channel K. The filtered water is collected from underneath the gravel by the system of gun-metal strainers shown at L. These have screwed caps and renewable phosphor-bronze screens, and they discharge through the automatic outlet controller into the inspection box, from which the water passes into the clear-water channel. All the valves and fittings are so arranged that the entire filtering and washing operations are controlled by one attendant from the main gallery.

In the cleansing process the filter-beds are first agitated with sterilized compressed air, at a pressure of about five pounds per square inch, and the impurities, loosened by this air scouring operation, float to the waste outlet by a reverse current of wash water. The process is particularly efficient, and the filter unit may be thoroughly cleaned and restarted within ten minutes.

After cleansing, and while the surface film is forming, the automatic control prevents the filter from coming into full operation for ten or fifteen minutes. This controller fulfils a very important duty. It is in the form of an equilibrium valve under double control, and acts in the following way: When the cleansing process has been completed, the water above the filter-bed is, of course, at the level of the waste-trough, and the outlet valve is held down in its closed position by the weight of the float N, in the figure. When the filtration process recommences, however, the inlet valve O is opened by means of the hand-wheel P, and the filter gradually fills up, but the outlet controller remains closed until the water level reaches the float. The outlet valve gradually opens as the float rises until it is released from the restraint of the float, and the rate of discharge is then controlled only by the regulating float in the inspection box. This inspection box is fitted with a V-shaped overflow weir, the arrangement being such that when the water, before flowing through the weir, rises to the height determined by the maximum allowable rate of discharge, the regulating float partially closes the outlet valve so that this maximum rate of filtration cannot be exceeded. By means of the outlet controller the following conditions, on which successful filtration depends, are secured: (1) It allows time for filling, and then starts the filter gradually, after the cleansing process is complete, so insuring that all water entering the service main is of the required degree of purity. (2) It governs the rate of overflow, so that the maximum safe rate cannot be exceeded. (3) It steadies the flow and insures a uniform rate of filtration. (4) It prevents furrowing of the filtration surface by insuring that a protective layer of water is always maintained above the sand-bed when the supply, for any reason, is very much below the normal or temporarily closed.

The advantages claimed for this system may be summarized as follows: (1) The central channel insures the equal distribution of the incoming water, prevents furrowing, and draws off the impurities uniformly during the cleansing process. (2) The compressed-air and wash-water agitation thoroughly scours the sand grains, and keeps the bed fresh and wholesome by repeated aerations. (3) The lowest possible proportion of wash-water is required, averaging 1 or 2 per cent. of the total volume purified. This result is due to the fact that the wash-water is not required during the air-scouring process, but only afterwards, to float the loosened impurities to the drain. (4) The liberal filtering area provided (more than double the recognized standard for existing rapid filters) enables the rate of filtration to be kept at a low figure. (5) The filters are simple, compact, and all valves are operated from the main working platform.

A record in output has been established, it is claimed, by the travelling plant which is making the concrete blocks for facing the Kensico Dam of the Catskill Aqueduct at Valhalla, N.Y. The concreting tower is carried on railroad trucks, is equipped with three Ransome mixers, as described in the Engineering Record of May 10, page 528, and traverses three rows of Blaw-steel forms in which 4200 blocks per month are cast, equivalent to about 5000 yd. of concrete. The concrete is delivered from the mixers directly into the forms. No buckets or derricks are employed. A large number of blocks have already been manufactured and are piled up, many tiers high, adjacent to the casting yard to season before being placed in the structure. An important advantage of the plant is said to be the elimination of concrete buckets and the direct delivery of the concrete.

Life of Water Pipe in Vancouver

A 16-in. riveted steel water-supply main was recently uncovered in Vancouver, B.C., where it had been in use for more than twenty-two years. On making a careful examination of this pipe it was found to be in a good state of preservation, the only pitting observed being at a few of the field connections where the paint had been scraped off in order to make the lead joints and, through careless workmanship, had not been repainted. Judging from its present condition, this pipe will probably last as long again, according to Mr. H. M. Burwell, consulting waterworks engineer, so that its total life should not be under forty-five years. It has a shell of only ⅛ in. in thickness, and is coated with an asphaltum compound by dipping the pipe into a bath raised to a temperature of about 350 deg. Fahr. Since the year 1905 the minimum thickness recommended for the shell of steel pipes used in the city system is 3-16 in. With good coating and proper care in laying the pipes they are expected to last for fifty years in ground of this nature.

When conditions are such as exist in the Vancouver supply mains, where the entire length of the pipe is constantly full of water under pressure so that the wood is kept saturated, a continuous wooden stave pipe should have a life equal to that of the steel bands, Mr. Burwell states. This, however, only applies to pipe made of carefully selected, sound fir which is free from sapwood. Where the bands have a diameter of not less than half an inch and are properly coated with paint, they are expected to last as long as the steel pipe.

The life of the flexible cast-iron submerged mains under the Narrows of Burrard Inlet has been watched with considerable interest by waterworks officials. These mains are subject to continual tidal currents which attain a velocity up to 6 and 8 knots per hour. The wear on the pipes at the First Narrows is thought to be greatly increased by reason of the fact that Capilano Creek empties quantities of gravel and sand into the tidewaters near the pipes, so that the corrosive action of the water is accelerated by the wear of the sediment carried backward and forward over the pipes by the currents. Under these conditions the life of the 12-in. submerged mains, having a thickness of 1 in., has been found to be about fifteen years.

During the last twenty-five years four old submerged mains have been hauled out and replaced. In this period there have been numerous repairs and about twelve bad breaks, which were repaired under water by divers. The breaks were caused chiefly by ships' keels which landed on the pipes near the shore ends during foggy weather or when vessels were beyond control.—Engineering Record.

Method of Estimating Structural Steel[*]

Taking Off Quantities and Summarizing—Figuring the Weight of Columns—Riveted Work and Other Costs

One of the leading books upon estimating says of structural steel, "First find the correct weight of steel and then multiply by the proper price per pound." The fact that the correct weight must be ascertained and then the proper price, or rather combination of prices chosen, makes the estimating of structural steel one of the most detailed processes that the building estimator is called upon to undertake.

As in estimating other branches of work in a building, first the quantities must be "taken off," then summarized by grouping together all tonnage that has the same kind of shop work.

The cost of the work is generally made up as follows: (1) The cost of the fabricated material F.O.B. cars point of delivery. (2) The cost of unloading and teaming to the building. (3) The cost of erection and field painting.

In taking off quantities from the plans, each beam, or each group of beams which are alike, is noted with the number of beams, size, weight per foot, the kind of shop work to be performed, the number of end connections, recording by distinct abbreviations, whether such connections are to another beam or girder, or to a column, bearing plates and anchors if any. The usual classification for beams is as follows:

Plain—Cut the length with a variation of not over ⅜ in. from ordered length.

Single Punched—Punched one size hole in either web and flange.

Double Punched—Punched one size hole in both web and flange.

Framed—Having connection angles at one or both ends rivetted or bolted to connect with some other member, and with one or both ends, if required by the framing, coped to engage the flange of a supporting beam or beams made into a single member by the use of bolts and separators.

Rivetted—Having plates, or angles, of shorter lengths, or running the entire length of the beam, rivetted to the flange or flanges, or to the web of the beam.

Fittings—Connection angles, bolts and separators. In dealing with rivetted beams, the estimator has the option of treating the beam together with the plates or angles rivetted to it as a rivetted beam, or to regard the beam alone as a single punched, double punched or framed, and classify the plates, or angles, as fittings, choosing whichever method gives the cheaper cost.

Tie rods, bearing plates and anchors, are generally figured by themselves and not classified as fittings.

The length of beam is taken center to center of girders, or face to face of columns, and the steel estimator's sheet appears somewhat like this:

(1)	2, 15 x 42	D P 2C	16-8
(2)	4, 12 x 315	F^1 1C	14-1
(3)	1, 12 x 40	S P 1a 1b 1c	14-1
(4)	2, 8 x 18	B & S 2b	12-0
(5)	1, 15 x 60	riv. 2C	18-2
	1, 12 x ⅜ pl		

Item (1) signifies 2, 15-in. x 42-lb. beams, each 16-ft. 8-ins. long, double punched and connecting to columns at both ends.

Item (2), 4, 12-in. x 31½-lb. beams, each 14-ft. 1-in. long, each having standard connection angles at one end, and connecting to a column at the other end.

Item (3), 1, 12-in. x 40-lb. beam, 14-ft. 1-in. long, single punched, connecting to a column at one end, and with a bearing plate and anchor at the other.

Item (4), 2, 8-in. x 18-lb. beams, bolted together and with bearing plates at both ends.

Item (5), a 15-in. x 60-lb. beam, 18-ft. 2-ins. long, with a 12-ft. x ⅜-in. plate rivetted upon one flange, connected to columns at each end.

Connection angles are figured separately from the beams, the weight of a pair of standard connection angles with the rivets required being taken from the Carnegie or Cambria steel hand book.

In computing the weight of connection angles, the beam sheets are run over and all connections of the same weight are grouped together. With rivetted beams, the weight of beam with all plates, angles and rivets, except connection angles, are taken together.

Often in a steel frame, the outside members consist of two channels, or an I-beam and channel, with an angle rivetted to the channel. Such a member is generally split up and the I-beam or one of the channels is considered bolted and separated, while the remaining channel with its angle is considered as rivetted.

The usual shop prices for beam work per 100 lbs. is as follows:

Cutting to length + ⅜-in.	no charge
Single punched	15 cts.
Double punched	25 cts.
Framed	35 cts.
Bolted and separated	35 cts.
Riveted	50 cts.

Beams over 15 inches in depth cost 10 cents per 100 lbs. extra.

In summarizing the weight of beams for shopwork, this is most easily taken care of by including the deeper beams in a classification one step ahead; thus, a single punched 18-in. beam would be included with double punched beams 15 inches and under.

There is a further charge of, generally, 5 cents per 100 lbs. for painting, and sometimes a charge of 5 or 10 cents per 100 lbs. for drawings. The steel contractor may be called upon by the specifications to pay a charge of 75 cents to $1.25 per ton for inspection.

Fittings are generally figured at $1.55 per 100 lbs. for shopwork. Tie rods at the price of the roads and nuts plus freight, plus 50 cents per 100 lbs. for shopwork. Bearing plates, allow about 15 cents per 100 lbs. for cutting from the long plate. Anchors, generally a small item, figure at 3 lbs. each, and 4 cents per pound.

Sometimes beams are framed into another beam on an angle or skew, at one or both ends. In this case, the beam is classified as framed, but the connections, which must be heated and bent, are classified as bent connections, and priced at a higher rate than ordinary fittings, say 6 cents per pound for material and shopwork.

To the base price of the beams at the mill should be added the cost of shopwork, and these different costs multiplied by the tonnage of each sort of work.

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[*] By Geo. A. Merrill, Amesbury, Mass., in Engineering and Contracting.

The items of freight, paint, drawings and inspection are more easily figured from the total weights of steel.

In building work, rivetted work generally includes the following: (1) Columns, (2) Beam Girders, (3) Plate Girders, (4) Trusses.

Columns may be I-beams, Bethlehem H-sections, latticed channels, latticed angles, plates and angles, with or without flange plates, and plates and channels. The Z-bar column, once a favorite, is now rarely used. In figuring the weight of columns, the size, weight per foot, and length of the principal members are taken off, and the weight of the column shafts computed. To the weight of the column shafts must be added:

(1) Weight of hitch angles at bottom, and steel base plate if one is used.

(2) Weight of splice plates.

(3) Weight of connections of beams to columns. The beam sheets are run over, and the number of connections noted and computed, keeping connections of the same weight together. The weights of such connections are given in some of the steel hand books. Often they may be computed from a typical column detail furnished with the framing plans.

(4) Weight of rivets: In plates and angles, and plates and channel columns, rivets will run from 6 per cent. to 5 per cent. of the weight of shafts with fittings, being less with heavy shafts. With I-beams or Bethlehem H-sections, the rivets must be estimated with each plate or angle attached, calling each rivet (say) ½ lb.

In latticed angle columns allow 40 per cent. of the weight of main members; for lattice bars and rivets, and for latticed channels, 60 per cent.

Beam Girders. Take the weight of beams with cover plates and allow 2 lbs. to 3 lbs. per foot for rivets.

Plate Girders. If stiffeners and fillers are taken off, add 5 per cent. to 6 per cent. for rivets, according to whether the girder is light or heavy. If only the main members of the girder are taken off, add 15 per cent.

Trusses. Take off the sizes and lengths, center to center, of joints and add 30 per cent. for light trusses made up of 2½ x 2-in. angles, and 25 per cent. for trusses having chords of 4 x 3-in. angles, or more.

For the small work usually included with the structural steel in building work, such as framing for pent houses, skylight curbs, bulkheads, cornice brackets, take the weight of the main members and add 25 per cent. Price at 3 or 4 cents per pound for material and shop-work.

It is a general principle in estimating rivetted work, that light work with considerable shop-work must be priced high, and as the work grows heavier, to decrease the pound price.

The prices for rivetted work are not as definite as those for beam work. Fair average prices would be about as follows:

	Cents.
Beam girders, per 100 lbs.	60
Plate girders (according as the work is heavy or light)	55 to 80
Columns—	
I-beam columns	50
Plate and angle	65 to 75
Plate and channel	70 to 80
Bethlehem H columns	55 to 65
Latticed Ls	80 to $1.00
Latticed channels	80 to $1.10
Trusses—	
Very light	$1.25
Ordinary	1.00
Heavy	0.85

Cast Bases: Usually columns rest upon cast bases. Sometimes the bases are detailed upon the framing plans, and in such cases the weight can be readily computed, allowing 0.26 lbs. per cubic inch. Often, however, merely the size of the bottom of the base is given, leaving the estimator to arrive at the weight as best he can. It is a good practice to record and preserve the weight of well proportioned cast bases, figured upon previous jobs, to use in cases such as these. The following are average weights for cast bases:

24 x 24	525 lbs.
27 x 27	675 lbs.
30 x 30	850 lbs.
33 x 33	1,050 lbs.
36 x 36	1,275 lbs.
39 x 39	1,500 lbs.
42 x 42	1,750 lbs.
48 x 48	2,300 lbs.

The cost of cast bases varies from 2 to 2¼ cents per pound.

To the cost of the fabricated material delivered upon cars must be added a profit. Just what profit to add depends upon conditions. If all the mills and structural shops are busy they will put on a higher percentage than in dull times.

The mills will generally quote on beam work at the prices previously given, without adding any profit.

The cost of teaming to the site can generally be figured close enough by estimating the weight of an average load, the number of trips per day a two-horse team will make, and the cost per day for such a team. If the pieces are heavy, the time of one or two helpers at the car must be added in.

The erection cost will vary with the character of the work, whether straight or crooked, light beams or heavy, whether the rivets are bunched together at column connections, or well scattered over the work, whether bolted or rivetted connections.

A fair price is $10 per ton, although the figures may get down to $8 or up to $12. If unusually heavy girders or trusses occur in the work, it is best to figure the erection of these separately from the remainder of the steel.

The part of steel-estimating, which is both tedious and time devouring, is computing the weight after the work is "taken off."

The estimator should be an expert with the slide rule and know by heart the unit weights of the usual sizes of plates and angles, and have convention schedules at hand of the weights of beams and column connections, rivets, bolts and separators.

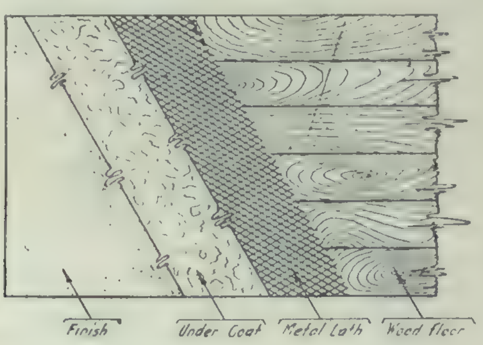
Cinder-concrete wall lining is used on the exterior walls of the new building of the Deutsches Museum, at Munich, Germany. Its purpose is to serve as insulation and also supply a base which will take nailing, etc. It is not made with ordinary ashes or cinders, but with broken tufa, from Andernach-on-the-Rhine. With this material a cement concrete is mixed 1:12 or 1:16, and used to form a 5-in. layer on the inner face of the exterior wall, the rest of the wall being stone concrete. This tufa concrete permits nails to be driven in easily, and it can be worked with tools, as was proven by sawing into it at the corner of a door jamb with an ordinary crosscut saw.

Composition Flooring—Its Field, Qualities and Cost

By H. M. Hooker

THE basic process for composition flooring was worked out, or at least given to the world, in 1866, by Stanislas Sorel of Paris, France, who at that time took out patents for a cementing material composed of magnesia and chloride of magnesium as the two chief ingredients to which other powdered substances could be added. For exterior use, it was discovered that this "Sorel Stone" had not the enduring properties necessary. But chemists, manufacturers and workers, from this basic compound, have developed a permanent floor surface by the addition and treatment of different ingredients. Gradually the substance has been improved until, about seven years ago, a really desirable flooring material was produced.

Composition flooring is a light-weight, fireproof, resilient covering. It is laid plastic, usually about one-half inch thick, and sets in a few hours into a seamless, tough, warm and rather quiet mass; in appearance and feel not unlike high-grade battleship linoleum. Its jointless character and comparative freedom from cracks, due to warping, uneven settlement and vibration of buildings give it special value. It is laid over wood, metal, or concrete, and adheres firmly thereto. It appears in many colors and combinations of color from black to a light pearl-gray.



Typical composition flooring on wood.

In addition to its sanitary qualities, it combines warmth, resilience and a degree of quietness not possessed by concrete, tile, or terrazzo. It was first installed in hospitals, schools and public buildings.

Recently industrial concerns have put it to use in places where many employees are on their feet for hours at a stretch and where heavy or constant trucking has destroyed the more generally used Portland cement concrete surface. In reducing foot-weariness it proves to be about on a par with maple flooring. As a wearing surface under heavy trucking it has a much longer life than cement, wood, or asphalt. Actual wear in runways through which trucks frequently pass and in livery stables where the calks of sharp-shod horses attack the surface returns a verdict distinctly in favor of composition flooring.

It is laid plastic in one or two coats and sets in a monolithic mass. Where base and wainscot are used, these are ordinarily run into the flooring material with a cove, so that the finished work has a smooth, jointless surface which can be freely mopped, scrubbed and cleaned, and which offers no refuge for filth and germs.

A desirable characteristic in flooring is resilience. It is the most pleasing feature under the tread that a floor can possess. For restaurants, offices, factories and places where people are forced to stand for hours at a stretch, it is a cash asset. In this respect composition flooring ranks high. Cork tile, linoleum, rubber tile when new, and white pine possess somewhat more resilience and we owe much of their flooring value to this fact. Yet cork, linoleum and rubber tile are slightly more tiring because, owing to their softness, they offer more frictional resistance to the foot or truck wheel passing above.

Two factors play an important part in determining the waterproof value of a flooring: First—the porous or absorptive character of the material itself; second—the joints or seams which, as usually installed, it offers to the passage of liquids.

Composition flooring is practically non-absorbent, its coefficient of absorption for 48 hours being less than two per cent. During the first few minutes there is a slight absorption (less than one per cent.); thereafter for a few days it very slowly takes up more water.

Under constant immersion there is a gradual softening of the regular commercial composition which disqualifies it for swimming tanks and for conditions of permanent wetness. If the material is intermittently dried there is no deterioration. It may therefore be successfully used for very wet places where the moisture is applied at intervals, as in the case of shower, toilet and bath-rooms. Cork is the warmest flooring material in standard use. Composition comes next, ranking but little lower. It is therefore particularly desirable for bathrooms, bedrooms, refrigerating rooms, schools and other places where it is desirable to retard heat transference,

The life of composition flooring when properly installed is undetermined. Material suitably installed six or eight years ago shows no appreciable deterioration. It will doubtless be good for one hundred years.

This flooring may be heated to a temperature of 1700 degrees Fahrenheit, chilled in water, reheated, chilled and reheated again, and will not be destroyed. It will stand temperatures in excess of those usually found in burning buildings and is much above the fireproof requirements of city building codes and fire insurance companies. Among fireproofed flooring materials it is unique in its possession of softness, warmth and comfort under the foot. It is the highest of the fireproof materials, and withal weighs but slightly more than wood and much less than concrete.

The materials to be used in the case of any high-grade floor are prepared at a factory and delivered to the job in two units,—the magnesium chloride and the dry mixture.

The cost of composition flooring varies with the area to be installed at one time. The larger the installation, the lower the square-foot price. The range is usually between twenty and fifty cents per square foot. When laid in a considerable area, the price is about one-fourth that of marble, one-half that of good tile, and two-thirds that of terrazzo. It is about one and one-half times the price of a wood floor when on a wood foundation. On a concrete foundation the cost of wood and composition flooring is about the same, as the latter can generally be set off against the cost of wood sleepers, cinder concrete fill between sleepers and the hardwood finish. The accompanying table gives approximate comparative prices for composition flooring and some other standard flooring materials during 1912, based on areas of 1,000 and 10,000 square feet.

The foundation for this material may be either wood, concrete, iron, or steel. It cannot be laid directly upon plaster, adamant plaster, plaster board, brick or terra cotta.

It may be laid upon new or old wood floors. The wood flooring should be well seasoned, not over six inches wide and not less than seven-eighths of an inch thick. Where possible, the underflooring should be laid rough side up and in such manner that it will not sag under the load for which the flooring is intended. The best practice is to apply expanded metal lath on all wooden foundations. This metal reinforcement adds only about one and one-half cents per square foot, and its added protection more than offsets the possible saving.

The flooring will usually take its initial set in from four to six hours, but travel should be kept from it for seventy-two hours, although it will stand careful walking in half that time.

With regard to after-care, the flooring may be left permanently untouched. If, however, at intervals of a few months it is gone over with an inexpensive mixture of oil and wax, secured from any flooring manufacturer, its beauty is greatly enhanced and its life prolonged.

Lighting Principles in Mills

The following fundamental principles of cotton-mill lighting have been outlined by Mr. Albert L. Pearson in a paper read before the American Society of Mechanical Engineers: As the operative is the one for whom the light is provided, he should be given every consideration. Adjustable lamps, hung low down, tempt operatives to meddle with them. Lamps should be arranged to give uniform illumination at the working plane, avoiding shadows, as far as possible, and particular attention should be given to the requirements of each machine. White walls and ceilings add to the effectiveness of the lighting system. With individual driving of machines it is possible, owing to omission of overhead belts and shafting, to keep the rooms cleaner than with mechanical or group driving, thus benefiting the lighting system. On account of glare, low exposed units should be avoided. In places where it is necessary to have the lamps low down, reflectors which will entirely conceal the filament of the lamp should be used. The position of lamps should be carefully determined, both as to spacing and mounting height. In general, the height of the lamp above the floor should be such that with the spacing available the lines representing the angles of maximum illumination with a given type of reflector will cross at the working place.

It is anticipated that during the next few years the government will spend one hundred million dollars on new docks and harbor improvements. These contemplated works include dry docks at Victoria, Vancouver and Esquimalt, and terminal and harbor improvements at Montreal, Toronto, St. John, Hamilton, Halifax, Fort William and Sault Ste. Marie.

Windsor Station Extension, Montreal

THE extension of the Windsor Station, C. P. R., Montreal, is now practically finished. The extension gives a total frontage of 490 feet on Windsor street and a frontage on St. Antoine street of over 170 feet. The foundations are carried to rock by means of cylindrical caissons. There is a difference in levels of about forty feet between one end of the extension and the old building, and this enabled large vaults to be constructed beneath the main floor and beneath the tracks. These vaults cover a ground area of 66,000 sq. feet, leaving room for an Immigration Hall covering 10,000 sq. feet, Chinese waiting room covering 6,900 sq. feet and third class passenger waiting room covering 3,000 sq. feet.

The cubic capacity of the new portion of the building, exclusive of vaults under tracks, but including the concourse is 4,703,000 cubic feet, while the viaducts total another 1,000,000 cubic feet, and the power houses or 16 including the basement, and is 225 feet above the level of St. Antoine street. It contains water tanks with a combined capacity of 30,000 gallons. The general waiting room in the main building, has a ground area of 7,800 ft. The new building alone contains 2,800 tons of steel, apart from the steel used in the train sheds.

When completed there will be thirteen elevators, eight for passengers (two of which have a lifting capacity each of 7,000 pounds) four for freight and baggage, and one for the kitchen and restaurant.

Windsor Station, Montreal

In the construction of the exterior of the building, limestone from the Province of Quebec was used. The steel was manufactured at Lachine by the Dominion Bridge Company. The ornamental ironwork and bronze were of Canadian manufacture. The woodwork was made by Montreal manufacturers, and the plumbing was done by a Montreal contractor, and the electric fixtures by a firm in Toronto. In the exterior marble is used exclusively in the principal halls and corridors.

On six tracks the sheds will cover a train 1,000 ft. long, on two of the tracks, the roof covers a train 800 ft. long; on two more the capacity of 550 ft., while on Track No. 1 particularly intended for suburban traffic, the capacity is 420 ft. Over 2,000 tons of steel have been used in these sheds, exclusive of the concourse. The area covered is 205,000 sq. ft. or about 5 acres.

The roofs of the train shed are carried out on a new design. The skylights are designed as to be always clear, and snow can be shovelled through slots in the roof to the cars below.

The C.P.R. Hotel, Vancouver

OUR illustration is from a photo showing the progress made upon the construction of the C. P. R. Vancouver Hotel, Vancouver. The old hotel, now being torn down, was, twenty years ago, the only building in the block, on the corner of Georgia and Granville streets. Some three years ago the How street wing and annex were built of reinforced concrete, the banquet hall is now being used as a dining hall during the construction of the new building. The Van Horne wing of the present hotel will evidently be torn down to make room for the new hotel.

The power house, which supplies both heat and light to practically the whole block, was then erected. The upper portion of the power house is used for laundries, and employees' quarters. The lower part, containing the boilers and engine room, goes down nearly three storeys underground. There are three immense boilers, capable of using either coal fuel or oil fuel. Oil fuel is being used at the present time. The auxiliary engine room extends from the power house to the motors, hydraulic pumping and refrigerating machinery. Tunnels are run from the engine room and power house containing the pipes for heating and pumping purposes. Opening off from the auxiliary engine room is a large incinerator for the purpose of burning all rubbish. The engine room of the power house is located just below street level and is fitted out with the latest recording instruments, showing the consumption of fuel oil, pressure of steam, thermometers, etc., all working automatically. The power house is finished throughout, both inside and out, with cement.

Vancouver Hotel under construction

The main portion of the new hotel, which is in the course of construction at the present time, was started something over nine months ago, and is about three-quarters finished. It will be constructed of steel, with concrete floor slabs, and will tower sixteen storeys above street level, with three storeys underground. The roof, when completed, will contain a roof-garden.

The kitchen is planned on the Old Country style. A complete bake house will be installed, as will also complete refrigeration and storage rooms, butcher shop, etc. Electricity, gas and coal are used for cooking purposes. The kitchen will be finished in tile work throughout.

The main floor of this wing will have a tea room and lounge, floors being of mosaic marble work, and walls of Austrian oak. The ladies' tea room will be oval in shape, with large marble columns, and ceiling of glass. There will be 283 bedrooms in this wing, with telephone in every room, while practically every room will contain a private bath.

The base of the exterior of the hotel will be of granite, the upper part being of clayburn brick and terra cotta.

The old hotel will be replaced by the Granville street wing of the new hotel. This section of the building will be partly seven and partly eleven storeys high, and will contain 126 bedrooms, each room with a private bath. The most notable features in this portion of the hotel will be the huge convention hall, large grill, bar room and barber shop. It will also contain a public ticket office and billiard room.

At least 18 months will pass before the Van Horne wing of the present hotel building will be torn down, and the Marpole wing of the new hotel erected in its place. The Marpole wing, when constructed, will be eleven storeys high and will contain 60 bedrooms with private baths. There will be a large lounge on the main floor, and the sample rooms will also be in this section of the building. Throughout the entire new hotel, there will be in constant use about 20 elevators and dumb waiters.

The main entrance is to be on Georgia Street, with great pillars supporting the overhead protection of the driveway, which, starting from Georgia Street near Granville, runs in around the entrance, describing almost a half circle, and has its exit on Georgia Street near Howe Street.

Mr. Francis S. Swales, formerly of Painter & Swales, is the architect, and the contractors are Messrs. Skene & Christie, who constructed the Empress Hotel at Victoria.

The first Canadian Roads Congress, a national convention arising out of the urgent need in all the provinces for better roads, is planned to be held in Montreal about the end of January. Both the federal and provincial governments are co-operating with the Automobile Club of Canada, as well as the local and foreign roads associations, boards of trade, municipal and county councils and societies in general, to make the congress a big educational feature. The best methods of road-making will be reported upon by geological committees in the different provinces, and the most up-to-date methods in road construction will be explained by experts and contrasted with the old-fashioned methods of the past. The importance of this congress and the interest to be evinced in it may be inferred from statistics drawn up by the Automobile Club. These show that over 12,400 more motor vehicles were in use in the Dominion on November 1st than at the end of last year.

The provincial government of British Columbia has expended the large sum of four million dollars on road extension and improving roads within its boundaries during the past season. It is pointed out by the Deputy Minister, Mr. W. W. Forster, that the sum required for road maintenance year by year is rapidly increasing, owing to the additional mileage. There are at present in the province 18,000 miles of roads and trails. Upon bridges the sum of $900,000 has been expended by the Provincial Works Department this year, $50,000 for wharves, and $70,000 on road location work.

Glossary of Terms Used in Road Construction

(Continued from last issue.)

Course.—Applied to the various layers of metal or other material spread on a road, such as bottom course, top course, etc. "Crust" is sometimes used instead, but there is some confusion in the use of these words. "Course" is also used to describe the rows of paving setts or wood blocks.

Court.—A walled-in space, but generally applied to a group of houses in an alley.

Crab.—A portable windlass.

Crawl.—To creep slowly, applied to bituminous mixtures which creep under heat.

Craze.—Slightly to crack or split open the skin of a surface.

Creep.—See "Crawl."

Crempoid.—The trade name of a dust palliative.

Creosote.—A powerful antiseptic obtained from coal tar, and used extensively in the preservation of wood blocks.

Croft Blocks or Flags.—The trade name for a specially prepared artificial stone.

Crossfall.—See "Camber."

Cross-grip.—A cutting or channel across a road to divert the surface water from one side to the other.

Crossing.—A term used to designate a passageway, which is generally paved, over a street or road.

Cross-road.—A road intersecting another road, but sometimes used to designate a by-road traversing the country.

Crows.—Often used to designate the centre of a carriageway or the top of the camber.

Crude.—Untreated, raw, in a natural state; often used as a qualifying description in referring to tar, oils, etc.

Crumble.—To fall or break into small pieces or fragments.

Crunch.—A synonym for "crush."

Crusher.—Sometimes applied to a "stone breaker."

Crusher Run.—A term applied to the unscreened product of a stone breaker.

Crusher Sand.—The sand or small stuff remaining after stone has been crushed or broken in a stone breaker.

Crust.—The external covering of a carriageway; it is sometimes qualified as upper and lower crust if there are two layers making up the formation.

Cubes.—Setts which are actual cubes in measurement.

Cul-de-Sac.—A street open at one end only. A narrow street of this description is often called a "blind alley."

Culvert.—An arched drain of brickwork or stone carried under a road for the passage of water. A culvert is distinguished from a bridge if not of more than 6-ft. span.

Cups.—A term applied to hollows or depressions in the surfaces of a carriageway. (See also "Potholes.").

Curb.—Generally spelt "kerb." The edge stone of a sidewalk or footwalk. Sometimes called curbstone.

Curtilage.—A courtyard; or, in law, a court-yard, back, side, or piece of ground lying near and belonging to a dwelling-house.

Curvature.—The contour or camber of a carriageway surface.

Cushion.—Or cushion bed. A bed of sand or ashes, etc., laid between any paving and the concrete foundation.

Cyclometer.—An instrument for measuring the distance travelled by a vehicle.

Dacite.—A road-making rock, coming under the trade name of "Andesite," as settled by the Engineering Standards Committee.

Dandy.—A portable can for the distribution of tar or bituminous binder. Also used to designate a portable mixing vessel.

Dapping.—Or "dabbing." The use of a broom to drive tar into the interstices of the surface of a carriageway.

Dead Oils.—Oils distilled from tars with a density greater than water.

Decay.—To deteriorate, waste, wither or rot, moulder or fail gradually.

Decimetre.—A French measure = 3.937 in.

Declivity.—A steep descent.

Deformation.—A distortion or disfiguration.

Degredation.—The wearing down of stones, rocks, etc., by the action of water or other causes.

Dehydrate.—To remove all water from tars or other materials.

Deliquescent.—Capable of attracting moisture from the air and retaining it.

Dell.—A small narrow valley or ravine.

Density.—Used to describe the quality of being close or thick in direct proportion to the mass and volume of some substance used as a standard, and inversely proportional to the bulk or size.

Denudation.—The act of making bare. (See also "Degradation.")

Deodoriser.—That which destroys smell.

Depot.—A place of deposit.

Depression.—A hollow, or concave falling in, of the surface of a carriageway. The state of being pressed down.

Derrick.—A boom supported by posts and stays. The name is derived from that of hangman Derrick.

Detergent.—Any substance that has a strong cleansing power.

Detour.—A deviation from the direct or shortest path.

Detrition.—The act of wearing away.

Detritus.—Waste or disintegrated material. Specially applied to the mineral matter washed or scraped off the surface of carriageways.

Diabase.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Diffuse.—To pour out and spread on a surface.

Dilute.—To make more liquid.

Dingle.—A narrow vale or valley.

Diorite.—A road-making rock, coming under the trade name of "Granite," as settled by the Engineering Standards Committee.

Direction-post.—Or sign post. A post indicating the direction of certain places at the bifurcation of roads.

Dish.—A term sometimes applied to a hollow depression in the surface of a carriageway; and, as a verb, to denote the act of making a hollow or depression.

Disintegration.—The act of separating the component particles of a substance as distinguished from decomposition.

Distributor.—A machine for spreading bituminous or other liquid substances upon the surface of carriageways.

District Roads.—A term applied to roads which are repairable by the inhabitants at large through town and district councils.

Ditch.—A side drain of a country road.

Dog's Leg.—A term sometimes applied to denote a crooked lane.

Dolerite.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Dolomite.—A road-making rock, coming under the trade name of "Limestone," as settled by the Engineering Standards Committee.

Drag.—A skid or shoe on a wheel.

Drain.—A channel through which water or other liquid flows off.

Dray.—A four-wheeled open wagon. Usually applied to a brewer's dray.

Dribbling.—Sometimes used to denote the placing of small quantities of material in depressions on carriageways to restore the surface to its original shape.

Drizzle.—A very fine rain.

Dryer.—A machine for drying stone or sand by the application of heat.

Duct.—A conduit for pipes, usually applied to the underground carrier of electric cables, etc.

Ductile.—Flexible or pliable, easily drawn out to a thread.

Dump.—To unload from a cart by tilting.

Dumping Ground.—The site where spoil is deposited.

Durability.—The capacity to resist wear, the power of lasting.

Durax.—The trade name of a method of paving with cubical setts of small size. (The same as "Kleinpflaster.")

Dust.—Fine, dry particles of earth or other matter so attenuated that they may be raised and wafted by the wind.

Dustabato.—The trade name of a dust palliative.

Dusting.—Sometimes used to designate the operation of street cleaning.

Dustroyd.—The trade name of a dust palliative.

Dynamometer.—An instrument for measuring force or power, especially that of men, horses, machines, etc., by means of springs.

Earth.—A generic term for soil, mould, etc.

Earth-up.—To cover with earth, or heap-up soil, earth, etc.

Easement.—A liberty or privilege without profit which one owner has in the estate of another owner; distinct from the ownership of the soil, such as a right-of-way, or right of drainage, etc.

Ease-off.—To soften or slacken, as applied to an angle or curve, etc.

Echelon.—Wedge-shaped.

Edge-iron.—A tool for cutting the grass verges of carriageways, etc.

Elastic.—The power of recovery from compression or tension.

Elastite.—The trade name of a bituminous compound for roads.

Elbow.—A sudden turn in a road not quite so acute as a "hairpin" turn.

Eminence.—A term usually applied to a hill of moderate elevation.

Emulsification.—The act of making an emulsion.

Emulsion.—A mixture prepared by uniting oil and water, generally resembling milk in appearance. (From mulgeo, to milk).

Encroachment.—Unlawful intrusion. Assumption of the rights and privileges of another.

Enhydrous.—Containing water within.

En Masse.—In the mass, or the whole of a number of things taken together.

Enrockment.—A mass of large stones thrown in at random to make a foundation.

En Route.—On the road, on the way to any place.

Epidiorite.—A road-making rock, coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Equestrian.—A person on horseback.

Erminite.—The trade name of a dust palliative.

Erratic Blocks.—Scattered stone boulders which are supposed to have been carried by icebergs during the glacial epoch.

Escarp.—To cut rocks at a very steep angle.

Espalier.—A sort of trellis work.

Esplanade.—A term generally applied to roads or broad paths abutting on the sea.

Evaporate.—To dissipate in fumes.

Excoriate.—To strip or tear off the skin of any material.

Excrescence.—A growing out or superfluity.

Expansion Joint.—A joint which allows for expansion. Generally applied to open joints in wood or other similar pavements to allow for the swelling of the material by moisture without disturbing the pavement.

Exude.—To discharge by "sweating," or under pressure.

Facade.—The front view or elevation of a building.

Face.—"The front or fore part," generally applied to the surface of a carriageway.

Facettes.—"Little faces." Generally applied to the faces of a crystal or of a stone.

Fairfield.—The trade name of a bituminous compound.

Fall.—A difference in level. Sometimes used instead of "gradient."

Fat.—Sometimes used to designate a concrete or mortar which is rich in cement or lime, or a mixture rich in bitumen.

Fatigue.—The weakening of metal produced by repeated vibrations or strains.

Fatty.—A word sometimes used to describe a mixture with an excess of bitumen.

Felsite.—A road-making rock, coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Ferro-concrete.—Concrete fortified or strengthened by steel rods or framing.

Ferromac.—The trade name of a special method of making roads with a cementitious powder.

Filler.—A term now applied to a thin surface coat or course of fine bituminous material which is used to fill the surface voids in a carraigeway. Sometimes called a "seal coat." (There is some confusion now existing as to the use of this word.)

Filling.—The material used for filling-in. Now sometimes employed to denote the material used to fill the voids or interstices in bituminous-bound carriageways.

Finger-post.—An almost obsolete word for a sign-post or direction-post.

Fissure.—A crack or narrow chasm.

Fixed Carbon.—The organic matter of the residual coke obtained upon burning hydro-carbon products in a covered vessel in the absence of free oxygen.

Fixity.—Stability.

Flag.—Or flagstone. Usually applied to a natural (but sometimes to an artificial) stone used for paving footpaths.

Flake.—A chipping or small piece of stone of a flat or thin nature.

Flaky.—A term used to denote road metal which has in it a large proportion of thin, flat pieces of stone.

Flanks.—Sometimes used to denote the haunches or shoulders of a carriageway.

Flexible.—Pliant, ductile, and yielding.

Flint.—A variety of chert found in the chalk. Flints used for road construction are known as pit flints, field flints, hand-picked flints, etc.

Float.—To smooth over the face of cement, mortar, etc.

Floating.—A term used as a substantive to describe a thin layer of cement and sand or similar material laid on concrete to form a true bed for blocks or setts.

Flocculent.—Coalescing and adhering in flakes.

Flour.—A term sometimes used to describe a very fine stone dust.

Flume.—A water channel driving a water wheel.

Flush.—In a manner so as to be even or level with anything else.

Flush Coat.—Sometimes used to describe a fine coat of bituminous mixture laid on the surface of a carriageway.

Fluting.—A narrow groove, channel, or furrow.

Flux.—A substance or mixture used to promote the fusion of metals or minerals. Also applied to certain materials used for softening the harder bitumens.

Fluxphalte.—The trade name given to a bituminous mixture

Footpath.—The name formerly applied to a narrow path or way for foot-passengers only, across fields, etc., but now often applied to the footway. Sometimes called "Path," or "Pathway."

Footway.—The part of the highway used by foot-passengers, generally divided from the carriageway by a kerb, and raised above the level of the carriageway. Also called footpath, side-walk, path, pathway, parapet, causeway, foot pavement.

Fork.—The point in a road where it divides into two branches.

Formation Level.—The surface of the excavated or made-up ground on which a road is constructed.

Forward.—A word used in measuring to denote lineal measurement—i.e., "a yard forward."

Foundation.—Used sometimes to denote the solid ground on which the road formation rests, and sometimes to denote the lowest part of the structure of a road. (This is one of the words that requires an accepted definition, as it is now used very loosely.)

Founder.—To go to pieces. A road that has "foundered" requires entire reconstruction.

Free Carbon.—Organic matters in tars which are insoluble in carbon disulphide.

Freestone.—Stone composed of sand or grit. Unsuitable for road metal.

Fret.—To wear by attrition.

Friable.—Easily crumbled or pulverised.

Fringe.—A word sometimes used to denote the edge or borders of a road.

Frontage.—The extent of the front of any building or land abutting on a road.

(To be continued)

LETTERS

A Plea for the Adoption of the Quantity System

London, Ont., Nov. 13th, 1913.

Editor Contract Record:

I have been much interested in the discussions appearing in your paper from time to time regarding the advisability of adopting the Quantity System among the contracting fraternity of this country.

In my opinion the owners who erect buildings lose large sums of money annually, owing to the present system by which contractors figure off their own quantities. Architects cannot fail to have noticed when opening tenders the great difference between the various amounts, whereas if proper figuring had been done there should hardly be any difference. This is not due, however, to one contractor having to buy his material at a lower or higher price than his fellow competitor, for all contractors are aware of the prevailing market prices of the material required in their respective trades. But it is due to a slip in taking off their quantities that this noticeable difference in the highest and lowest bid occurs. To come to the point where the owners lose money, let me recite the following (and I think, only those of limited experience will disagree with me). We insert a clause when calling for tenders, "the lowest or any tender not necessarily accepted," which to my mind is a farce, for in ninety-nine cases out of a hundred, the man who has gone so far as to incur architects' fees for plans invariably builds from the plans so prepared; in very exceptional cases, even against the advice of the architect, he will insist on the lowest bid being accepted, even though by comparison with other tenders he knows the contractor must have left out something, or made a slip. This class of owner is usually a very hard man to do business with, just one huge "grabber" from start to finish. However, as he forms a fair percentage of architects' clients we will consider his position, as not many architects in these days of earnest competition can afford to turn him down when he comes along and offers us his business. Unless the contractor finds out his mistake before the contract is signed (I speak of course where no deposit is required to be forfeited should the successful contractor fail to carry out the work upon which he submitted a figure) the owner signs up his contract with Mr: Contractor, and shrugging his shoulders he walks away thinking, "Well, I got that cheap enough, the contract is signed, and it's up to Mr. Architect to make Mr. Contractor live up to his agreement." But, I ask, does he get his job cheap enough? All architects know the worry and annoyance he will have to stand through such a bargain; all of us know what it is to have a contractor skimp his work, and of the daily visits to our offices of our client, who sits on the job and rushes to the architect with every tale of woe he can think of; angry with complaints about lack of supervision; how he (the architect) is allowing Mr. Contractor to get away with inferior workmanship and material, and so on. We know this class of client, and by the time he has paid us our fee, we feel that we have earned our money many times over, and feel like kicking ourselves for not turning him down in the first place.

Now-a-days contractors are not fools, neither are they, as a rule, willing to give something for nothing, contract or no contract. It is hard enough in the majority of cases to get good value from contractors even when they are being paid for a first class job, let alone when they are called upon to provide something according to plans and specifications upon which they have omitted to figure. For example, one morning Mr. Architect goes to the job and asks why certain work is not being done; in blank astonishment the contractor looks up and says, "Why I never figured on that, it's not in the specifications." "Oh yes it is," replies the architect, then follows a scramble to the shed where the specifications are located, wrapped in the blueprints under a pile of tools, or behind some bags of cement, in fact anywhere but in a proper place to preserve them. A careful survey of the plans and specifications follows, and presently the contractor finds he has missed out something else, and then the fun begins, it is a battle of wits all through, whereas nothing but pleasant relations should exist between everyone. But woebetide the proprietor should he require changes made or extras done as the work progresses, for it is only a rare occurrence that the Owner does not require to deviate from his original intentions and change his mind before completion of his job. For any little changes or extras, the Contractor boosts his price many hundred per cent. over the price as rated in his tender, and after all who can blame him? It is only human nature for him to want to make good his oversight while he has his chance, and here it is that a proper bill of quantities would save the contractor from his oversight. In the first place it would save the architect no end of conflicting interviews and numerous trips to the job, and lastly it would save Mr. Proprietor from being everlastingly soaked for extras.

Let us suppose the architect refuses to pass the contractor's account, and the case goes to court. It is up to the proprietor to prove the contractor's charge is unreasonable, and in nine cases out of ten judgment is given for the contractor, as he is better prepared with evidence, time sheets and pay roll, material invoices, and witnesses. We have all been through such experiences, so I need say no more than erpress an opinion that in the end the proprietor pays very dearly for entering into such a contract, and regrets not taking our advice in the very first instance and have nothing to do with accepting such a low figure; he certainly lacks his architect's sympathy for insisting upon taking advantage of another man's ignorance, in fact every one is sore.

I do not wish to infer that a bill of Quantities would eliminate mistakes, for while the world lasts mistakes and bad judgment will occur, but I do strongly feel that by the adoption of a system of quantities, such as I herewith propose, a basis would be established for a satisfactory remedy for any mistakes that were made. My suggestions are as follows:—

1. The bill of quantities should form a part of the contract, and all prices or rates quoted therein should be taken as a rate upon which all extras and deductions are charged.

2. An item designated "Preliminaries and Sundries" should be inserted, to include only those items of the "General Conditions" which can be priced individually, such as setting out the work, water, scaffolding, hoarding, etc. The contractors should refer to the specification and "Conditions of Contract," and have a note made to the effect that these works are to be considered to include for any expenses in connection with the general clauses therein.

3. Then should follow the different trades, excavation, concrete and brick work for example; proper dimension sheets with columns should be kept by the surveyor taking off the quantities, showing step by step how he arrived at the final total inserted in his Bill, so that if any claim for extras or deductions be made these figures could be checked over with the actual measurements on the job. The brickwork should all be reduced to a wall of one thickness, with special mention of any work requiring extra labour. This latter rule applies to all trades, and the following examples will better illustrate my meaning.

BILL OF QUANTITIES of Material required and work necessary for the Erection and Completion of a Residence for Mr. X, at No. ?? .... Street, Kalamazoo, in accordance with the accompanying plans and specifications:—

Messrs. A & B, Architects,
City.

NOTE:—This Bill of Quantities forms a part of the Contract between the Owner and the Contractor.

Amount of Preliminaries and Sundries, under General Conditions ... ... $
600 yds. super. Removing top soil and grading ... ... $
115 yds. cub., Excavation for foundations, etc., at per yd. ... ... $
17 yds. cub., Concrete in footings as described ... ... $
200 yds. super, Waterproofing in footings as described ... $
60,000 yds. super, Brickwork reduced to 1 brick thick laid in lime mortar as described, at per yd. ... ... $
200 yds. super, Extra only for brickwork in cement ... ... $
75 No. Setting Window frames and bedding ... ... $
4 No. Setting Door frames and bedding ... ... $

The foregoing I think will illustrate my meaning, but every item mentioned in the specifications or shown on the plans should be made a note of in the quantities; let us take a few examples of carpenter work.

300 No. 2 in. x 10 in. joisting, i.e., ? ft. B.M., at per M. ... ... $
76 No. 2 in. x 12 in. joisting, i.e., ft. B.M., at per M. ... ... $
3,000 ft. B.M. rough boarding ⅞ in. thick for protecting mason work and ——— ... ... $
Attendance and cutting for other trades ... ... $
250 yds. Super, Deadening Felt as specified, at per yd. $
Allowance for nails, screws, etc. ... ... $
700 ft. run pine base, prepared for paint ... ... $
200 ft., Extra labour only on hardwood base, prepared for stain ... ... $

Now let us take sheet metal work.

120 ft. run copper eaves troughing, at ... ... $
7 No. Extra labour only on mitred angles ... ... $
10 ft. run double swan necks to down pines ... ... $
60 ft. run down pipes and fixing to walls ... ... $

All the foregoing illustrations are merely given as a guide, and when the time for settlement comes, everyone at a glance can see exactly what the contractor figured on, and arrive at a proper amount to be paid for any extras or deductions as the case may be. It should of course be thoroughly understood beforehand that the rates quoted by the Contractor in his original bill of quantities are to hold good for pricing extras or deductions, and a fully priced and added bill of quantities sealed in the envelope should be deposited with the architect at the time the contract is signed. I might say that I have known cases where a proper bill of quantities was handed to a contractor for a fairly large job, and the contractor only took a short glance at the plans, priced out the bill of quantities, read the specifications, and sent in a bid which was accepted. If my memory does not fail me I believe that in England very few of the contractors will figure on a job of any size unless a bill of quantities is furnished. The adoption of the quantity system would save contractors many hours of hard work, usually undertaken in the evenings when they are tired after working all day, and consequently all the more liable to make a slip.

In my humble opinion, the Builders' Exchanges throughout the Dominion should unite on this question and work in harmony with the various chapters of architects' associations to further this end, which would result in the ultimate abolition of the present slip-shod method of tendering. In a country like ours, where millions of dollars are annually spent on buildings, this question is one of great importance, and it is only by the united efforts of those identified with the building industry, that the quantity system will become an accomplished fact. Primarily it is up to the contractors to take the initial step to put an end to the waste of time and money involved in sending in a tender and refuse to bid unless a set of quantities is furnished. After that I think the architects will unanimously fall in line.

I have read the articles in your current issue, under the titles "The Gratuitous Bid" and "Competitive Tendering," and must say I thoroughly endorse all you have said with the exception of your plea that the "sole alternative is to pay the contractor for the trouble he is put to in tendering, and to reimburse him any expenses he may incur." This I think would be going to the other extreme, because a contractor who might have an idle half hour on his hands would then take the nearest trip to an architect's office and figure off a job, send in a bid although he might never have intended to try and get the job, his object in coming into your office being apparently to get under cover during a heavy shower and incidentally pocket a fee for putting in a bid. Even suppose a contractor never did a job, he could make a tidy income by merely sending in bids which he never intended should be accepted. The contractor should I think, sell his goods and labour like any other business man, and not be paid a fee for telling us his price; at the same time conditions should be made as easy as possible for him and he should not be expected to lose money because we ask him to tender. After considering the question from all sides, I cannot fail to come to the conclusion that many of us who are earning a living by being identified with the building business would find our day's work much easier and less full of pitfalls, should a universal system of tendering by quantities be adopted.

I trust, Mr. Editor, that you will follow up this matter and arouse such an interest in this important question as will ultimately lead to the adoption of the system of tendering by quantities.

Yours very truly,
H. Bryan Gilbert.

Mainly Constructional

The News in Brief—From Coast to Coast

A most important scheme for the improvement of roads in Manitoba has been announced by the premier, Sir Rodmond Roblin. The project provides for an expenditure of $2,500,000.

Montreal is to have a new apartment house firm in the Oldfield Apartments Company, Limited, whose incorporation has been announced in the Canada Gazette. The capitalization is $500,000.

The Dominion Government has awarded the contract for the construction of the Nassau dam on the Trent Canal to Chambers, McCaffrey & McGuigan, contractors, Toronto. The contract price is $72,768.

The Union Switch Signal Company, of Montreal, has been given the contract for automatic signals on the Intercolonial Railway, costing $85,000. The contract was awarded by the Dominion Government.

The death occurred on the 11th instant of Mr. Henry Benallich who was for the past twenty years one of Guelph's foremost contractors. The deceased was born in Truro, Cornwall, England, in 1843, and came to Canada when a young man.

The Industrial Foundation & Waterproofing Company have executed the damp-proofing of the exposed superstructural walls on the Loew Theatre, Yonge Street, Toronto. Messrs. Fleischman Brothers, Limited, were the general contractors.

A programme is under consideration for the carrying through of the $400,000 storm sewer project in London, Ont. Mr. Willis Chipman, of Toronto, and City Engineer Ashplant, of London, are conferring in the matter and the work will probably soon be in the hands of the contractor.

The General Supply Company of Canada, Limited, Winnipeg, have removed to their new offices and warehouses at 85 Water Street. The company's business in the western metropolis has increased considerably of late and the removal is undertaken with the idea of securing improved facilities.

The Saskatoon Builders' Exchange have passed a resolution expressing their unanimous disapproval of the action of the city council in requiring the building contractors to pay for the water they use at the meter rate, and calling for the appointment of a committee to wait on the Commissioners.

Work has already commenced on the new Welland ship canal. Operations have begun at Port Weller, the new town located at the Lake Ontario entrance to the new canal. Immense piers a mile and a half long and forming Port Weller harbor are being built by the Dominion Government at a cost of over three and one half million dollars.

Mr. A. D. Swan, the former assistant engineer of the Montreal Harbour Board, has returned to Montreal after spending several months in Central and South America. He also visited Kingston, Jamaica, in connection with a coal plant project. His object in visiting Central and South America was to report on some schemes for British capitalists.

The Dominion Government are inviting tenders for the construction of the two new piers that are a part of the huge development scheme in connection with the outer harbor at Victoria, B.C. Contracts for the construction of these piers will be let before the close of the year. The specifications call for ferro-concrete and the substructure will be of reinforced concrete.

That there is a serious lack of housing accommodation in Fort William is evidenced by the fact that although some four hundred dwellings have been erected there since last spring, living quarters are now even scarcer than ever before. It is pointed out that industries now nearing completion will have the effect of increasing the population enormously in the near future, so that the urgency which exists for more housing accommodation will be readily realized.

The amazing growth of some of the western provinces is indicated by the fact that four million dollars have been spent this year in British Columbia in building new roads and trails. The most notable achievement was the progress made on the Banff-Windermere motor road. The fact that plans are now being prepared for five million dollars worth of new civic work in Vancouver for next year seems a good augury for the building trade.

According to a return issued from Edmonton there was a falling-off in the number of building permits issued for the month of October. The total of $546,925 is a decrease in comparison with the same month of last year of $285,025. So far this year there have been issued permits to the value of $8,808,100. For the corresponding period in 1912 the amount was $13,011,352, which shows a falling off for the present year of $4,203,252 up to date.

The construction of the new terminal pier at Halifax is nearing completion and the dock is expected to be ready in time for the winter shipping traffic. As it now stands the pier extends almost 700 ft. out into the harbor and next summer it is planned to add another 100 ft. Extensive additions are also being made to the Immigration sheds, and a wall two storeys high is reared up across the full breadth of the property, about 150 yards.

Early next year a Canadian Roads Congress will be held in Montreal, with the object of bringing together the leading authorities on good roads, representatives of the Federal and Provincial Governments, municipal authorities, automobile associations, engineering societies—in fact all those interested in the good roads movement. Papers will be read on various aspects of the question, and it is also proposed to exhibit specimens of road materials and models of different kinds of machinery.

The name given by the C. P. R. to the new town a few miles south of Medicine Hat, where the Canada Cement Company is building its $2,500,000 plants, is Dauntless. It was formerly called Delano, but owing to confusion with a place in Alberta called Delano, the railway company decided on the change. While Delano post office is not on the railway, post matter and freight intended for Delano was sent there, much to the annoyance of shippers and recipients, as well as of the railway company.

Mr. Fuller, Architect of the Public Health Department, Ottawa, having examined the plans and specifications of the new Armories Building in course of erection at Amherst, N.S., has recommended a number of changes in the plans with a view of still further improving that building, which when finished is expected to be one of the most up-to-date of its kind in the Maritime Provinces. Messrs. Rhodes, Curry Company, Limited, are the contractors for the building, which will be completed by next fall.

The Ontario Gazette announces charters for the following companies:—The Lake Superior Drydock & Construction Company, Limited, Sault Ste. Marie, capital $1,500,000; Weseloh, Goudie Limited, Berlin, capital $200,000; Auto-Transportation Limited, Toronto, capital $150,000; Cornhill Limited, Toronto, capital $100,000; The Ramsden Sand, Gravel & Brick Company, Limited, Toronto, capital $100,000; The Nash Realty Company, Limited, St. Catharines, capital $100,000; John Heard & Company, Limited, St. Thomas, capital $75,000.

The corner-stone of the Toronto Housing Company's second building development at Bain Avenue, Toronto, was laid recently by the Hon. W. J. Hanna, Provincial Secretary, the ceremony being presided over by the Lt.-Governor Sir John Gibson. In addition to the Logan Avenue frontage, the whole work when completed will cost in the neighborhood of five hundred thousand dollars, and will include a central plant for the distribution of heating and hot water for domestic purposes. Accommodation will be provided for about two hundred families. It is expected that about half of the houses will be ready for occupation next spring. Application has already been made for a considerable number of the houses.

Canadian Railroad Development

According to Mr. S. P. Brown, chief engineer of the Mount Royal tunnel, the borings from the two shafts will meet on December 15th.

The new C. P. R. hotel at Calgary, which involves an expenditure of $1,500,000, is now nearing completion, and will be ready for opening by January. The hotel is nine storeys high, and the contractor for the work is Mr. P. Lyall.

New tenders will probably have to be called for the new Intercolonial terminals at Halifax. Tenders were received by the Railway Department, but is stated that none of these meet all the requirements. The whole work will cost upwards of $15,000,000.

The Montreal city engineers have prepared estimates of the cost of raising the Grand Trunk Railway tracks from Bonaventure Station to Point St. Charles. The cost is put at $5,500,000, while the Grand Trunk estimates it at $5,760,000. The City will have to bear a portion of the cost, and the Railway Commission will determine the amount to be so paid.

Mr. J. B. Armstrong, chief engineer of the Hudson Bay Railway, has resigned and is succeeded by Mr. J. Porter, who is on Major Leonard's staff in the construction of the National Transcontinental. It is understood that the head office of the Hudson Bay Railway construction department will be moved from Winnipeg to Le Pas. Mr. Armstrong proposes to go into the contracting business.

Mr. McLeod, railways and tramways engineer of the Montreal Council, has prepared a report outlining additional lines required in the outer wards, but the Tramways Company have declined to consider any building of fresh tracks until the company are granted more facilities for handling traffic in the centre of the city. Notwithstanding this, the Board of Control have been authorized to continue negotiations with the company.

Mr. R. P. Motley, the chief engineer of bridges of the C. P. R., has given some information as to the rebuilding and double-tracking of the bridge at Lachine, P.Q. The structure occupied three years in building, this extended period being due to the necessity of not interfering with the traffic on the single track of the old bridge. There were in effect, says Mr. Motley, two bridges, each of single track, traffic being shifted from up stream to down stream until the new track was finished. By June, 1910, the steel and masonry work were proceeding together, and the first half of the bridge was completed between June, 1910, and March, 1912. Last spring, the old spans were taken down and the last of the channel spans installed. Between April 21 last and October 21, the last five old spans—two 270 feet, two 408 feet, and one 120 feet—were taken out and five new spans of similar length erected. In connection with the work of building the bridge 3,500,000 rivets were used. The bridge is five-eighths of a mile long.

The Diamond Band Saw

A new departure and a complete revolution in the method of cutting stone was recently demonstrated at George Anderson & Company, of Canada's Scotch Works, Carnoustie, before many interested witnesses, amongst others Mr. F. E. Wallis, of Messrs. G. E. Wallis & Sons, Maidstone; Mr. J. H. Woodward, of Messrs. Holland & Hannen, London; and Mr. J. C. Wolstenholme, of Messrs. Walton, Goody & Cripps, Limited, London, who had travelled up to the works for the purpose of inspecting this machine.

George Anderson & Company have been experimenting on this method of cutting stone for the last four years, and have had to contend with numerous difficulties, owing to there being no data or experience in band saw practice for this particular purpose. Wood and iron band saw experience having been found quite useless in designing this machine, each step in the design had to be proved separately to find out what was best for this purpose.

To briefly describe the machine, it consists of two steel pulleys carried on four cast iron columns, these pulleys being so arranged through friction gear as to move simultaneously in a vertical direction at different speeds to suit the cutting. These pulleys carry the band, which runs at a speed of a mile a minute, the lower cutting edge of the band being fitted with diamond sockets at intervals of 3 in. to 4 in., and liberally supplied with an automatic water feed at the entering side of the stone. The whole of the machine is belt driven by a motor mounted on the machine. The feeds, belt moving gear, clutches, etc., are all operated from one position, the operator only having to mount his stone on a bogie and run it under the saw, start his machine, set his feed, and the machine automatically cuts the stone correctly.

The first cut taken was of Portland stone, blocks measuring up to 8 ft in length being negotiated, the cutting rate being 1½ in. per minute. The motor was connected to an ammeter, which showed the power taken. At this rate of cut 12 h.p. was required, and the band showed that no depreciable strain was being put on when cutting, as there was practically no tendency for the band to rise up against the pressure pulleys. A cut was taken right through the stone to the depth of 12 ins., and gave a perfectly clean surface ready to go on to any building without further attention, those present being particularly enthusiastic about the excellence of the surface left. A fresh cut was taken on the same stone at the rate of 3¾ in. per minute, when the power absorbed rose to 35 h.p., and no appreciable difference was shown at the finish of the cut. Some of the gentlemen present were rather sceptical about the results on marble, but on Sicilian marble being substituted for Portland stone, no variation was shown in the horse power taken or in the output. As a further test, a block of Cornish granite was placed on the machine; this was cut at the rate of 3 ins. per minute without any difficulty, a thing unheard of in the previous annals of stone working history.

For some reason, it has been considered that circular diamond saws could not cut granite. This was an erroneous impression, but it was certainly held that diamonds could not cut granite economically. In the rase of the band saw, the action of the band is different from that of the circular saw, for the band saw action is in the nature of a continuous scrape, rather than in the manner of a continuous blow and scrape as in the case of the circular saw. There is no reason to doubt therefore, that the diamond band saw has solved the problem of fast cutting of granite.

The machine under test has been installed at Haley's, Ont., for the Renfrew White Granite Company, and it is expected that a full and severe test in thorough keeping with our Canadian stone yard practice will be made during the next week or two.

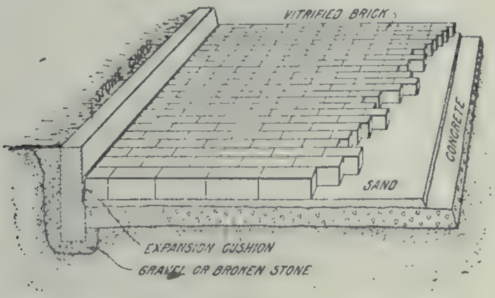
Brick Paving for Country Roads

Information Relative to Preparation, Construction and Cost

COUNTRY roads paved with vitrified brick are becoming quite common, and, owing to the general satisfaction which these roads are giving when properly constructed, it is probable that their mileage will continue to increase rapidly. The principal advantages which brick roads possess may be stated briefly as follows: (1) They are durable under heavy traffic conditions; (2) they afford easy traction and good foothold for horses; (3) they are easily maintained and kept clean; and (4) they present a pleasing appearance.

The principal disadvantage is the high first cost. The defects which frequently result from lack of uniformity in the quality of the brick or from poor construction are usually to be traced indirectly to an effort to reduce the first cost or to a popular feeling that local materials should be used, even when inferior.

In the preparation of the subgrade upon which a brick pavement is to be constructed, the essential features to be considered are thorough drainage, firmness, uniformity in grade and cross section and adequate shoulders.



Proper construction of stone curb.

Strong durable curbing should be supplied both on the sides and at the ends. Otherwise, the marginal brick will soon become displaced by the action of traffic and deterioration will spread over the entire pavement.

Satisfactory curbing may be constructed of stone, Portland cement concrete, or vitrified clay shapes made especially for this purpose. With stone the individual blocks should be not less than about four feet long and should have a depth of about 18 to 36 inches, depending on traffic conditions and on whether the curb is to project above the surface to form one side of the gutter. A thickness of four inches will ordinarily prove satisfactory. Stone curb should always be set on a firm bed of gravel, slag, or broken stone, not less than three inches thick, and should be provided with a backing of the same material on the shoulder or sidewalk side. Fig. 1 shows a typical stone curb in place.

Concrete curbs may be constructed alone or in combination with either a concrete gutter or a concrete foundation. The advisability of constructing a curb in combination with the foundation, however, is doubtful. Concrete curbs should have approximately the same cross-sectional dimensions as stone curbs and should be constructed in sections not exceeding about 7 or 8 feet in length.

Vitrified clay curbing should be set in much the same manner as that described for stone curbing. The principal additional requirement is that, since vitrified clay is a lighter material than stone and the curb sections are ordinarily shorter, the bedding must be made correspondingly more secure in order to prevent displacement.

The proper type of foundation depends largely on the material composing the subgrade and the character of traffic for which the road is designed. Where the traffic is comparatively light and the subgrade is composed of some firm material which does not readily absorb water, a very satisfactory foundation may be constructed of broken stone or gravel filled with sand. Where the traffic is comparatively heavy, however, or where the material composing the subgrade is defective in any way, a monolithic concrete foundation should be used.

Gravel and broken-stone foundation may be spread in one or more courses, each of which should be from 5 to 9 inches thick before compacting. The stone or gravel should be clean, hard, tough and durable and should be graded in size between certain reasonable, fixed limits. It should be compacted in the usual manner by rolling with a power roller weighing not less than about ten tons, and sufficient clean, coarse sand to fill the voids should be spread and flushed into the foundation while the rolling is in progress. When complete the foundation should present a surface uniform in grade and cross section and parallel to the proposed surface of the finished pavement.

Concrete foundations are unquestionably better adapted for brick pavements than any other type. They are practically monolithic in form, nearly impervious to water, and possess a relatively high crushing strength. All of these qualities may be obtained with a relatively "lean" concrete if the subgrade has been properly prepared. Under ordinary circumstances a satisfactory foundation may be constructed of concrete composed of 1 part of Portland cement, 3 parts of sand, and from 5 to 7 parts of broken stone or screened gravel.

It is necessary to provide an adjustable cushion of some kind between the foundation and the brick for correcting any slight irregularities in the surface and to secure an even bearing for the brick. Sand has been found a most satisfactory material and is almost exclusively used. The proper thickness for this sand cushion will of course depend on the extent of the inequalities. Two inches has generally proved very satisfactory.

After the cushion is spread uniformly it should be thoroughly compacted by rolling with a hand roller weighing from 300 to 400 pounds, and any depressions which form should be corrected.

The brick may all be hauled and piled at convenient intervals along the sides of the roadway before grading is begun. Hauling over the finished pavement with wagons until it is complete and opened to traffic should be avoided. If the brick are delivered on the work as needed, they should be unloaded from the wagons outside of the curb and carried to the pavers, either by hand or in wheelbarrows. Plank trackways should also be provided over the newly laid pavement for the wheelbarrows when they are used.

The brick should be laid on edge and in uniform courses running at right angles to the line of the pavement, except at intersections; and in order to "break the joints" each alternate course should begin with a half brick. In laying the brick the pavers stand on the pavement already laid and, beginning at the curb each time, carry across as many courses together as they can conveniently reach. The courses should be kept straight and close together, and if necessary each block of eight or ten courses should be driven back by means of a sledge and a piece of straight timber approximately 2 by 4 inches by 5 or 6 feet long. The brick should also be laid close in the courses and should be crowded together, if necessary, after a course is laid, by means of a crowbar inserted at the curb.

After the pavement has been laid and all defective brick have been replaced to the satisfaction of the engineer, the next step is to sweep the surface clean and smooth out all inequalities by means of ramming or rolling. The rolling should be done with a power roller weighing from 3 to 5 tons, and the pavement should ordinarily be rolled in both the longitudinal and transverse directions. The longitudinal rolling should be done first and should begin at the curbs and progress toward the crown. The roller should pass at least twice over every part of the pavement in both directions.

In order to keep the brick in proper position and protect the edges from chipping, it is necessary to fill the joints with some suitable material before the road is opened to traffic. The materials which have in the past been most commonly used for this purpose are sand, various bituminous preparations, and a grout made of equal parts of Portland cement and fine sand mixed with water.
used.

Sand is the least expensive of these materials, but there are several very serious objections to its use as a joint filler. Bituminous fillers vary considerably in quality and efficiency, but all are more or less unsatisfactory. One of the principal objections to their use is based on their tendency to run out of the joints into the gutters during warm weather and to crack and spall out during cold weather. This tendency can, of course, be partially overcome by exercising proper care in selecting the materials. It should also be noted in their favor that brick pavements, the joints of which have been filled with bituminous preparations, are ordinarily less noisy at first than those in which a Portland cement grout filler has been used. The grout filler is unquestionably very much superior from a standpoint of durability, however, and the excessive noise under traffic which has been frequently observed in connection with its use can be largely eliminated by the use of proper bituminous expansion cushions along the curbs. It is, therefore, recommended as better adapted for filling the joints in brick pavements than any other material which has been commonly used for that purpose.

Expansion cushions should be provided for at the time the brick are laid, by placing a board of the required thickness on edge adjacent to each curb. Small iron wedges may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as three-eighths inch for very narrow pavements.

The cost of brick pavements varies widely, and is affected by so many influences that it is difficult to attempt to derive a general expression showing the relation between probable cost and local conditions. The prices of brick, as also the prices of the various materials entering into the foundation, vary greatly according to the locality and the freight rate. The cost and efficiency of labor is also far from being constant. Furthermore, the material composing the subgrade and the method of preparing it may exert a marked influence on the cost of the pavement.

If C = cost of cement per barrel, S = cost of sand per cubic yard, A = cost of coarse aggregate per cubic yard, B = cost of paving brick per 1,000, and L = cost of labor per hour, with all materials considered delivered on the work and all costs expressed in cents, then the probable cost of constructing a brick pavement, including the subgrade, a 6-inch concrete foundation, and suitable curbs, may be estimated by substituting in the formula:

Cost per square yard $= 1.90\ L + .213\ C + .138\ S + .157\ A + .045\ B$.

The cost as estimated from this formula should, however, be increased by about 10 per cent. to allow for wear on tools and machinery and to guard against unforeseen contingencies. If it is desired to use a different thickness of foundation, it is safe to assume that each inch subtracted or added to the thickness of the foundation will make a corresponding difference of from 8 to 12 cents in the cost per square yard.

IN depositing concrete in deep water through a tremie the most difficult part of the operation is filling the tube at the start. As is well known, unless the tube is sealed in some way the cement will wash out during the downward passage and leave only a pile of stone and sand. This waste of concrete may in the case of a 12-in. tube 50 ft. long amount to more than 1 cu. yd. A simple but effective method of eliminating this waste used by Mr. G. W. Rear, general inspector of the Southern Pacific, was described by him at the recent convention of the American Railway Bridge and Building Association at Montreal. He starts with a 7 or 8-in. layer of planer shavings, which he covers with about 1 inch of cement. This forms a plug, and as the concrete is dumped on top the buoyancy of the plug and resistance of the column of water underneath prevent the first concrete from falling rapidly enough to wash out the cement; from then on the concrete itself serves as a seal.

SPEAKING before the Canadian Railway Club, Montreal, Mr. G. Percy Cole, M.Sc., Mem. A.I.E.E., Assoc. M.I.E.E., of the Canadian General Electric Company, advocated the electrification of railways as a means of conserving natural resources. He quoted figures to show the enormous cost of running locomotives by coal, and estimated that a saving of $2 per ton, or $147,000,000, could be saved in Canada and the United States if the railways were electrified. In the process of turning the coal into power we are throwing away 90 per cent. of its value—a serious national concern. When it is considered that 70 per cent. of railroad revenue from operation is obtained from the transportation of freight, it is easy to see why railway managers are beginning to study the question of electrification from the standpoint of economy.

Five and a-half million dollars is the estimated cost for raising the G. T. R. tracks from Bonaventure Station to Point St. Charles, Montreal, according to the report compiled by the City Engineer for the Board of Control. This estimate has been reached by Mr. McLeod, municipal and railway engineer. The cost, as estimated by the railway, is placed at $5,760,000.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
Sewer extension on Mill and Lorne, planned by Town Council. Clerk, W. H. McFadden. By-law carried Nov. 10.

Ingersoll, Ont.
Watermains extension planned by Town Council (Fire and Light Com.). Chairman, Councillor W. Mills. Additional hydrants to be installed.

New sewage system, $59,000. Engineers, F. W. Thorold & Co., 2 Toronto St., Toronto. Plans drawn.

Medicine Hat, Alta.
Subway, $52,303, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. To be completed about July 27, 1914. Plans drawn.

Paving and sidewalks, cost $32,450, contemplated by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer.

Ottawa, Ont.
Coverings for wells planned by City Council. Mayor, J. A. Ellis. General contractors, Gibson & McCardie. 12 buildings, frame construction.

Port Arthur, Ont.
Commissioner of Utilities, J. J. Hackney. Construction of pipes, Drummond, McCall & Co., 28 Victoria Sq., Montreal. Duplicate pipe line of welded steel pipe 24-in. diam., line 5 miles long. Pumping station is planned by the City Council being erected at shore end of intake. System to be in operation by summer of 1914.

Regina, Sask.
Equipment for new filter bed planned by City Council. Contracts awarded as follows: Adams' Hydraulics Ltd., York, England, for 1 "Cresset" distributor, $843. Canadian Lock Joint Pipe Co., Ltd. Regina, for about 10,700 sq. ft. triangle wire mesh at 3c sq. ft., $321. Drummond, McCall & Co., Winnipeg, for one 6-in. gate valve, $22; one 12-in. gate valve $52. Canada Iron Carberation for supply of pipe.

A subway costing $50,000 is contemplated by City Council. Commissioner, L. A. Thornton. City Engineer, F. McArthur. Plans will be prepared this winter. Work to start next year.

The additions to filter bed, cost $14,700, planned by the City Council, have been completed. Commissioner, L. A. Thornton. City Engineer, F. McArthur. General contractor, O. W. Smith, 4 Peart Block.

St. John, N.B.
Street extensions are contemplated by City Council. Mayor, Mr. Hooper. Carleton and Aberdeen Sts. to be extended to new I. C. R. freight sheds.

Stratford, Ont.
Sewer, cost $10,500, Erie, planned by City Council. Mayor, C. N. Greenwood. Concrete arch to cover sewer. Plans in progress.

Toronto, Ont.
Asphalt pavement on roadway north of Withrow Park, estimated cost $5,000, recommended by Board of Control. Commissioner of Works, R. C. Harris.

Pavements recommended by Board of Control. Commissioner of Works, R. C. Harris. Asphalt pavement on Glenholme, Boultbee, Gertrude and Montclair. Estimated cost $8,010. Brick block on two lanes. Estimated cost $1,530.

Board of Control, Mayor H. C. Hocken. Commissioner of Works, R. C. Harris, recommend grading the following streets: Hiawatha Ave., $1,112; Glen Mount Park Rd., $13,630; Burgess Ave., $5,520; Sparkhall Ave., $2,280; Brookside Drive, $21,063.

Tenders received until Nov. 18th for sewers planned by Board of Control. Mayor, H. C. Hocken. Plans at office of Commr. of Works, R. C. Harris. Ascot, Springmount, Benlamond, Farrford and Dufferin. Midway Drainage System, Gerrard and Hiawatha.

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders will be called after Dec. 13th. Asphalt on Cornwall and Renhold, estimated cost $4,927. Brick on lane east of Dovercourt, $5,908.

Tenders received by Engineer until Nov. 15th, for concrete walks on Baby Point Crescent, planned by York Twp. Clerk, W. A. Clark, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E.

Wainfleet, Ont.
Tenders received by Reeve, on behalf of Council, until Nov. 27th for repairing and enlarging Beederman Drain. Plans, etc., at office of Reeve, P. J. Wilson, Marshville, Ont.

Welland, Ont.
Tenders received by Clerk, C. M. Webber until 4 p.m. Nov. 17, for sewers on Parkway, Cross, Fraser, Edward, Hooker, Queen, Cady, Cozy and Welland Sts., and sewer connections on North Main St., Division, Hellems, Burgar and Cross Sts. Plans and specifications at office of Engineer, also further information. Chairman of Sewerage Com., Jas. Hughes. Town Engineer, D. T. Black.

Winnipeg, Man.
Prov. Govt. Dept. of Public Works contemplate spending $2.500.000 on good roads. Acting Minister, G. R. Caldwell.

CONTRACTS AWARDED

Camrose, Alta.
The Municipal Council contemplate the purchase of road machinery. Commissioner of Works, Sydney Appleton. A concrete mixer and stone breaker will be required early next year. Commr. of Works will receive prices for both steam and gasoline units, which must be portable and self-contained.

Ottawa, Ont.
Intercepting sewer, cost $56,827, planned by City Council. Mayor, J. A. Ellis. City engineer, Arch. Currie. General contractor, Thos. McLaughlin, Sterling Ave. Brick and concrete construction.

Regina, Sask.
Paving planned by City Council. Engineer, F. McArthur. General contractors, National Paving Co., Ltd. For paving west side of Board St. subway, 2,796 sq. yds. at $5.60 per sq. yd.

Portable gasoline-driven centrifugal pumps required by City Council (Waterworks Dept.). Engineer, J. M. McKay, Supt. Waterworks Dept. General contractors, Canadian Fairbanks Morse Co., 300 Princess St., Winnipeg.

Toronto, Ont.
Special castings, cost $7,311, required by Board of Control. Mayor, H. C. Hocken. General contractors, Camden Iron Works, Camden, N.J. 20 in. and 36 in. special castings for waterworks system.

Sewer, cost $53,465, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Fussell-McReynolds Co., Dundas St. Storm sewer, Argyle St., from Shaw to Gladstone Ave.

Pavements planned by Board of Control. General contractor, Commr. of Works, R. C. Harris. Asphalt on Coady, Edith, Hickson, Standish, Theodore. Daylabor. Estimated cost $15,247.

Concrete sidewalks planned by Board of Control. Alton Ave., to Grant Contracting Co.; Bain & Windeat, to Wm. E. Ransom; Carlaw Ave., to A. Gardner & Co.; Evelyn Cres., to Herbert Mitchell; Lee Ave., to Queen City Concrete Paving Co.

Pavements planned by Board of Control. Asphalt concrete on Givens from Queen to Halton, estimated cost $7,003. Bitulithic on Peel and Russell Hill Rd., estimated cost $3,160. Brick block on Derby Lane, $2,595, to Commrs. of Works, day labor.

Sewers planned by Board of Control. General contractors as follows:—Balmy, Lyonde, Spruce Hill Rd., Willow Ave., to McLaren & Co., cost $5,795; Bloor St. W., Grant Contracting Co., $2,150; Cedar Ave. and McLean, National Contracting Co., $1,456; Pine Ave., J. F. Connally, $3,425; Regal Rd., W. E. Taylor, $1,593.

Sewers, cost $79,600, planned by Board of Control. General contractors, The Godson Contracting Co., Manning Chmbrs. West Toronto Sewer Outlet Div. No. 2, Contract No. 3. Keele St. and Uttley Park.

Winnipeg, Man.
Additional concrete pavement, McMillan Ave., planned by Board of Control.

Sec., M. Peterson. General contractor, C. F. Campbell, Supt. of Asphalt No. 2, for grading construction, of artificial stone curb and gutter and base. General contractor, J. W. Astley, Engineer of Constr., for surfacing.

Sewer, cost $4,600, Waverley St., planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Engineer of Constr.

Water mains, cost $739.05, planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Engineer of Construction. Water mains on Burrows Ave., Ethelbert St., Grey St., Kent St., Wolfe St., Spruce St.

Railroads, Bridges and Wharves

Black Rock, Ont.
The G. T. R. has been authorized to construct bridge No. 62, mileage 152.25 from Black Rock over Public Road between Lot 12, Huron Road, Con. and Lot 83, Maitland, Twp. Goderich, Co. Huron.

Edmonton, Alta.
Bridge, over Sask. River. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox, Civic Offices. City Engineer, A Latornell, Civic Offices. General contractors, Carter, Halls & Aldinger, Winnipeg. Piers in, work to be continued when river is frozen over.

Kingston, Ont.
The C. P. R. has been authorized to construct spur for Frontenac Floor & Wall Tile Co., Ltd., mileage 101.58, Ont. Div., Kingston Sub. Div., in lot No. 8 Con. West of Great Calaraqua River.

Listowel, Ont.
The G. T. R. have been authorized to construct siding into premises of Andrew Malcolm Furniture Co., Ltd.

Little Sands, P. E. I.
Breakwater planned by Dom. Govt. Dept. of Public Works. Ses., R. C. Desrochers, Ottawa. Tenders received by Secretary until 4 p.m. Dec. 3rd. Plans etc., at offices of Dist. Engineers, Charlottetown, P. E. I., and Halifax, N.S., Postmaster, Little Sands, and at Dept., Ottawa.

Mara, B.C.
The C. P. R. has approved the location of station at Mara in N.E. ¼ Sec. 8-20-8, W.6.M.

Province of Ontario
The C. N. O. Rly. has approved the location of station at Alice, mileage 96.65 from Ottawa.

The C. N.-O. Rly. has location of station at Hiam, mileage 91.6 from Ottawa.

The C. P. R. has been authorized to construct bridge No. 9.17 on Nipigon Sub. Div., over Maggot River.

Ottawa, Ont.
Tenders received by Commissioners of Transcontinental Ry. Secretary, P. T. Ryan, Ottawa, until 12 o'clock noon, Nov. 27th, for 196,000 ties, to be delivered at Hervey Junction and La Tuque, Que., as per specifications. Specifications and further information at offices of Mr. Gordon Grant, Engineer, Ottawa, and A. E. Doucet, District Engineer, Quebec.

Port McNicoll, Ont.
The C. P. R. has approved the location of station in Lot 16, Con. 15, Twp. Tay, Co. Simcoe.

Regina, Sask.
Addition to car barns will not be undretaken at present.

The City Council contemplates building a timber bridge over the Wascana Creek at Elphinstone St. Commr., L. A. Thornton.

Rocky Point, P. E. I.
Wharf. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders will close with Secretary, Nov. 12th. Plans, etc., at offices of W. E. Hyndman, Dist. Engineer, Charlottetown, P.E.I., F. G. Goodspeed, Dist. Engineer, St. John, N.B., C. E. W. Dodwell, Dist. Engineer, Halifax, N.S., Postmaster, Rocky Point, and at Dept., Ottawa.

St. Catharines, Ont.
Bridge, cost $100,000, contemplated by City Council and C. P. Rly. By-law to be submitted to ratepayers.

Province of Sask.
The C. N. R. has approved location of station at Chandler.

Summerside, P. E. I.
Tenders for the repairs to breakwater planned by the Public Works Dept., have been received but nothing further has been done.

White River, Ont.
The C. P. R. has been authorized to construct bridge No. 35.92, White River Sub. Div., Lake Superior Div., near Goldie.

CONTRACTS AWARDED

Ottawa, Ont.
Automatic signals, cost $85,000, required by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones. General manager Intercolonial Rly., F. Gutelius, Moncton, N.B. General contractors, The Union Switch & Signal Co., Pittsburgh, Pa., and Montreal, Que.

West St. John, N.B.
Additional grain shipping and conveying galleries planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Jno. S. Metcalf Co., St. Francois Xavier St., Montreal. Steel, Dom. Bridge Co., Lachine. Electrical, O'Leary, 36 Recollect, and Gen. Elec. Co., 11 St. Sacrament.

Winnipeg, Man.
Paving bridge planned by Board of Control. Engineer, H. N. Ruttan, 223 James Ave. General contractors, Canadian Wood Preserving Co., Ltd., 305 Commercial Travellers Bldg., for supply of 1,300 sq. yds. of creosote blocks for paving Main St. bridge at $1.82 per sq. yd. General contractor, J. W. Astley, engineer of construction for laying creosote block pavement and constructing new sidewalk on Main St. bridge over Assiniboine River.

Public Buildings, Churches, Schools, etc.

Bienfait, Sask.
School contemplated by School Dist. No. 897. Treas., John H| McBeth. The Board of Trustees will borrow $2,000 for the purpose.

Beacon Hill, B.C.
School for School Board. Architect, J. C. M. Keith, 416 Sayward Bldg., Victoria. Tenders received by Secretary at office of Board of School Trustees until 4 p.m. Nov. 18th. Plans and specifications at office of Architect.

Berlin, Ont.
Church, cost $50,000, Benton and Church Sts., for St. Matthews Lutheran Church. Chairman of Bldg. Com., A. Sippel. Architect, W. H. Spear, Detroit, Mich. Carpenter, J. Baetz. Steel, Hamilton Steel Co., Hamilton. Excavating completed.

Edmonton, Alta.
Church, cost $30,000, planned by Norwood Presbyterian Congregation. Pastor, Rev. J. E. Duclos, Carey and Willow Sts. It has been decided to erect new church probably in spring.

Fort William, Ont.
Fire hall, cost $21,000, Pacific, for City Council. City Engineer, Ray R. Knight. Plans drawn. Tenders to be called shortly. Two storeys, 30 x 90, stone, common and pressed brick construction, concrete foundation, waterproofed, felt and gravel roofing.

Customs house, cost $175,000, May St. N., for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, M. H. Braden. Three storeys, 100 x 80, stone, reinforced concrete and brick construction. Excavating progressing.

Haileybury, Ont.
Court House and Registry Office planned by Prov. Govt., Dept. of Public Works. Secretary, H. F. McNaughten, Parliament Bldgs., Toronto. Tenders received by Secretary until noon, November 21st, for heating, plumbing and electric wiring. Plans, etc., at office of Sheriff, Haileybury, and at Department, Toronto.

Hamilton, Ont.
School furniture required by Separate School Board (Sherman Ave. N.) Sec.-treas. Com., Father Leyes, 260 Herkimer St. Seating, A. Thomson, Bay and York streets.

Addition to school, cost $82,000, Stinson St., for Board of Education. Sec. of Board, R. H. Foster, City Hall. Architect, A. W. Peene, Clyde Block. Tenders close with Architect, 5 p.m. Nov. 11. Two storeys, 10 rooms, brick construction, central heating plant, modern ventilating, slate roofing. Tenders open.

Mervin, Sask.
School planned by School Dist. No. 3045. Treas., H. Grant Dow. The Board of Trustees will borrow $2,000 for the purpose of securing a site, erecting and furnishing a school building.

Moncton, N.B.
Church, cost $62,200, Church and Queen, for First Moncton Baptist Church. Architect, C. B. Chappell, Charlottetown, P.E.I. General contractor, Jas. Reid, Moncton, N.B. Contractor changed. Building is to be floored this season and not completed until next year.

Montreal, Que.
Tenders are in for kindergarten school and janitors residence, for the Prot. Board of School Commrs., Notre Dame de Grace. Architects, Saxe & Archibald, 59 Beaver Hall Hill.

Church, Decarie Blvd., St. Lukes Congregational Church. Rev. W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Insurance Bldg. Contract for foundation to be given this week. Tenders for general contract to be called about November 17th.

Fire station No. 3, cost $57,900, Ottawa and Young, planned by Board of Commissioners. Secretary, L. N. Senecal. General contractor, C. E. Deakin, 41 Mayor.

Post office, Maisonneuve, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, C. Dufort, 192 St. Catherine W. Architect changed.

Armoury, Sherbrooke W., for McGill College. Principal Peterson. Architect, P. E. Nobbs, 49 Beaver Hall Hill (University Architect). Plans in progress.

Hospital, cost $35,000, Cedar Ave., for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg. General contractor, C. E. Deakin, 41 Mayor. General contractor will sub-let some trades. Foundations going in.

Fire and police station, cost $85,000, Bois de Doulogne, for Board of Commrs. Sec., L. N. Senecal. Architect, C. A. Reeves, 58 St. James St. General contractors, Picard & Balin, Gouin Blvd., Bordeaux, Que. General contractors may call for some trades. Excavating being done.

New Toronto, Ont.
Lodge hall contemplated by West Point Lodge of Oddfellows, No. 245. Three storeys, brick construction. Estimated cost $10,000. Work to start in spring.

Ottawa, Ont.
Alterations to St. Johns Evangelist Church Hall, Elgin St., costing $5,000. Carpentry, Taylor & Lackey, 1st Ave. Electrical, P. Ackroyd, 128 Bank St. Walls up.

Church contemplated by St. Lukes Anglican Church. Pastor, Rev. W. A. Read, 760 Somerset. Committee, Rev. C. L. Bilkey, W. Farmer, E. Foster, R. Barnett, Dr. Hollingsworth. Address members, c/o Pastor. Site will be purchased.

Prince Albert, Sask.
The Board of Trustees will borrow $26,000 for the purpose of completing and equipping George V., Queen Mary and Connaught Schools. Treas., C. O. Davidson.

Port Arthur, Ont.
Central school contemplated by the Board of Education. Chairman, Mr. Roberts. Trustee, J. A. Kennedy. Site selected, 264 ft. frontage x 165 ft. deep.

Market building, cost $12,000, planned by City Council. Mayor, J. A. Oliver. Clerk, T. F. Milne. Chairman of Com. in charge, Ald. Lester Cain, 20 Winnipeg Ave. Architect not yet appointed. Option for site accepted by Council Nov. 10th. Location, Lower Van Norman St. between Court and St. Paul streets. Work to start in spring.

Quill Lake, Sask.
School planned by School Dist. No. 936. Treas., John Buie. The Board of Trustees will borrow the sum of $5,000 for the purpose of erecting and furnishing school.

River Glade, N.B.
Hospital, cost $15,000, for the Jordan Memorial Sanitarium, c/o Dr. David Townsend, River Glade. Architect, F. Neil Brodie, 42 Princess St., St. John. To accommodate 100 patients. Concrete foundation, frame construction, felt and gravel roofing, birch floors. Plans in progress.

Regina, Sask.
Addition to car barns, cost $20,000, planned by City Council (Street Railway Dept.) Commissioner, L. A. Thornton. Supt. Street Railway Dep't., H. Doughty. Plans will be prepared this winter. Work to start next year. Brick construction and foundation, corrugated iron roofing, electric lighting, concrete foundation.

Police station for City of Regina (Police Commission). Architects, Clemensha & Partnall, 1721 Scarth St. Consulting engineer, S. S. Kennedy, 211 Carlton St., Winnipeg, has been appointed to drawn plans for plumbing, heating and ventilating system for police station.

Collegiate, cost $35,000, contemplated by Collegiate Institute. Sec.-Treas., J. Kelso Hunter, 1818 Scarth St. Site purchased. Nothing further will be done until spring 1914.

Sarnia, Ont.
School, cost $30,000, planned by School Board. Chairman, A. N. Hayes, M.D., 142 Christina. Architect, Robt. W. Fawcett, 152 Essex St. To be completed early in 1914.

Province of Saskatchewan
The Board of Trustees will borrow the sum of $18,500 for the purpose of purchasing school site, erecting and equipping a school building. Treas., Cecil C. Forsham, Cando.

School contemplated by Riverdene School Dist. No. 3081. Treas., W. R. Miller, Calbri. The Board of Trustees will borrow $1,800 for the purpose of erecting and equipping a school building.

St. Agathe des Monts, Que.
Post office planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Finley & Gagnon, New Birks Bldg., Montreal. Tenders will not be called till some time in December. Plans drawn.

St. John, N.B.
Fire apparatus for City Council. Commissioner for Public Safety, H. McLellan. Prices wanted for gasoline pumping engine, motor chemical and hose cart. No tenders will be called.

Selkirk, Man.
Addition to hospital for insane planned by Prov. Govt. Dept. of Public Works. Minister, Hon. W. H. Montague, Winnipeg. General contractors, Carter, Halls & Aldinger, Union Bank Bldg., Winnipeg. Tenders received by Architect, V. W. Horwood, 261 Fort St., Winnipeg, until noon Nov. 24th, for plumbing and heating. Plans, specifications, etc., at offices of Prov. Architect.

Stratford, Ont.
Addition to Shakespeare School, Strachan, contemplated for Public School Board. Chairman of Com., Dr. Eidt. Chairman of Board, Jas. Stewart. Inspector, Jas. Smith. Red pressed brick construction, stone foundation, slate roofing.

Toronto, Ont.
A church, cost $40,000, is contemplated by Bellefair Methodist Church Congregation. Pastor, Rev. Dr. German, 8 Williamson Road. Institutional building, seating capacity 1,200. Will include gymnasium, library, etc.

Lodge Hall for Dian Loyal Orange Lodge No. 2054, 182 Rhodes. Secretary Building Committee, J. L. Bolton, 146 Hiawatha Rd. Architect, W. J. Morris. Two storeys, 25 x 65, brick and stone construction, gas and electric lighting, hot water heating, seating and lodge furniture required. Plans drawn.

Police station, cost $8,000, Centre Island, for Board of Control. General contractor, Property Commsr. Chisholm. Work being done by day labor under Inspector Chick. Two storeys, concrete foundation, brick and frame construction.

Addition to church contemplated by Queen St. East Presbyterian Church. Pastor, Rev. W. H. Andrews, 85 Simpson Ave. Seating capacity to be enlarged to 1,200.

Union, Ont.
Essex County Health Assn. contemplate purchasing hospital equipment. Regent, Mrs. C. R. Casgrain, Windsor. Equipment for tuberculosis hospital required.

Vawn, Sask.
The Board of Trustees, Treasurer, H. G. Winger, will borrow the sum of $2,500 for the purpose of purchasing site, erecting and equipping a school building.

Victoria, B.C.
Drill hall, McBridge and Bay Sts., for Dom. Govt. Dept. of Public Works. Tenders received by Sec., R. C. Desrochers, Ottawa, until Dec. 11th. Plans, specifications, etc., at office of Wm. Henderson, Post Office Bldg., Victoria, Postmaster, Victoria, and at Dept., Ottawa. Two storeys, 120 x 100.

Welland, Ont.
Addition to registry office, East Main, for Welland County. Clerk, Robt. Cooper. Chairman, W. W. Brookfield. Architect, A. E. Nicholson, St. Catharines. Also new roof on old registry office, etc. Registry office fittings required. Additional 1 storey and basement, 60 x 30, pressed brick construction, cement foundation. Plans in progress.

Westboro, Ont.
Church, cost $11,000, for Presbyterian Church. Pastor, Rev. W. H. Cram. Architect, J. P. McLaren, 104 Sparks St., Ottawa. Plastering, Bowman & Son, Ottawa, Roofing on.

Weyburn, Sask.
City and fire hall for City Council. Mayor, M. C. Taggart, City Hall. Sec.-Treas., J. D. Murray. Architect, B. O. Boyam. Work will not start until after sale of debentures. Plans drawn.

Windsor, Ont.
Addition to hospital, cost $25,000, Ouellette, contemplated for Hotel Dieu, Ouellette Ave. and Erie St. Pres., Dr. E. Prouse. Sec., Dr. W. C. Pepin. Architect not yet appointed. Two storeys, brick construction.

Winnipeg, Man.
Addition to hospital, cost $65,000, Selkirk, for Prov. Govt. of Manitoba. Minister, Hon. W. H. Montague. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, Carter, Halls & Aldinger, Union Bank Bldg. Tenders re-

ceived by Architect until Nov. 19th, for electric wiring.

Church, Qu Appelle Ave., for Knox Presbyterian Church. Pastor, Dr. Du Val.. Architect, J. H. G. Russell, 1105 McArthur Bldg. General contractors, J. McDiarmid & Company, Canada Bldg. Excavating finished. Work suspended till 1914.

Yorkton, Sask.

The Board of Trustees will borrow the sum of $16,000 for the purpose of purchasing site, equipping and completing new school building.

CONTRACTS AWARDED

Montreal, Que.

Hospital, cost $35,000, Cedar Ave., for Children's Memorial Hospital, Cedar Ave. Architects, Brown & Vallance, 44 Canada Life Bldg. General contractor, C. E. Deakin, Mayor St. Contract awarded.

Regina, Sask.

Addition to hospital for City of Regina (Hospital Board). Architect, N. R. Darrach, Western Trust Bldg. General contractors, R. J. Lecky Co., Northern Crown Bank Bldg. Heating and plumbin, Regina Plumbing & Heating Co., Ltd., Hamilton St., $42,000. Contract awarded.

Garbage transfer station for City Council. Contract for roof trusses awarded to Sack & Co., $15,870.20.

Steelton, Ont.

Post office, cost $30,000, for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Thos. R. Wilks, 612 Queen St., Sault Ste. Marie. General contractors, Woolrich & Thornton, Sault Ste. Marie.

Toronto, Ont.

Church, cost $8,000, Glen Morris, for St. Pauls Lutheran Church. Architect, M. Klien, 46 Bellevue Place. Mason, F. & A. E. Ham, 83 Salem. Carpenter, O. S. DeForest, 67 Westmoreland Ave. Work not started. One storey, 32 x 69, brick and steel construction, brick foundation, slate roofing.

Alterations to school, Dewson, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Mason, J. C. Bayliss Sons, 278 Gladstone Ave., $499. Ash hoist, Elevator Specialty Co., 36 Lombard St., $541.

Addition to school, Ryerson, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Mason, A. Webb, 12 Shirley st., $13,398. Carpenter, F. Armstrong, Oak St., $11,850. Plastering, Geo. White, 688 Kingston Rd., $2,522. Painting, James Taylor, 179 Markham St., $1,150. Roofing, A. Matthews, 256 Adelaide St. W., $880. Fireproof floors, R. Bennett, Kingston Rd., $999. Iron stairs. Shipway Iron Bell & Wire Mfg. Co., King W., $1,348. Plumbing, L. Legrow, 98 Harbord St., $338.

Westboro, Ont.

Contract has been awarded to J. A. Ellacott, 226 Bank St., Ottawa, for wiring and new fixtures in the First Baptist Church.

Business Buildings and Industrial Plants

Beaconsfield, Que.

Alterations to club house, cost $55,000, planned by Beaconsfield Golf Club, R. J. Tooke, Montreal. Architects, Brown & Vallance, Can. Life Bldg., Montreal. General contractors, Atkinson, Glassco, Lawrence, Ltd., 45 St. Alexander St., Montreal. General contractor will call for tenders on plastering, plumbing, heating and electrical work, in spring. Excavations to be started.

Berlin, Ont.

Auto factory for H. Nyberg. Industrial Commissioner, Geo. Rumpel. One storey, 250 x 250. Plans drawn.

Felt hat factory, Victoria St., for Walter G. Rumpel. General contractor, J. Baetz, day labor. Three storeys, 60 x 120. Foundations in.

Wholesale grocery warehouse, Victoria, for J. Sloan & Co., Church St., Toronto. Architect, C. Knechtel. Carpenter, Geo. Bucher. Foundations in.

Brantford, Ont.

Ice manufacturing plant contemplated for Brantford Ice Co. New ice manufacturing plant to be constructed. Estimated cost, $45,000.

Caledonia, Ont.

Elevator and warehouse for The Shirra Milling Co. Arrangements are being made to have G. T. R. build switch into new premises. Plans in progress.

Calgary, Alta.

Warehouse, $150,000, for Pilkington Bros. Architects, Hodgson, Bates & Beattie, Grain Exchange. General contractors, mason, carpenter and painting, Carter, Halls & Aldinger, Burns Block. Heating and plumbing, Wm. Heab & Co., Ltd., 833 7th Ave. W. Electrical, Gracey Crane Elec. Co., 6th Ave. and 1st St. W. Brick work to start.

Stores and offices, cost $250,000, for Herald Publishing Co. Architects, Brown & Vallance, 400 Lougheed Bldg. General contractors, Fysche, McNeil, Martin & Trainer, Dominion Bank Bldg. Trimming interior.

Canada Life Bldg., for Canada Life Assurance Co. Architects, Brown & Vallance, 400 Lougheed Bldg. General contractors, Fysche, McNeil, Martin & Trainer, Dominion Bank Bldg. Interior trimming.

Creamery, cost $12,000, 3rd ave. and 5th St. W., for P. Pallesen. Architects, Laing & Smyth, 210 Beveridge Block. General contractors, Union Building Co., Judge Travis Bldg. Two storeys, brick veneer and frame construction. Foundations in. 46 x 110.

Stores, cost $5,000, 17th ave., for P. J. Crohan. Architects, Laing & Smyth, 210 Beveridge Block. One storey, 50 x 70, hollow tile construction, concrete foundation, Carey roofing. Nothing will be done till next spring, when tenders will be called.

Stores and bachelor apartments, cost $50,800, for P. O. Sullivan. Architect, J. B. Henderson, 313 Beveridge Block. General contractors, McDougall & Forster. Two storeys, 75 x 130, brick and reinforced concrete construction, cement foundation. Tenders will be called in about two weeks.

Warehouse, for Alaska Bedding Co. General contractors, Carter, Halls & Aldinger, 7th and 1st Sts. W. Completed.

Charlottetown, P.E.I.

Curling rink, cost $5,000, Grafton, for Charlottetown Curling Club. Secretary, Sydney Grey, 31 Orlebar. Architect, C. B. Chappell. Secretary will shortly call for tenders. Ice area 148 ft., three waiting rooms. 70 x 160, frame construction, pitched roof. Plans in progress.

Edmonton, Alta.

Rectory, cost $5,000, Picard, for Ruthenian Catholic Mission. Architect, A. J. McCormick, Gen. Del. Two storeys, 26 ft. 6 in. x 32 ft. 6 in., brick construction, concrete foundation, shingle roofing. Foundations started.

Alterations to building, Crystal Block. Promotor of company, Jno. Dawson, Crystal Block. Capital, $28,000. Basement of building will be altered and equipped with Turkish baths, swimming pool, etc. Work to start at once.

Store and apartment, cost $20,000, Syndicate, for Architect, E. S. McQuaid, Gariepy Block. General contractor, masonry and carpentry, Mr. Armstrong, General Delivery. Three storeys, 133 x 77½, brick construction, concrete foundation, felt and gravel roofing. Foundations started.

Store and apartments, cost $60,000, for E. S. McQuaid, Gariepy Block. General contractor and architect, McSporrin & Co., 715 2nd street. Three storeys, 100 x 66, steel and brick construction, felt and gravel roofing, electric lighting, steam heating, fir floors, wood fibre plastering, plate glass, fire escapes, store fronts and fixtures, telephone system, fire extinguishers. Foundations in.

Store contemplated at Whyte ave., for Jno. Walters, Walterdale. Store to be built on site of building recently destroyed by fire.

Goderich, Ont.

Addition to plant, cost $90,000, contemplated by American Road Machinery Co. Ratepayers will vote on Nov. 29th to guarantee bonds and give fixed assessments.

Hamilton, Ont.

Stores and apartments, cost $10,000, King street, for T. W. Hand, 584 King St. W. Architects, J. A. Armes and Walter Scott, Federal Life Bldg. Roofing, M. V. MacLean, 314 Hess St. S. Walls up.

Stores and hall, cost $25,000, Main St. E., for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Painting, Goodale & Laidlaw, Hunter St. E. Metal work, M. V. MacLean, 314 Hess St. S. Foundations in.

Kincardine, Ont.

Chopping mill. Owner and general contractor, J. W. Rea. Two storeys, 36 x 40, frame and steel siding construction, steel roofing, machinery required. Work started.

London, Ont.

Store, cost $12,000, King near Talbot, for S. E. Burridge, 99 King St. Tenders received by owner. Plans drawn. Two storeys, 50 x 80, red brick construction, concrete foundation, felt and gravel rfg.

Remodelling two stores, cost $10,000, Dundas street, contemplated for W. G. Young, jeweller, 500 Colborne street. All new furnishings required, shelving, show cases, burglar alarm, vaults, store fronts, plate glass, etc.

Midland, Ont.

Saw Mill boiler house. Dollartown. Owner and general contractor, Manley Chew. To be in operation next spring.

46 x 44, Dutch ovens to be installed, also additional engine. Work is in progress.

Montreal, Que.

Factory, cost $5,000. Owner and general contractor, A. Chenevert, 103 Delorimier. Work done by day labor. Three storeys, 80 x 40, concrete foundation, felt and fravel roofing. Excavating.

Stores, Westmount (Victoria and Sherbrooke W.) for F. P. Buchanan, Victoria and Sherbrooke. Architect, H. E. Shorry, 56 Beaver Hall Hill. Plans will be ready shortly.

Club house, cost $30,000, Westmount for Westmount Lawn Bowling Club. Secretary, F. Fowler. Owners have decided to build a small addition to present wooden house.

Offices, St. Lawrence St. and Notre Dame E., contemplated. Interested, Mr. R. T. Leclerc, 8 St. Lawrence Blvd.

Stores, Westmount, for F. P. Buchanan, Victoria & Sherbrooke,. Architect, H. E. Shorey, 56 Beaver Hall Hill. General contractors, A. F. Byers & Co., 340 University. Excavating in progress.

Garage, cost $7,000, Westmount (Roslyn Ave.), for Geo. Rabinovitch, 107 St. James St. Architects, Saxe & Archibald, 59 Beaver Hall Hill. Masonry and carpentry, Favre & Corbeau, 12 Erie Street Roofing, Douglas Bros., 19 St. Maurice. Excavating proceeding.

Moose Jaw, Sask.

Six stores, cost $11,000, 6th and Horne Sts. Owner, R. F. Jackson, Sixth and Horne Sts. Architect, Sholto Smith, 36 Main St. One storey and basement, 125 x 65, brick, structural steel and terra cotta construction, cement foundation, B. C. fir floors, galvanized iron, felt and gravel roofing. Sketches drawn.

Newmarket, Ont.

Summer hotel contemplated for Wm. Prosser. Site has been purchased on Lake Shore.

North Buxton, Ont.

Contemplated purchase of chopping mill equipment for C. H. Shupe. Machinery to be operated by steam. All new apparatus required.

Oakville, Ont.

Planing mill contemplated by the Owners, Messrs. Davis & Doty. 45 x 100, brick construction, electric motors required.

Ottawa, Ont.

Business block, cost $145,000, Wellington street, for American Bank Note Co., Wellington St. Architect, J. Albert Ewart, 193 Sparks St. Carpentry, J. & C. Low, 262 Catherine. Walls up four stys.

Theatre, cost $40,000, Bank St., for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Brick, T. C. James, 140 Flora St. Steel, Dominion Bridge Co., Sparks St. Tenders not yet called for other trades. Foundations going on.

Stores and offices, cost $50,000, Queen, for R. W. Stephens, Queen St. Architect, Jas. Mather, Wellington St. General contractors, Chas. Holbrook & Sons, 425 Somerset. Steel and brick construction, concrete foundation, waterproofed. Excavation going on.

Alterations to bank, cost $15,000, Wellington, planned by Bank of Montreal. Manager, Mr. Parker. Architect, C. P. Meredith, 126 Sparks St. Carpentry, J. G. Adamson, 126 Sparks St. Foundations in.

Harness factory and warehouse, Mosgrove, for S. & H. Borbridge, 90 Rideau St. Electrical, Rideau Electric Co., Rideau St. Walls up.

Business block, cost $100,000, Bank St., for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Carpenter, Alex. Christie, Elgin Street. Walls up six storeys.

Prince Albert, Sask.

Packing plant, $20,000, for Saskatchewan Abattoirs Ltd., North P.A. Architect, N. Luke. General contractor, masonry and carpentry, Luke Bros. One storey, 30 x 60, concrete blocks, reinforced concrete and brick veneer construction, composition paper, felt and gravel roofing, electric lighting, ventilating, concrete floors. Foundations in.

Factory, cost $120,000, contemplated by Royal Farm Machinery Co. Representative, F. L. Taylor. Company has been granted site of five acres.

Petrolia, Ont.

Remodelling store contemplated for J. W. Patterson, clothier. Architect to be selected.

Regina, Sask.

Hotel, cost $45,000, Broad St., for Geo. Broder, Winnipeg and Victoria Sts. Architect, S. J. Tripp, Princess Theatre Bldg. Tenders will not be called for other trades until early in spring, 1914. 100 bedrooms, brick and terra cotta construction. Foundations in.

Printing office, Halifax St., for Saskatchewan Courier, 104 Northern Crown Bank Bldg. Manager, F. Brewgmann. General contractors, Parsons Construction & Engineering Co., Ltd., 1712 Scarth St. Foundations in.

Machine shop contemplated for Norris & Barrett Co., Petoskey, Mich., U. S. A. for manufacture of steel tools and rough instruments of various kinds. Have applied to city for site.

Stratford, Ont.

Addition to factory for the Avon Hosiery Co., 82 Erie St. Manager W. Pearson. By-law to guarantee bonds and fixed assessment defeated. Company proposed to add four storeys, 95 x 60, to present plant.

Strathroy, Ont.

Addition to bakery, cost $5,000, contemplated for Jno. Nunn. Architect to be selected. White brick construction.

Sunnyside, Ont.

Addition to hotel, cost $5,000, for Albemy Chappus, Sunnyside. Architects, G. Jacques & Co., Windsor. Two stys., 30 x 69, concrete foundation, frame construction, shingle roofing. Plans in progress.

Saskatoon, Sask.

Stores and offices, $600,000, for J. C. Drinkle. Architects, Thompson & Crockart, Masonic Temple. General contractors, Frid Lewis Co., 637-9 Somerset Bldg., Winnipeg. Five storey addition to be added to building, being erected Work will be completed in the spring. Ten storeys and basement, 75 x 100, brick, stone, reinforced concrete, granite and hollow tile construction.

Toronto, Ont.

Factory, cost $25,000, for Lever Bros., Ltd., Eastern Ave. Architect, Geo. W. Gouinlock, Temple Bldg. Two storeys, 35 x 118, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, lime and sand plastering, metal lath and sash, wire glass, fireproof doors. Plans drawn.

Addition to warehouse, cost $6,000, for Barrett Bros., 111 Adelaide St. W. Mason, Wickett Bros., 35 Deer Park Cres. Carpenter, E. A. Cale, 312 Wellesley. Two storeys, 20 x 38, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, concrete and birch floors, metal sash, wire glass, fireproof dors. Excavating.

Store and apartments, cost $6,000. Owner and general contractor, I. Ellenson, 211 McCaul St. Architects, Ellis & Connery, 72 Queen St. W. Three stys., 24 x 60, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, spruce, birch and oak floors, lime and sand plastering, wood lath, plate glass, built-in fireplaces, mantels. Plans drawn.

Addition to warehouse, cost $8,000, for Debenham & Co., Wellington & Bay Sts. Architect, Geo. W. Gouinlock, 1108 Temple Bldg. Mason and carpenter, Joseph Sim, 372 Markham St. Plumbing, R. Paterson, 907 Keele St. Four storeys, 20 x 80, reinforced concrete, steel and brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, lime and sand plastering, metal lath and sash, plate and wire glass, fireproof doors. Work in progress.

Store and apartment, cost $9,000, 1996 Dundas St. Owner and general contractors, Rosenfeld Bros., 572 Annette St. Owner employs regular staff, first floor will be occupied by Dom. Knitting Mills, for manufacture of sweaters, etc., about Feb. 1st. Three storeys, 30 x 80, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, spruce and concrete floors, lime and sand plastering, wood lath, plate glass, galvanized iron, store fronts, mantels. Work in progress.

Garage, cost $7,000, 268 Summerhill Ave. Owner and general contractor, J. Nelson, 115 Jarvis St. Brick and steel construction, brick and concrete foundation, felt and gravel roofing. Work in progress.

Villeray, Que.

Store and flats, cost $8,000, St. Hubert St., for Mr. Auger, St. Hubert St. Architect, Z. Trudel, 238 St. Andre St., Montreal. Nothing further will be done till spring.

Weyburn, Sask.

The additional two storeys to the McKinnon Departmental Store will not be started at present.

Windsor, Ont.

Store and office building, cost $20,000, Pitt W., for Dr. A. J. Menard. Architects, G. Jacques & Co. Two storeys, 50 x 94, brick construction. Sketches in progress.

Winnipeg, Man.

Industrial plant is contemplated by Frys, Ltd., London, Eng. Additional information later.

Addition to office, cost $12,000, William and Ellen, planned by Public

(Continued on page 71)

Tenders and For Sale Department

WANTED

Duplex Steam Pump, Size 17 by 10 by 12. Slight variation in dimensions not detrimental.

J. L. MILLARD,
F Aylmer, Ont.

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913,** for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ÈD. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

BOARD OF EDUCATION
TORONTO

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, November 28, 1913.
for the several trades required in the

Enlargement of Strathcona School.
Enlargement of Western Avenue School.
also for
Heating and Ventilating, Plumbing, Electric Wiring and Heat Control in the following schools

REGAL ROAD PARKDALE
HUMEWOOD AVENUE
HOWARD KIMBERLEY
SHIRLEY STREET

also for
Hot Water Heating and Plumbing George Street School
and
Metal and Glass Partition St. Clair Avenue School.

Specifications may be seen, and all information obtained at the office of the Superintendent of Buildings, City Hall. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.
W. C. WILKINSON,
Secretary-Treasurer.

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
47-48 Woodstock, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of South Pier at Burlington Channel, Ont.," will be received at this office until 4 p.m. on **Monday, December 15, 1913,** for the renewal of South Pier at Burlington Channel, Wentforth County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department, at the District Engineer's office, Confederation Life Building, Toronto, Ont.; at the Post Office at Hamilton, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46299. 47-48

Tenders Wanted

Tenders are required for the erection and completion of a public school on Rawdon Street, in the City of Brantford, and will be received by A. K. Bunnell, Secretary, City Hall, Brantford, up to noon on **Friday, the twenty-eighth instant.** Form of tender, plans and specifications, and further particulars to be had of Taylor & Bodley, Architects, Brantford.

Brantford, Nov. 15th, 1913. 47

Special Notice

Every man who puts in a tender must see your plans and specifications first. If you are in Montreal and he is in Vancouver the inspection of your plans is a problem. Let us solve that for you. Place on file copies of your plans and specifications in any or all of the "Contract Record" offices.

Contractors and manufacturers read the "Contract Record." It is the logical place to look for tenders called, and where most important works are advertised.

Send along your plans when asking for tenders put a line in your advertisement to that effect.

No extra charge is made for filing plans at one or all four offices.

Contract Record
and Engineering Review

Montreal—119 Board of Trade.
Toronto—220 King Street West.
Winnipeg—Commercial Travellers' Bldg.
Vancouver—429 Pender Street.

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED

from

Experienced Contractors

for

Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

Business Buildings and Industial Plants

(Continued from page 69)

School Board. Secretary, R. H. Smith. Architect, Col. J. B. Mitchell, William and Ellen. General contractors, Worswick Bros., Hart Ave. Trimming interior.

Office, cost $173,000, Smith St., for Tribune Publishing Co. Architects, J. D. Atcheson & Co. General contractors, Hazelton & Walin, Donalda Bldg. Trimming interior.

Printing plant, McDermot and Margaretta, for Birt Printing Co., 386 Colony St. Architect, care owner. Plans drawn and work to start at once.

Addition to factory, cost $2,300, Talbot. Owners and general contractors, Bird Archer & Co., 563 Talbot St. One storey, addition, 24 x 28, stone foundation. Excavating proceeding.

CONTRACTS AWARDED

Berlin, Ont.

Theatre, cost $25,000, King West, for L. Longo, King St. W. Architect, C. Cowan, Victoria St. Electric, Rank & Ferrier, King St. W. Gallery completed, ready for seats.

Ford City, Ont.

Store and flats, cost $4,000, Drouillard, for Frank St. Louis, Windsor. Architect and general contractor, Walter Taylor, Windsor. Two storeys, 35 x 56, concrete foundation, frame construction, shingle roofing.

London, Ont.

Garage, cost $18,000, York St., for J. Hendricks, rear Gaste Cigar Factory, King St. General contractor, R. H. Smith, Wharncliffe Rd. Two storeys, 65 x 135, red and white brick construction; concrete foundation, waterproofed, asbestos roofing.

Montreal, Que.

Stores, etc., cost $750,000, St. Catherine and St. Denis, for U. H. Dandurand, St. James & St. Lawrence. Architects, Ross & MacDonald, 1 Belmont St. General contractor, C. E. Deakin, 41 Major St. Granite, Argenteuil Granite Co., 42 Craig W.

Ottawa, Ont.

A contract has been awarded by the city of Ottawa to McDonnell & Dibblee, New Birks Bldg., Montreal, for the erection of a temporary bridge at Bank St.

Alterations to hotel, Besserer, planned by Federal Hotel, Estate of Margeart Cowan. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Ed. Ave. Plastering, E. Normand, Redpath St. Painting, C. A. Ferguson. Heating and plumbing, Holloway & Son, 373 Somerset. Electric, Thos. E. Hopson, 213 Wellington. Bar room extensions, alterations and addition to lavatories, etc.

Alterations and addition to warehouse Wurtemburg, for McDougalls Ltd., 527 Sussex St. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Smith Bros., 448 McLeod. Metal work and heating, McKinley & Northwood, Rideau St.

Toronto, Ont.

Alterations to factory, cost $5,500, Don Roadway, for Lever Bros., Eastern Ave. Architect, Geo. Gouinlock, Temple Bldg. General contractors, T. Cannon & Son, 75 Brock Ave. Iron tanks, J. Inglis & Co., Strachan ave. Concrete foundation, brick construction, foundation for iron tanks.

Windsor, Ont.

Store, cost $25,000, Wyandotte, for G. Kahn, Windsor. Architects, Watt & Blackwell, London, Ont. Masonry, Geo. Goodman, Windsor. Carpentry, Victor Williamston. Two storeys, 55 x 60, brick foundation, reinforced concrete and brick construction.

Residences

Calgary, Alta.

Residence, cost $50,000, for Dr. N. J. Lindsay, 503 Centre St. Architects, Hubble & Kelly, Oddfellows Block. Two storeys and basement, cut stone and brick construction, one electric elevator. Work will be discontinued until next year.

Dartmouth, N.S.

Residence, cost $9,000, for W. H. Covert, K.C., care Covert & Pearson, 45 Sackville St., Halifax. Builder and general contractors, Thomson & Theakston, 100 Hollis St., Halifax. Sub-contracts not yet let. 2 ½storeys, 40 x 60, frame construction, shingle roofing. Foundations in.

Edmonton, Alta.

Residence, cost $5,000, for M. Price, architect and general contractor, 1822 26th St. 2½ storeys, 22 x 28, frame construction, brick foundation, shingle roofing, electric lighting, hot air heating, maple floors, wood fibre plastering, one built-in fireplace. Foundations started.

Eight residences, cost $8,000, for Alberta Lumber Co., architects and general contractors, Muskoka Ave. One storeys, 16 x 24, frame construction, brick foundation, shingle roofing, electric lighting, stove heating, fir floors, wood lath plastering. Walls up.

Exeter, Ont.

Four residences contemplated, cost $8,000, for C. B. Snell. Architect to be selected. 1½ storeys, brick foundation, frame and white brick construction, shingle roofing, maple and pine floors, lime and sand plaster, plumbing.

Hamilton, Ont.

Two residences, cost $6,000. Owner and general contractors, MacKay Bros., Lister Chambers. 2½ storeys, brick construction, stone and concrete foundation, shingle roofing, gas and electric lighting, hot water heating, maple floors, mantels, plumbing. Permit issued.

Six residences, cost $11,000. Owner & general contractor, M. Levy, Lister Chambers. Plumbing, Clyde Plumbing Co., York St. 2½ storeys, brick construction, concrete foundation, shingle roofing, hot air heating, pine floors, plumbing, electric lighting. Permit issued.

London, Ont.

Apartment house, cost $25,000, for R. Y. Stinchombe, Wharncliffe Rd, West London. Architect to be selected. Brick construction, gas and electric lighting, hot water heating, fireproof, maple and concrete floors, plumbing, lime and sand plastering.

Montreal, Que.

Six flats, cost $5,500. Owner, F. X. Poirier, 2257 Notre Dame W. Foundation ready. Work to go ahead in spring. Three storeys, 39 x 59, concrete foundation, felt and gravel roofing. Foundations in.

Six flats, cost $6,000. Owner and general contractors, Beaudin & Frere, 40 Walker. Three storeys, 38 x 63, concrete foundation, felt and gravel roofing. Excavating.

Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury St. General contractor wishes more tenders for heating, plumbing and electric. To close about Nov. 15th. Roof on.

Two residences, cost $10,000, for Anglins Ltd., 65 Victoria. Three storeys, 48 x 36, concrete foundation, felt and gravel roofing. Excavating done.

Apartment house, cost $20,000, for Mr. Joly, St. Viateur W. Architect, Z. Trudel, 238 St. Andre St. Plans are being changed for apartment house. Architect will be ready in a couple of weeks to call for new tenders.

Apartments, cost $8,000. Owners and general contractors, Hand & Pick, Belmont Ave. One storey, 58 x 73, concrete foundation, felt and gravel roofing, fireproof construction. Foundations in.

Residence, cost $7,000, Outremont (Querbes Ave.) Owner and general contractor, David Abel, 2156 St. Urbain St. Two storeys, 25 x 50, concrete foundation, pressed brick construction, felt and gravel roofing, gas and electric lighting, plate glass, hot water heating, hardwood floors, lime and sand plaster. Foundations going on.

Two residences, cost $16,000. Owner and general contractor, Geo. E. Blackwell, 4184 St. Catherine W. General contractor ready to receive tenders for roofing and electric. Contracts to be given shortly. Foundations going in.

Montreal West, Que.

Residence, cost $6,000, for G. E. Templeman. Architects, Peden & McLaren, St. Alexis St. General contractor, H. Payne. Concrete foundation, encased brick construction, slate roofing, gas and electric lighting, hot water heating, hardwood floors, lime and sand plaster, built-in fireplaces. Excavating.

Residence, cost $5,500, for A. Sampson, Canadian Fairbanks Morse Co., St. James. General contractors, Montreal West Realty & Contracting Co. General contractors doing all trades. Foundations in.

Residence, cost $5,000, for E. B. Barley, Westminster Ave. General contractors, Montreal W. Realty & Contracting Company. Walls up.

Residence, cost $10,000, Owners and general contractors, Montreal West Realty & Contracting Co. Brick construction. Foundations in.

Flats, cost $15,000, for J. A. Duval, 1701 St. Lawrence St. Architect, Z. Trudel, 238 St. Andre St. Three storeys, 90 x 25. Foundations in.

Ottawa, Ont.

Residence, cost $6,000. Owner, architect and general contractor, J. D. Wilson, 17 Clarey St. Brick construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch floors, water heaters, built-in fireplaces, mantels. Excavating.

Residence, cost $6,600, for S. J. Willoughby, 101 James St. Architect and general contractor, R. E. McKinstrey, 91

2nd Ave. Brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, oak and birch floors, water heaters, lime and sand plastering, built-in fireplaces, mantels. Excavating.

Residence, cost $6,000, for J. C. Reynolds, 117 Henderson Ave. General contractor, R. W. Hamilton, 81 Echo Drive. Double brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch floors, water heaters, built-in fireplaces, mantels. Excavating.

Residence, cost $6,000, contemplated by J. D. Wilson, 17 Clarey St. 2½ storeys, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and spruce floors, water heaters, built-in fireplaces, mantels.

Residence, cost $5,000. Owner and general contractor, Robert Edmondson 63 Blackburn. Stone foundation, double brick veneer construction, shingle roofing, electric lighting, hot air heating, water heaters, birch floors, built-in fireplaces, mantels. Excavating.

Residence, cost $8,000, for Col. Sherwood, Daly Ave. Architect, C. J. Burritt, 193 Sparks St. Carpentry, Ferguson & Lambert, King Edward St. Plastering not yet awarded. Walls up.

Residence, cost $6,000, for M. C. Odell, 335 Somerset St. E. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot water heating, birch and spruce floors.

Residence, cost $5,500, for Geo. E. Preston, 280 Elgin St. Architect, C. J. Burritt, 193 Sparks St. General contractor, R. W. Hamilton, 81 Echo Drive. Electrical, T. E. Hopson, 213 Wellington S. Walls up.

Quebec, Que.

Alterations to residence, cost $7,000, for Mrs. Luce Couture, cor. St. Joseph and St. Anselme. General contractor and mason, A. Deslauriers, 400 St. Francis. Two walls to be demolished and rebuilt. Three storeys, 44 x 33, Scotch brick construction, felt and gravel roofing.

Qu'Appelle, Sask.

Residence, cost $5,000, for Jas. Caswell. 2½ storeys, brick and frame construction, shingle roofing, hot air heating. Foundations in.

Regina, Sask.

A five-storey apartment block, cost $30,000, is contemplated by A. M. Fields, care W. A. Burns, New Dallas Block.

Stanbridge East, Que.

Residence, cost $25,000, for C. S. Campbell, Merchants Bank Bldg., Montreal. General contractors, Laurentian Construction Co., 10 St. Francois Xavier St., Montreal. Roof on.

Toronto, Ont.

One pair residences, cost $5,500, Bertmount. Owner and general contractor, G. L. Robinson, 107 Armstrong. Owner will sublet. 2½ storeys, 38 x 40, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Three pair residences, cost $10,000. Owner and general contractor, A. Kemp, 108 Edgewood Ave. 2½ storeys, 36 x 40, brick and roughcast construction, brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels. Plans drawn.

Six apartment residences, cost $15,000. Owner and general contractor, G. Phillip, 556 Huron St. Owner superintends construction. Two storeys, 90 x 60, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, spruce and oak floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Two residences, for S. Fried, 265 Maria Ave. Two storeys, 22 x 42, brick construction and foundations, slate roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels. Owner wishes prices on plumbing and heating.

One detached residence, cost $9,500. Architect, S. B. Coon & Son, 512 Temple Bldg. 2½ storeys, 30 x 44, stone foundation, stone and brick construction, slate roofing, oak and birch floors, gas and electric lighting, hot water heating, lime and sand and ornamental plastering, wood lath, marble tiling, art glass, galvanized iron, mantels, built-in fireplaces. Tenders received by architect until Nov. 20th.

Residence, cost $15,000, for C. J. Read (in trust), architect, Confederation Life Bldg. Contracts let by architect. 2½ storeys, 20 x 43, brick construction, stone and brick foundations, slate roofing, gas and electric lighting, hot water heating, oak and maple floors, hard wall, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $5,000. Owner and general contractor, C. J. Doughty, 4 Playter Blvd., who will supervise. Will let roofing, plastering, painting, plumbing and electric. 2½ storeys, 22 x 43, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $6,000, for J. H. Keens, 174 Spadina Ave. Architect, H. G. Salisbury, 10 Adelaide St. E. General contractor, D. A. Peacock, 577 Church St. 2½ storeys, 25 x 36, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Work in progress.

Two detached residences, cost $8,500, for Frank Taylor, 162 Delaware Avenue. 2½ storeys, 23 x 36, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, built-in fireplaces, mantels. Excavating.

Two detached residences, cost $6,000. Owner and general contractor, Building & Construction Co., 26 King St. W. Architects, Designing & Draughting Co., 36 Toronto St. No work sublet. Two stys., 27 x 36, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, spruce and birch floors, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

Three pair residences, cost $11,000. Owner and general contractor, A. A. Barthelmes, 373 Keele St. Architect, J. J. Miller, 23 Perth Ave. Two storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Residence, cost $8,000, for Dr. F. Winnett, 525 Sherbourne. Architect, Eden Smith & Sons, 199 Yonge St. Three storeys, brick construction, brick foundation, slate, felt and gravel roofing, gas and electric lighting, hot water heating, oak, spruce and concrete floors, lime and sand plastering, plate and leaded glass, galvanized iron, mantels, built-in fireplaces, refrigerators. Work started.

One pair and one detached residence, cost $9,000, for Mrs. M. Cohen, 215 Dupont St. General contractor, C. J. Cudmore, 46 Pacific Ave. 2½ storeys, 20 x 42, each, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Work in progress.

One pair residences, cost $5,000. Owner and general contractor, A. G. Chambers, 9 Withrow Ave. 2½ storeys, 36 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces Plans drawn.

Two pair residences, cost $12,000. Owner and general contractors, Anglins Ltd., 507 Lumsden Bldg. Work by day labor. 2½ storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels. built-in fireplaces. Plans drawn.

Westboro, Ont.

Residence, cost $6,000, for J. E. Caldwell, City View. Architect, C. P. Meredith, 126 Sparks St., Ottawa. Plastering, Lethbridge Bros., Ottawa. Heating and plumbing, M. M. O'Connell, Gloucester St., Ottawa. Electric, H. B. Parks, 205 Laurier W., Ottawa. Walls up.

Windsor, Ont.

Alterations to four-family flat, cost $5,000, for Geo. S. Murray, Fire Chief. Architect, G. Jacques & Co. Oak floors, electric lighting, hot water heating. Plans in progress.

Apartment house, cost $30,000, for D. M. Eagle, 18 Elliott St. Architects, G. Jacques & Co. Masonry, steel and roofing, Geo. Sewell. Carpentry and painting, Thos. Thorne. Plastering, Frank Phillips. Heating and plumbing, Joseph L'Heureaux. Three storeys, 82 x 63. Foundations in.

Residence, cost $20,000. Owner and architect, Eugene Baby, care W. J. McKee Lumber Co. Two storeys, 26 x 24, concrete foundation, frame construction, shingle roofing, gas lighting, stove heating, maple and pine floors, lime and sand plastering.

Three-family terrace contemplated, cost $8,000, for Edward Glasgow. Architects, G. Jacques & Co. Two storeys, 34 x 60, brick construction.

Winnipeg, Man.

Four residences, cost $8,000, for O. Bjarnason, 726 Simcoe. Two storeys, 21

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x 36, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

Two residences, cost $5,000. Owner and general contractor, J. T. Watson, 58 Sherbrooke. Two storeys, 21 x 32, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

Three residences, cost $7,500. Owner and general contractors, Pschaida & Hess, 554 Mountain Ave. Two storeys, 20 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors.

Three residences, cost $6,900, for G. Storeseter, 354 Simcoe. Two storeys, 18 x 26, frame construction, stone foundation, shingle roofing, hot air heating, maple and pine floors, Excavating.

Two residences, cost $5,000, for B. Brown, 473 Stella. Two storeys, 24 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

CONTRACTS AWARDED

Montreal, Que.

Residence, cost $23,000, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. (architect changed). Foundation, masonry, and carpentry, A. K. Hutchison, New Birks Bldg. Architect to call for all other trades next week.

Residence, cost $14,000. Owner, Dr. Bournival, 387 Wiseman Ave. Architect, Charles Bernier, 70 St. James Ave. General contractor, J. B. Bisson, 811 Marechal Ave. Two storeys, 42 x 65, stone foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating, hardwood floors, lime and sand plaster.

Ottawa, Ont.

Two residences, cost $8,000. Owner, Frank Williams, 207 Riverdale Ave. General contractor, Walter Fryer, 5 Glen Ave. Two storeys, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot air heating, birch and pine floors, water heaters, built-in fireplaces

Toronto, Ont.

One detached residence, cost $7,000, for W. H. Baker. Architects, Chadwick & Beckett, 18 Toronto St. General contractors, Harmon & Son, 156 Dupont St. 2½ storeys, 25 x 38, brick construction, brick foundation, shingle roofing, gas and electric lighting, hot water heating, pine and oak floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built-in fireplaces, mantels.

Two pair residences, cost $10,000, for T. G. Smart, care general contractor and carpenter, D. Muirhead, 52 Amelia, who will sublet plastering, painting, heating, plumbing and electric. 2½ storeys, 30 x 42, brick construction, brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, time and sand plastering, wood lath, built-in fireplaces, mantels.

Two detached residences, $6,000, for F. Woods, 158 Fairview Ave. General contractor, masonry and carpentry, E. Post, 210 Fairview. 2½ storeys, 24 x 36, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

Power Plants, Electricity and Telephones

Aurora, Ont.

Electric pump and apparatus required by Town Council. Clerk, S. H. Lundy, General contractors, The Allis Chalmers Co., 212 King St. W., Toronto, $6,695.

Amherstburg, Ont.

Transmission machinery required for Essex County Light Company's power house. Manager, R. S. Stewart. Engineer, Mr. Gunson. One storey, 26 x 30, concrete foundation, white brick construction, electric lighting steam heating, maple and concrete floors.

Calgary, Alta.

The City Council are calling for tenders which will be received by City Commissioners until Nov. 19th, for year's supply of polyphase and single phase integrating watt hour service meters (induction type). Specifications, etc., at office of Engineer, R. A. Brown, City Hall.

Lambeth, Ont.

Village Council contemplate installing Hydro system. Clerk, T. Hamlyn. Further information from Jas. Kelly.

Oshawa, Ont.

Fire alarm system contemplated by Town Council. Acting Town Clerk, F. C. Hare. System to be installed at once. Further information from Clerk.

Peterboro, Ont.

Tenders are being called for steam and hot water heating system. General contractor, Thos. C. Epgrave, 615 Union St. Plans, etc., with general contractor or Jas. R. Bell, Hunter St.

Prince Albert, Sask.

Steam power house and plant, cost $275,000, planned by City Council. Clerk, O. Davidson. Nothing will be done till next year.

Steveston, B.C.

Cold storage plant and warehouse, Lulu Island, for Columbia Cold Storage Co., 702 Front St., New Westminster. Plans prepared.

Winnipeg, Man.

The City Council, Secretary, M. Peterson, Clerk, C. J. Brown, contemplate installing ornamental street lights on both sides of Market Ave.

Welland, Ont.

Electric Steel & Metal Company's steel plant, cost $35,000. Architect, David Carnegie, London, Eng. Contracts to be let in about a couple of weeks. Four buildings, brick, structural steel and iron construction.

Yarmouth, N.S.

Pumping plant, cost $3,340. Plans and estimates have been submitted for a pumping plant at Lake George, distance of 12 miles, by the Canadian Allis-Chalmers, Ltd., Montreal. Council, Mayor, S. C. Hood, has decided to install plant provided the Electric Light Company will guarantee sufficient power to run the pumps continuously, also that the Allis-Chalmers Co. will guarantee their pumps to supply 700 gals. per minute.

Yorkton, Sask.

Diesel electric machinery planned by Town Council. Sec.-treas., T. F. Acheson. Electrical engineer, M. M. Inglis. Tenders received by secretary till 12 o'clock, Dec. 22nd, 1913, for the supply and delivery of one 500 B.h.p. combined unit. Specifications at office of engineer.

CONTRACTS AWARDED

Toronto, Ont.

Stop valves, cost $7,135, required by Board of Control. General contractors, Drummond McCall & Co., 373 Front E. 12 36-in. valves at $510 each; 7 20-in. valves at $145 each.

Winnipeg, Man.

Electric fixtures required by Board of Control. Engineer, F. A. Cambridge, City Electrician. General contractors, The Elec. Shop, Boyd Bldg., for sections "A" and "B," at $2,339.35. General contractors, The Winnipeg Brass & Fixture Co., Portage Ave. and Clifton St., for section "C," at $811.25. Fixtures for the King George Isolation Hospital.

Miscellaneous

Cowansville, Que.

Stable and barn with threshing machine and farm implements of R. E. Ruiter destroyed by fire.

Montreal, Que.

Residence of J. A. Champagne, 151 Dufresne St., destroyed by fire. Loss $10,000.

Paint shop of Dom. Iron Bound Box Co., Levis and Notre Dame, destroyed by fire. Loss $3,000.

Nipigon, Ont.

Stores, residences, etc., destroyed by fire. Owners, Enser & Dowler Block, M. Nitkin, clothier; Atwill Block, bakery, pool-room and residence; Salo Block, D. Iosenthal, clothier; M. Nitkin, barber shop; J. Goodridge, restaurant; J. Fournier, barber shop; Wm. McKirdy, general store and residence.

Oakville, Ont.

Owners, Appleby College. Barn, stable and gymnasium equipment destroyed by fire, loss $35,000.

Qu'Appelle, Sask.

Two barns destroyed by fire, loss $8,000. Owners, W. J. Craig, W. L. Waits.

BANK OFFICE SCHOOL CHURCH & OPERA LODGE FURNITURE
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PRESTON-----ONTARIO

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 “	4 60	6 75
41 to 50 “	5 10	7 50
51 to 60 “	5 35	8 50
61 to 70 “	5 75	9 75
71 to 80 “	6 25	11 00
81 to 85 “	7 00	12 50
86 to 90 “		15 00
91 to 95 “		17 50
96 to 100 “		20 50
101 to 105 “		24 00
106 to 110 “		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ “	2.16	⅜ “	3.06
½ “	2.72	½ “	3.57
¾ “	3.11	¾ “	4.26
1 “	4.59	1 “	6.29
1¼ “	6.21	1¼ “	8.51
1½ “	7.43	1½ “	10.18
2 “	9.99	2 “	13.19
2½ “	16.38	2½ “	22.23
3 “	21.43	3 “	29.70

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Argenteuil Granite Co., Limited

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Alphabetical Index of Advertisers
Page 16

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Conditions in the Brick Trade

THE present condition of the brick market affords a favorable opportunity for investigating the causes of the increase in supply over demand. Enquiries are being made as to whether a market can be found for the surplus resulting from the largely increased output this season. Building permits in all parts of the country have increased considerably during recent years, but the demand for brick and other clay products has not increased in anything like the same ratio. For some time the supply has more than counterbalanced the demand. New brick plants have been opened up here and there, many of these having a capacity for an immense output; besides, there have been many additions to the smaller plants, so that it is easy to understand why the demand is not keeping pace with the supply.

The trend of the observations of prominent brick manufacturers in Toronto is not encouraging in regard to the present condition of the trade, although everybody is optimistic as to the prospects for the coming year. One well-known manufacturer says that up to the beginning of the present year we were importing at the rate of thirty million brick per annum. That state of affairs has changed completely during the present year owing to the increased number of plants. One cause of the falling-off he attributes to the stringency in the money market, which, in his opinion, has practically eliminated speculative building. He admits that there has been a large increase in the output, but asserts that it is quite evident that the building trade in Ontario at least must have increased proportionately to the increased production of brick, adding, however, that owing to the period of financial stringency it is difficult to gauge the true conditions of supply and demand as they obtain in Ontario.

For years the speculative builder has been an important factor in Toronto's building trade, and it is easy to see how his operations are retarded during a period of financial stringency when he is unable to obtain loans without great difficulty. The builder of small houses and those having ready money at their command are practically the only people who have been building to any considerable extent. The builder with sufficient financial resources finds some encouragement in the slightly-reduced price of brick brought about by the surplus supply.

The drop in the trade barometer this year placed the brick manufacturer in an unenviable position. Last year such was the demand that he was at his wits' end to turn out brick quickly enough. He builds extensions and installs additional equipment only to find that conditions have changed and that the market is over-supplied. We are told that the only redeeming feature of the brick trade this year has been the fireplace business.

It is a source of gratification that signs of improved conditions in the near future are not wanting. From many parts of the country we have received returns registering higher figures than 1912. A conspicuous example is the city of Toronto, whose permits for last month exceeded those of October, 1912, by nearly half a million dollars and whose record for the year to date is well ahead of that of last year. It is surely a fair interpretation of these signs that conditions in the brick business will brighten up in the near future.

Everybody is looking forward with confidence to 1914 and we believe that this optimistic outlook is justified. There are many who declare with absolute conviction that all constructional records will fade into insignificance when compared with those that are to be made next season. Be this as it may, things are on the mend, and the year with the unlucky number is nearly closed.

How the Financial Stringency is Being Overcome

THE decrease of $972,911 in the customs revenue for October, 1913, as compared with that for the same month in 1912 can be said to illustrate one way in which the financial stringency is being overcome. Although strictly speaking the houses in the import business are supposed to have enough capital to pay the duties on imports with their own funds, says the Financial Times, the fact is that many of them find it necessary to go to their bankers with requests for direct loans in order to effect the release of incoming merchandise from the hands of the custom officials. In this way the banks are subjected to heavy demands from their importing customers whenever the custom collections are at record figures; even then the loans thus granted are merely temporary. It is a relief, however, to find that the strain on the banks is visibly diminishing owing to the reduced applications for credit for several months back. In the past two or three years it has been no secret that the commercial credits issued by the banks to facilitate the importation of merchandise have caused the financial institutions to draw heavily on their balances in London and New York, and that in spite of the large sums received as proceeds of Canadian issues in London, the outside safety fund has had a marked tendency to decline. Thus the banks have been relieved to a certain extent through the diminishing demands for funds for customs and freight charges and for commercial credits. Although the industrial loans stand at a comparatively high level, this tendency is towards a decrease since the manufacturers are now in many instances laying off hands and purchasing their raw materials more sparingly. Also, they have largely ceased to press their bankers for building loans and for loans for the acquisition of more extensive equipment.

Canada as a Constructional Field

BRITISH recognition is given slowly and conservatively and for this reason its momentum is a force that cannot be overlooked in our calculations. Leading British engineers are being led to recognize the Pacific Coast of North America, and especially Canada, as the best new field for their enterprise.

The engineering supplement of a recent issue of The Times publishes a two-column analysis of the preparations of the Pacific ports and harbors for the opening of the Panama Canal, and gives Vancouver first place. It says that the natural conditions of Vancouver, Prince Rupert and Puget Sound may well excite envy along less-favored coasts, and it endeavors to excite the interest of British engineers by the calculation that the sum of $350,000,000 is already being expended on railways by private companies in lines to the coast, harbors and terminal facilities, the greater part of which will go to improve the ports of British Columbia. Another $150,000,000 is being spent by municipalities, port and harbor boards in the United States, assisted in some instances by the U. S. Government. To this must be added the expenditures of the Dominion and Provincial Governments.

A full appreciation of the great potentialities of our country is what we have been asking from Great Britain for two generations. Slowly but surely it is coming.

Keeping the Cost Within the Estimate

HOW to build a $34,000 house for $25,000 is substantially the problem which the average owner vaguely expects architects to solve. Possible variations seldom reduce the inherent difficulties of the task proposed. According to The American Architect, when a California architect recently failed to perform this financial strategem, he was deprived of his fee by the court, on the ground that "he should have kept the price within the original estimate, if he desired to collect for his services under his contract."

We are not informed as to the exact provisions of the architect's contract with his client, but from published statements it would seem that the client's action in acceding to an expenditure of $9,000 more than was originally contemplated was in itself sufficient to release the architect from responsibility in the matter of cost. However, with our confidence in the infallibility of judicial decisions on matters architectural, we are forced to believe that the architect was at least lax in the protection of his own interests, when he entered into a contract that could be interpreted with such unfortunate results to himself, or failed to have it properly supplemented when it became evident that the owner's demands could not be supplied at the stipulated price.

Everyone concerned in building knows the tendency of wishes to outstrip wealth, but if the client really desires to keep the cost within a stated amount, there is, of course, a way by which the architect with the owner's co-operation can accomplish such a result. It consists in making the specifications both definite and comprehensive, and in so restricting the plans, that the full contract price plus the architect's fee, will be within the appropriation, and leave a small balance as a factor of safety.

If the cost must in some manner be made a condition of his employment, he should conserve the right to modify the specification in consultation with his client, so that the investment may not eventually exceed the contemplated sum. The responsibility for any subsequent deviation from the specifications tending to increase the cost, should then be borne in writing by the client. Such procedure will tend not only to prevent financial disappointment of both architect and client, but also to minimize popular criticism of the supposed extra costs sustained through the employment of an architect.

The method of making the architect's fee contingent in a sense upon the cost of a building, in that a certain amount may not be exceeded without nullifying the agreement upon which he is employed, may or may not have points in its favor, but if the mere mention of a sum as the desired limit of expenditure before plans are drawn, has the legal effect of depriving an architect of remuneration in the event of a larger sum being required to meet the owner's demands, it is important that architects take cognizance of the fact. Moreover the architect should bear in mind that he is not a contractor in any sense of the word and should not enter into any agreement which might prevent his giving disinterested advice to his client.

Estimates and Time Schedules in Large Building Construction

IN a recent paper presented before the Cleveland Engineering Society, James I. Stuart, Contracting Engineer, Pittsburgh, discussed business methods in construction work. One of the essentials in successful construction brought out in Mr. Stuart's paper is that the engineer in charge of the work should anticipate each step in the progress of the building, and outline a complete system for its erection, including the various steps from the time the drawings are received from the engineer or architect until the completed building is turned over to the owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery and numerous smaller items.

After the estimate of the total cost of the building has been made—and an estimate should be made of every building, whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule are based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project and a familiarity with the estimate which give the quantities of the different kinds of material and assist in estimating the length of time required to complete the various stages of the work.

The Gypsum Industry in Canada

SEVERAL companies are being formed, including two in Montreal, to exploit large deposits of gypsum in the Maritime Provinces. In view of this fact, a few particulars of the mineral itself will be of interest to our readers. In a special pamphlet on "Economic Minerals and Mining Industries" published recently by the Department of Mines at Ottawa, we are told that the quality of gypsum found in Canada, especially the white rock of Nova Scotia, New Brunswick and Ontario is of exceptionally high grade. The output in Canada of crude gypsum for 1912 was 576,498 short tons, valued at $1,320,823, as compared with 518,383 tons with a value of $993,394 in 1911. Gypsum is used in many of the fire arts, being extensively employed in the manufacture of structural materials, such as plaster of paris, hardware plasters, cement, etc. It is also used in the crude state as a fertilizer. The market for gypsum is almost unlimited. The cost of production, according to Government figures, averages slightly below 45c a ton and the average price obtained at the quarry in 1912 was $1.08 a ton. In 1908 and 1909 the average price was $1.69 and $1.71 respectively. The exports of crude gypsum from Canada, it is interesting to record, have increased from $201,912 in 1900 to $416,725 in 1910 and $422,506 in 1912. Imports of plaster of paris have increased from $6,492 in 1900 to $123,965 in 1910 and $205,676 in 1912. From these facts it is evident that the industry has a good future in Canada. Amongst the new organizations are:—The Cheticamp Gypsum and Plaster Company, Limited, The Nova Scotia Plaster Company, Limited, and The Iona Gypsum Company, Limited. A Montreal syndicate is being formed to operate a large deposit at Ingonish, Cape Breton.

A Balkan Competition

WE trembled a short time ago for those enterprising architects who had ventured to compete for the new Royal Palace at Sofia, says our London contemporary, The Builder. Anything then seemed possible—even a Bulgarian Republic, if, indeed, the rival States of Roumania, Servia, and Greece did not claim the whole soil of Bulgaria for themselves. But the Peace of Bukharest left us Bulgaria, and the Bulgarians have not turned out their rulers! But we learn from an official postcard that, though "Les evenements politiques dans les Etats Balcaniques entravent encore le transport des projets et la constitution du jury pour les concours internationaux du Palais Royal et le Palais de Justice a Sofia," the Ministry will receive designs on April 1 next. But surely the Bulgarian Government might have chosen a more reassuring date on which to receive the efforts of Europe in the shape of designs for its Royal Palace and much-needed Temple of Justice! When an architect has decided to compete for any building it is well for him to be undistracted by doubts, and we feel that the date of sending in may occasionally give the red-hot enthusiast a cold fit of wonder as to whether he is not designing a chateau en Espagne. Still, architects may hope that on April 1 next there will still remain a Bulgarian Government which will, at least, appreciate their efforts and reward the winner with Bulgarian gold and Balkan honours! How long will it be before a federation of the Balkan States, founded on brotherly love, necessitate a Union House of Representatives? We hope for those happy days when the Bulgarian wolf will lie side by side with the Roumanian fox, and the Servian eagle will sing them both to sleep in concert with the Grecian nightingale.

LETTERS

The Cost-Plus-Commission Basis

Editor Contract Record:

Your editorials on the subject of tendering, published in your issue of November 12, are the expression of principles to which I have clung for many years. As an illustration of the manner in which contractors are put to needless trouble and expense in figuring I do not think you can find a better example than the Methodist Publishing House in Toronto, upon which a great many responsible firms have probably wasted considerably money. As far as municipal work is concerned the end of competitive tendering is a long way removed, but in building construction evidence is not wanting that people are becoming educated more and more to the fairness of the cost-plus-commission basis for the execution of such work. Anything that you can accomplish in this direction will be appreciated by at least one of your readers.

Yours truly,
"A Building Contractor."

A British Columbia Branch of the Canadian Society of Civil Engineers

Editor Contract Record: Nanaimo, B.C.

Although I was not present at the last Annual Convention of the Canadian Society of Civil Engineers, I have eagerly followed the proceedings of that body in the Contract Record and I am strongly of the opinion that a provincial section of the Society should be formed in British Columbia.

When we consider a Society with its head offices thousands of miles away, the possibility of local members showing much enthusiasm is very remote. This is sadly detrimental both to the Society as a whole and to the members individually. If we could form a branch society here it would certainly give greater impetus to the cause of good engineering.

It would be a greater advantage to form a Municipal Branch of the Canadian Society of Civil Engineers. Personally, I am not in favor of forming new societies with confusing titles—and there is the danger of antagonizing the various interests. We are all engineers: we have different branches of work to perform, but our aims are centred in one ambition, viz., the raising of the standard of the engineering profession. We must keep this ideal high and show that the trained Canadian engineer is not only willing but capable of carrying out every engineering scheme without having to fall back on outside or foreign help.

Again, the Canadian Society of Engineers generally, and the British Columbia Branch in particular, feel the great impetus that will be given to our educational facilities by our new provincial university. I am confident that the British Columbia Branch will rally around this great educational institution. We must co-operate in that one great aim in helping to make our university a seat of learning and a home for those whose desire is to search for still more light. We do not want to produce merely book-learned men but rather men who are confident of success **because they know that they know their engineering.**

Yours truly,
S. B. Bennett.

Canadian Engineers Weak Numerically and Financially

Editor Contract Record: New Westminster, B.C.

The Canadian Society of Civil Engineers has not proved to be a huge success as at present constituted and I do not think that the time has yet arrived for the organization of another independent society.

There are no Water or Electrical Engineering Societies at present in Canada; therefore it seems evident that the members of these professions do not feel that the time has yet arrived when such institutions could be made a financial success. Those who wish to be in close touch with their work join either the British or American societies where they have the benefit of long experience and the use of the valuable collection of data and other interesting material which has accumulated through the years. These facts alone, to the young engineer, are sufficient to tempt him to join such existing societies.

How many municipal engineers are there in Canada at present? And what would their subscriptions amount to annually? I see no good reason why a branch of the British Institution of Municipal and County Engineers should not be formed in Canada. Perhaps it could be organized on the same basis as the new branch of the Royal Sanitary Institute in Vancouver. The proceedings of the municipal and county engineers are immediately available for members who join the branch, and they are especially valuable, since they are records dealing with municipal engineering problems from all parts of the Empire.

I am entirely in accordance with the suggestion contained in The Surveyor of October 17 and would like to see it carried into effect, as I feel it would be more successful than an independent institution.

Yours truly,
J. W. B. Blackman, City Engineer.

Contract Work for the City

Editor Contract Record:

I have read with interest your editorial articles, "The Gratuitous Bid" and "Competitive Tendering," published in your issue of November 12. Your arguments are calculated to appeal particularly to the building trade and our work is chiefly municipal, yet in dealing with the City Engineer's Department we have all the trials that you mention and we are compelled to bid upon specifications which are notorious for their unfair bids. Not only are we pitted against other contractors but we have to reckon with the City Engineer, who puts in a bid for every job and gets the contract if he is the lowest and wants the work; otherwise the next lowest tender is accepted, but only at the price submitted by the City Engineer.

If you are anxious to gather material for some constructive criticism and to do your part in instituting remedial measures, make yourself acquainted with the transactions of the Toronto city hall in regard to contractors. Find out just how the city regulates its costs of material and all such expenses as a contractor would have to bear. Do not overlook the fact that old material is used by the city—material which contractors may have removed from other works and hauled where ordered by the Department—possibly in the neighborhood of one of their so-called day labour jobs.

One of the complaints of the contracting community is that the City Engineer employs no inspector on day labour contracts; the foreman is entrusted with the whole of the contract; whereas in the case of the contractor's operations there is an inspector on the sub-grade, another on the concrete foundation, another on the curb and gutters, and yet another on the surface. Whatever the construction, the principle applies throughout. The engineer contends that his foreman has no reason to scamp the work, while the contractor may have, and yet the contractor is held responsible for the satisfactory conditions of the job for from five to ten years on his contract, with fifteen per cent. of the whole value held to ensure its maintenance.

In my opinion your idea of a Board of Arbitration is a good one and might be made to operate fairly in everybody's interest. Certain it is that the best interests of the citizens are not served by present methods. The specifications want overhauling badly and there is room for an examination into the city's methods of computing prices.

Yours truly,
"Fair Play."

Proposed System of Storm Sewers for the City of London, Ont.

Mr. Willis Chipman, of the consulting firm of Messrs. Chipman & Power, Toronto and Winnipeg, has submitted to the civic authorities of London, Ont., a report upon storm sewers which involves an expenditure of $392,000. He points out in the report that the central section of the city is now served by a system of combined sewers constructed prior to 1892, since which date, from time to time, a few drains have been laid for the removal of cellar water and street water without regard to any system. At present fully half the city is unprovided with storm sewers and the requirements in this respect are now urgent, the population having increased from 32,000 in 1892 to 49,000 in 1913.

At the present time the extent of the system is approximately as follows: combined sewers, 24 ins. diameter and larger, 14,800 ft.; combined sewers, smaller than 24 ins., 59,200 ft.; storm sewers, 24 ins. diameter and larger—none; storm sewers, smaller than 24 ins., 9,600 ft.; sanitary sewers, 18 in. and larger—none; sanitary sewers, smaller than 18 ins., 206,800 ft.; trunk sewers and three interceptors, 71,300 ft.; total 361,700 ft.

The total drainage area of the city is now 6,302 acres and the most important water course is Carling's Creek the total area of which within the watershed is 2,780 acres. The old business section of the city is drained on the "combined" system from three large brick sewers directly to the river. The dry weather flow of each of these mains in intercepted by the sanitary sewers constructed beneath them, specially designed adjustable openings being provided. If the interceptors become gorged the excess overflows into the brick sewers thence directly to the river outlets.

Flooding is reported in various sections and to overcome this Mr. Chipman recommends the construction of a large storm sewer on Colborne Street with branch sewers on Simcoe and York Streets.

The estimate of $392,000 is apportioned as follows: Carling's Creek area, $182,000; north area, $28,000; business area, $40,500; Hamilton Road area, $46,000;

London South area, $67,000; London West area, $28,500.

General Conclusions

The following general conclusions are given by Mr. Chipman in his report:—

(1) Retain the important natural water courses where practicable, as open outlets for the storm water, thus saving the expense of large conduits.

(2) Construct a trunk storm sewer in the valley of Carling's Creek from Waterloo Street eastward to Eva Street, the water course to be left open from Colborne Street to Maitland Street, and an enlarged culvert constructed at Richmond Street.

(3) In London South construct main Storm Sewers on Wharncliffe Road, discharging southward to Elmwood Avenue, and on Ridout Street, discharging at Carfrae Street.

(4) On Hamilton Road construct Storm Sewers from Maitland Street to Hyla Street, with four outlets.

(5) Relieve the central area by constructing a Storm Sewer on Colborne Street, with branches on York Street and Simcoe Street.

(6) Construct proper "catchbasins" and abolish the open "gullies" as rapidly as possible.

(7) Construct Storm Sewers at least one year in advance of laying down permanent roadways.

(8) Adopt an equitable frontage tax system for meeting part of the cost of the proposed works.

The following plans have been prepared in connection with the proposed storm sewer system:—

(1) General plan of city, scale 800 feet to inch, showing the sewers constructed prior to 1892.

(2) Skeleton plan of city, scale 800 feet to inch, showing the existing sewers.

(3) Topographical plan of city, on scale of 400 feet to an inch.

(4) Plan of city in sections, scale 100 feet to inch, in portfolio. These plans show all sewers constructed to date, with elevations.

(5) General plan of city, scale 800 feet to inch, showing proposed system of Storm Sewers.

(6) Plan of Carling's Creek, scale 100 feet to inch, showing existing Sanitary Sewers and proposed Storm Sewers.

(7) Profile of Carling's Creek, showing elevations of existing sewers and proposed sewers.

Sewage Disposal

In regard to sewage disposal Mr. Chipman reports in part:—

"The existing disposal works comprise three sedimentation tanks of 200,000 cubic feet combined capacity, and two bacteria beds each with an area of 15,000 square feet. These beds were more or less experimental, and when constructed it was the intention to add others year by year. Funds were not appropriated, however, and the total flow of the sewage was often discharged through the beds. They are now useless except as crude strainers for part of the effluent from the tanks. By removing or washing the filtering materials, the beds may be revived. Whether additional beds be constructed, or spraying filters, or trickling filters, is a matter for careful consideration, but some system should be decided upon before the pollution of the river attains a dangerous or offensive degree. Material alterations should also be made in the three tanks, to convert them into sludge removers rather than sludge digesters, and provision should be made for periodic removal of the accumulations of sludge, without pumping. Beds should also be constructed for drying the sludge."

Movable Concrete Chuting Tower

THE construction of the pneumatic-caisson foundations for the 38-storey Equitable Building in New York, will require about 12,000 yd. of concrete, besides about 8,000 yd. more of concrete in the interior piers, according to The Engineering Record. The caissons are built on the bottom of the preliminary excavation, about 25 ft. below the curb, and the concrete for them is mixed in three ½-yd. Ransome machines installed in three movable wooden towers 85 ft. high, that are located near the Pine and Cedar Street lines on opposite sides of the lot and on Nassau Street.

Concrete material delivered daily in wagons is chuted from street level to storage bins of 50 yd. capacity built in connection with the towers. The bins deliver by gravity to the charging hoppers of the mixing machine and the latter deliver to hoists in the towers, from which the concrete is distributed by the regular Lakewood system of suspended chutes to any point in the lot.

As a large portion of the area of the lot is covered by the caissons and piers it is difficult to locate the towers so that they will not interfere with some of the substructure work. They are, therefore, built, together with their storage bins, on horizontal timber sills, like skids, which enable them to be easily moved in any direction in order to clear or reach any given pier and then to be moved back again if necessary to clear or reach other piers.

The three plants have each a capacity of 40 batches of concrete per hour for the machine and for the hoisting apparatus, allowing for all reasonable delay. The apparatus has been installed by the O'Rourke Engineering Construction Company, contractor for the caisson and concrete work, from designs that are original and which are considered by the contractor to be most efficient.

ONE hundred persons are reported to have been injured more or less seriously in the collapse of a grand-stand at Greencastle, Ind. A football match was in progress and the enthusiastic rooters resorted to the swaying which proved such a popular innovation here a year or so ago and which is still continued spasmodically. It is not too late to direct attention to the fact that the inspection of these structures is not carried out as rigidly as it might be and that in many cases deterioration of some essential part of the structure has reached an advanced stage before it is detected. The changing tactics of the modern bleacher crowd bring with them an added measure of responsibility for the city building departments and the constructional interests.

The need for a cheaper method of excavation appears to have been supplied by Mr. John P. Risque, of Winnipeg. This machine is not only an excavator but is also a loader as the material is dumped straight into the waiting wagons. It is operated by a gasoline engine and can be moved about from place to place with ease. Its cost is said to be comparatively small. It is stated that whilst the average cost of excavating by hand is 30c a yard, the machine will do the same work at an expense not over 12c a yard. Its capacity is of 100 cubic yards a day and it weighs about 1600 lbs. One of these machines is at present in operation at the excavation for the new drill hall in Winnipeg.

Cost-Keeping for the Small Contractor

Value of a Simple and Easily Accessible System — The Forms Required to Maintain a Satisfactory Record of Labor and Material

By Chas L. Pitts, Toronto

THE most important item in the office work of any company, great or small, is to have an accurate and accessible system of costs: to be able, in a word, to tell exactly just how much it costs to manufacture a certain article or to undertake a designated work.

To the average small contractor, "cost" simply means the actual payment of cash for anything he may happen to buy. He neglects the fact that it is just as important for him to know, to a cent, what it costs to run his business as it is for the great construction company, with an international reputation to sustain, to know the exact cost of some gigantic undertaking. On costs depends the foundation of the contracting business.

To the small contractor the chief difficulty is in the general distribution of his work. In the absence of gang clerks, and, in common with most small contractors, acting as his own general foreman, he is too busy to handle any complicated system of cost-keeping; therefore, he must use some system which is not too exhaustive but accurate within a reasonable degree.

DAILY WORK AND COST CARD. WEATHER:

Foreman:
Location of Work: Gang No.

Material Received	Quantity	From	Cost per Unit
Brick:			
Lime:			
Gravel:			
Cement:			
Lumber:			

Material Moved	Quantity	To	Time and No. Men

Material Left Over:

Delays: Cause: Cost:

Completed Work:

Brick Laid:
Sq. ft. Concrete:
Excavation, Yds.
(How disposed of)

Remarks:

Total Cost of the Day:

Daily Card to be filled in by Foreman with the exception of the costs.

The most satisfactory method for the contractor with two or three gangs of men working in different parts of the town is to use the Daily Card system. This calls for the assistance of each Gang Foreman in the filling out of these cards. These cards are a daily record of the material received; number and time of men; material moved; delays for any reason; time of hired teams; time of owner's teams; weather conditions; amount of each different kind of work completed; material left over after the completion of that work, together with a column for remarks. These cards will vary with the general conditions, of course. To augment these cards there are the Order Books. It is well to remember that a foreman, in the hurry of the work, is apt to be in error with the order books, as has often been proved; therefore these books should not always be regarded as final in the event of a dispute; though, if a check be given to each teamster for each load, such mistakes will not be frequent.

The cards are filed under the heading of the street on which the gang was working and the order-book stubs are retained until the accounts have been paid. At the end of each month the cards are entered upon what is known as a Recapitulation Sheet. This is a monthly report in a brief form and shows which of the gangs has done the most work for that month, as well as the total cost of the work and the number of rainy days in each month. In brief, it is a monthly record of business.

The work of the small contractor may be divided roughly into four classes: first, material; second, labor; third, delays, and fourth, overhead expense.

Material received means more than, for instance, simply dumping a load of gravel and the final payment for same. It means the actual number of loads received on a certain date, where they were delivered, if any was left over, and, if so, where the surplus material has been removed to and the time it took to make that removal. If there are five loads of any material to be removed from one job to another, that is a charge against the work from which it was removed, because surplus material should not be brought upon the work.

Labor is the next consideration. If a gang of men are idle, or nearly so, for any length of time as a result of the non-delivery of material, or for any other cause, which, while not actually stopping the work, sends the men to some time-filling job to keep them on the work, then this is a charge against that work. If a gang of men doing any repair work or any work not tending towards the completion of the job, then this also is a charge against the work. Also, any work such as cleaning up, or repairing machinery, is a charge —in fact any work around the job not an overhead expense is a charge against that particular work. The only satisfactory way of keeping wages is to charge each man's time and rate as a separate account: not, for instance, "ten men, three hours," but one man, at so much, so many hours, and so on.

Delays are, of course, a charge against the particular work where such delay has been, unless the delay

No.	Date	No.	Date
Received from:		Received from:	
Article:		Article:	
For work at:		For work at:	

Foreman's order book. To give slip on receipt of goods.

has been caused partly by a piece of broken machinery, etc., then the cost of such work is charged to overhead expense, because it is too complicated, in a simple cost system, to charge machinery breaks to any particular account, as this machinery is used in all the work the contractor may have. Delay charges are, naturally, a part of the labor costs, inasmuch as they are usually caused by labor. It is well to know, though, in reckoning up a loss, just what has caused that loss—material, labor or delay.

Overhead Expense is any expense for the general up-keep of the business so distributed as to be impossible to charge to any particular branch. Office expenses, for example, are in this class; but tools, etc., though for the general use of the business, are not. This is a charge for the particular job they were bought for. Tools are sometimes lost or stolen and therefore the only way to keep track of this account is to charge it to the job. An Overhead Expense account is not deducted from the profit until a balance is taken at stated times.

CAR RECORD: (Sample for book to be ruled).

No.	Initial	Ordered	From	Placed	Test	Unloaded	Used at

Sample of Car Record Sheet for keeping track of cars. This sheet when filled in is a useful addition to such advice as the contractor receives from the shipper.

An accurate cost system is one in which the contractor can look back through his cards and price book—it is not always advisable to let the foremen know the exact cost of the material—and see just how much his material cost; the cost of the labor; the cost of the tools; the time of delays; the cost of repairs, the cost of extra work and where the charge for this work is to be placed; how much of his own time he has charged against each job; the cost by the foot, or by whatever measurement he uses in his business, and many other items in proportion to the perfection of his system and the care he uses. A cost system to be of use must tell the user how it is done and tell him in the shortest possible time.

MONTHLY OFFICE SHEET No. of idle days :

No. Gang	Location Work	Time on Work	Cost Material	Labor Cost	Tools Cost	Total Cost of job		Remarks
							Cost for Over-head Expense for the Month	

Total costs for all work completed, and total cost of all business for the month, including Overhead Expense.

Sample of Monthly Office Report. Profits are not usually placed on a sheet of this kind but are kept in the regular books.

In the exacting systems of the large contracting firms, there are car sheets, material records, time sheets, tool sheets, order forms, receiving blanks and a hundred-and-one reports. They get their costs to within a cent, but they pay large salaries for that knowledge. Such is not the system for the small contractor, because it is too expensive; but even the small contractor should know, within a dollar or so on the hundred, where he stands. He should know when a car is placed, when he ordered it, when it is unloaded, the number of the car, the cargo, and where he used the contents of that car. He does not want a car sheet for that: a ten cent book will do if properly ruled. At the end of each day he should have a fair idea of his profit or loss for that day. If he has lost he should know why; and if he knows why, possibly he can think of some way to avoid similar loss the next day.

Cost-keeping is not designed to do away with book-keeping. Its function, as its name implies, is to "keep the cost."

With an accurate cost system the contractor has his business in perfect control. Without it, the business controls him.

Work on the demolition of the old Union Station at Toronto commenced last week. It is planned to have the site cleared in time to commence excavation work as soon as the frost is out of the ground. The new building, plans for which are now completed, will be one of the most imposing railway stations on the continent. It will have a frontage of 840 feet. The plans were prepared by Mr. John M. Lyle, architect, Toronto, under the direction of a number of experts representing the Grand Trunk and Canadian Pacific Railways, the express and transport companies, and the Dominion and Provincial Governments.

Hopes are entertained of restoring to the perpendicular the great concrete tank elevator at Transcona. At present the huge tanks lie tilted, one side having sunk owing to the tremendous weight they had contained. As an indication of the strength of reinforced concrete, however, the tanks have remained intact and simply require the application of powerful jacks to keep the structures up whilst the foundations are strengthened beneath. It is estimated that it will cost about $30,000 to restore the structures.

Space-saving construction was exemplified in building concrete poles into the side of the No. 3 plant of the Aluminum Company of America, at Niagara Falls, N.Y. The reinforcing extends up to the side of the building, continuing to a point near the top of the pole, which is 10 ft. above the roof, and is braced to it by reinforced-concrete arms. This construction has permitted placing a spur track so close to the building that unloading and loading cars is greatly facilitated.

1913 27(48

The Economical Planning and Designing of High Office Buildings*

THE engineering questions connected with the economical planning of the sky-scraping and ponderous office building of the present day appear, at first sight, to be so complicated in their nature and so involved as to make their logical solution a matter of great difficulty. Due reflection, however, coupled with careful analysis of their relative importance, will reduce these problems to comparatively simple terms; terms so simple, in fact, as to make a solution quite easy. Generally speaking, these questions embrace those items which have to do with the adjustment of size, shape, location and relation of parts, rather than with the appearance of those parts and are questions which, by a popular misconception of the true functions of the architect, are supposed to belong to the engineer.

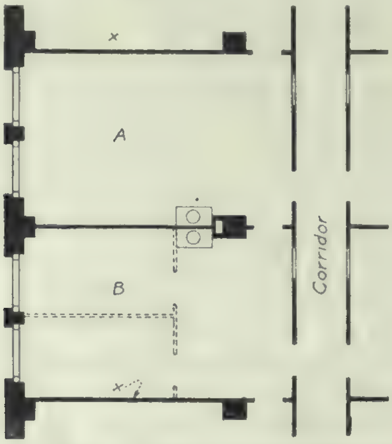

Fig. 1.—Typical unit-room and economical division of land.

Inasmuch as a typical building of this kind under construction will be wholly utilitarian in its purpose, the answer to these questions should be sought along similar lines, and it will be found that the economical plan is determined by the best disposition of the unit-room, while the height of the building depends upon the number of elevators which can be economically installed. In other words, the plan of the floor is determined by the unit-rooms of the floor, and the height by the space which may be economically set aside for reaching those rooms.

General Conditions and Requirements

As every investigation should be preceded by an exact definition of the thing investigated, it will be well to determine just what constitutes a sky-scraping office building, also the reason for its existence. An office building is one so planned as to afford conveniently arranged spaces in which numerous persons may transact, with freedom and dispatch, whatever business they may be engaged in—except the actual process of manufacture. Each occupant is to be provided with light—both natural and artificial—fresh air, water, heat, and such other requisites for his comfort and the conduct of his business as custom or wisdom justifies. Such a building is to be built upon ground whose value is relatively great and, by reason of the great cost of both land and building, it is generally financed by an assemblage of capital in corporate form. The reason for its existence lies in the desire for concentration within comparatively restricted areas, in the great cost of land within those areas, and the opportunity for economy due to what may be called the amalgamation of many buildings into one. When the value of the ground upon which it stands is great and the opportunity for revenue, by increase of tenantry, is large, it is raised high into the air, storey above storey, finally arriving at the distinction of being called a "sky-scraper." This extension of the height, however, causes a radical change in the construction. The low building (five to six storeys in height) is enclosed by walls of masonry, which not only support their own weight, but carry the loads imposed upon them by the floors and the roof. But when many storeys are added, the thickness of the lower portion of these walls—a thickness made necessary by the added load—becomes so great as to reduce materially the area of floor available for rental. Hence was devised the "skeleton construction," a steel frame in which the weight of the roof, the floor and the wall is concentrated upon and is carried by metallic columns to the earth, the thickness of the enclosing wall being only sufficient to afford a protection from the driving rain or from other elemental dangers.

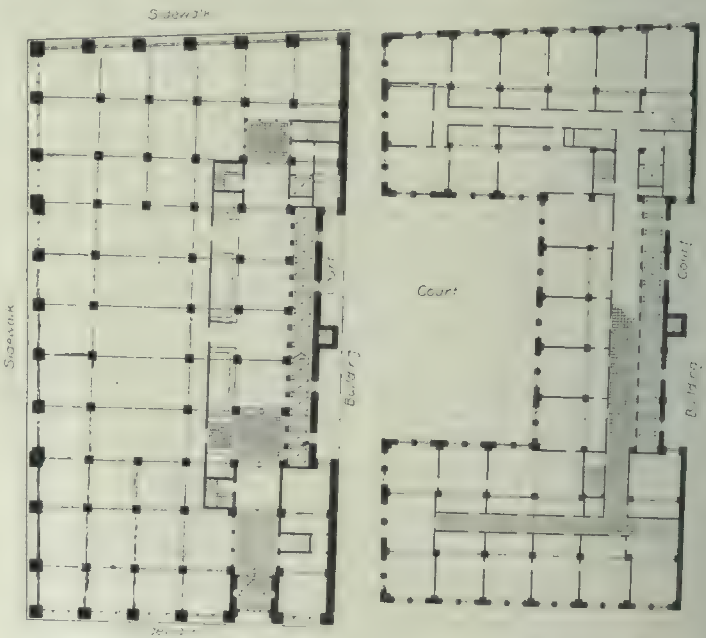

Fig. 2.—Ground and typical floor plans for an office building with streets on three sides and buildings on the fourth side.

Built as these office buildings are, as "business propositions," as investments for corporate funds, it is essential that they be built as economically as the stability, the durability, the requirements of their tenants and the custom of the day will permit. Moreover, as the return from the investment is wholly from rentals, it is essential that the buildings be so planned and constructed that the area available for rental is a maximum—a maximum, however, which has been fixed after carefully considering the requirements of light, air and approach.

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*By W. C. Hazlett, Architect, New York, in Engineering and Contracting.

Let us first establish the conditions of the plan—the conditions which are fixed by custom and by the desire of tenants. The first and second floors in buildings of this kind must be so planned that they may be let in large areas for stores, banks or similar institutions; and they must give (the first floor especially) ample space for the uninterrupted passage of the numerous tenants of the upper floors. Above these lower floors is a series of floors, divided, or capable of being divided, into rooms alike in size, purpose and value, each room in each storey being of equal importance. Inasmuch as the gross rental return from these upper floors is far greater than from the lower floors, it is more essential that the upper floors be planned to obtain a maximum return than the lower ones.

Size of Unit-Rooms

Persons experienced in dealing with the tenantry of such buildings agree that the size of the unit-room of these upper floors should contain approximately 350 square feet of rental area, their reason being that the number of persons willing to pay the five to eight hundred dollars—the sum demanded for rooms of this area in our larger cities—is greatly in excess of those willing to pay more. As the depth of such a room cannot exceed a maximum of 25 feet—due to the lack of natural light at a greater distance from the window—our unit-room has a maximum depth of 25 feet by a minimum width of 14 feet. For reasons which will appear later, the average size of this unit-room is 17½ feet wide by 20 feet deep. Experience has determined that 9 to 10 ft. is a satisfactory clear height, so that we find a unit-room of about 3,200 cu. ft. is ample for the five to six persons who may occupy it.

An investigation of the strength of the floorbeams and girders, considering the required loads, will show that they are economically stressed when arranged in bays to suit the size of the unit-room. Therefore a room having dimensions of about 17½ x 20 ft. not only meets the desires of tenants but also lends itself to an economical use of steel.

Fig. 1 (A) shows the type of unit-room, and Fig. 1 (B) shows the manner in which it may be subdivided.

Type of Construction and General Arrangement

As good practice will not permit the construction of buildings of this class to a greater height than 100 ft., unless fireproofed, and, as no building of less height could well be called a "skyscraper," we shall deal with fireproof construction in this investigation. As fireproof construction presupposes the use of fireproof floors, we shall deal with a combination of beams and girders having a filling of tile or concrete—plain or reinforced; this, in turn, being carried by interior columns. As the partitions which divide the unit-rooms should, for reasons of convenience and economy, follow the ranged lines of the columns it is essential that these columns be (in one direction at least) the same distance apart as the partitions.

As to the disposition of these unit rooms, it is almost self-evident that an arrangement of rooms on both sides of a central corridor is theoretically perfect. As the two rooms with the corridor and the enclosing walls and partitions will occupy a space of about 60 ft. in width, the typical plan will consist of an assemblage of wings approximating 60 ft. wide and enclosing or forming the sides of the courts. The space in the rear of the re-entrant angles of these courts—ill-lighted and therefore useless for rental—is used for stairs, elevators or for other purposes not requiring light.

Figures 2 (a) and 2 (b); 3 (a) and 3 (b); 4 and 5 are, respectively, the ground and typical upper floor plans of specific designs, for which a solution has been found. A careful study of these plans will show how the problem of getting the best arrangement has been solved in each of these three buildings.

The building represented in Fig. 2 is located on a plot fronting upon three streets, the light on one long side being obstructed by adjoining building. Fig. 3 shows floor plans for a building on an interior plot running through from one street to another, with the two long sides unlighted. The building represented in Figs. 4 and 5 is on a plot embracing an entire block, with streets upon four sides.

It will be noted how closely the solution of each specific problem approximates that which has been abstractly considered; the size of unit-room, with the corresponding economy in the use of steel; the width and disposition of wings; and the relegation of—what may be called the "machinery"—elevators, stairs, toilet rooms, flues, etc., of the building to the dark sides or to the rear of the re-entrant angles of the courts. The solutions shown are all quite possible, in fact, the only apparently logical solutions of the problems.

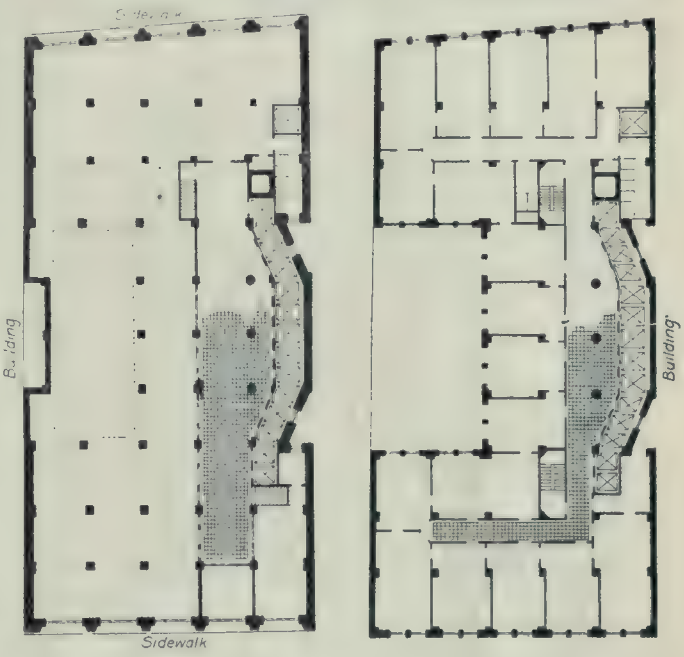


Fig. 3.—Ground and typical floor plans for an office building with streets on two sides and buildings on two sides.

In the case of the building noted in Fig. 5, the arrangement shown gives an actual net rental area (well lighted and available) of something over 61 per cent. of the area of the plot, while by no other disposition would such a large area be obtained. It is, of course, true that larger rental areas may be devised, but any space which lies at a greater distance than 25 ft. from the source of natural light (with the usual height of storey) will require artificial lighting and artificial lighting is costly, as it reduces the net return by the capitalization of the amount so expended.

It may be said in passing that the illustrative plans are not set down as models to be followed, but are given as "visible" examples of solutions arrived at under the stringent conditions imposed upon a designer by the requirements of tenants and by a desire for a maximum economy in construction. That satisfactory re-

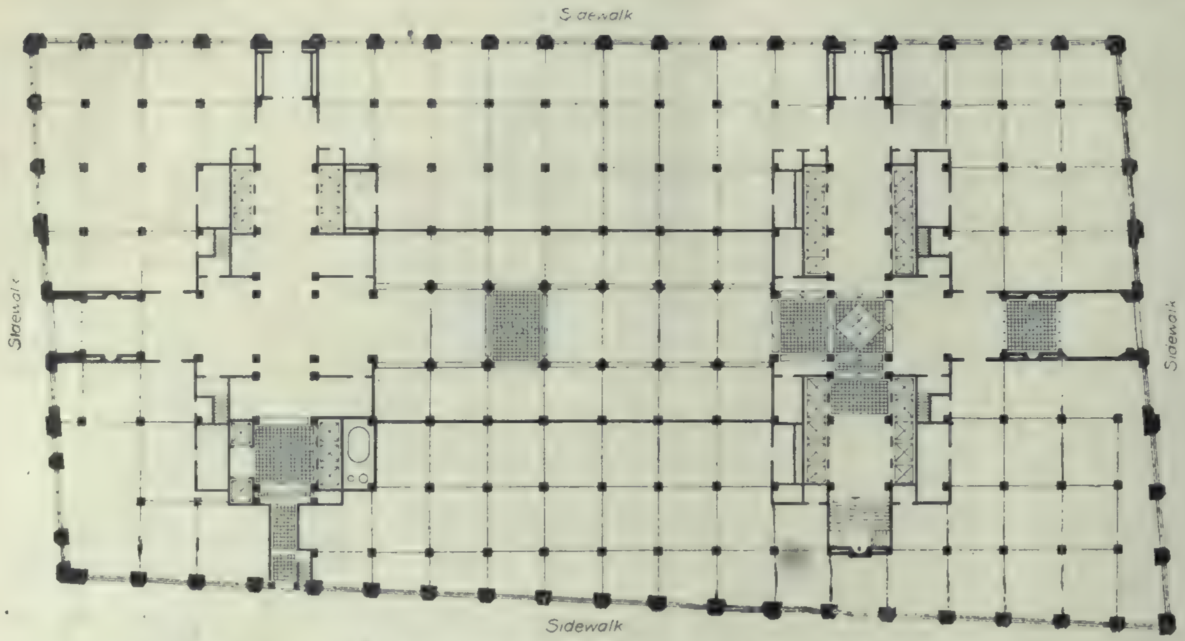


Fig. 4.—Ground floor plan for an office building with streets on all four sides.

sults may be obtained even under these stringent conditions seems self-evident.

Height of Building and Elevator Service

Having determined, in the manner and under the conditions already outlined, the general disposition of the plan it will now be necessary to fix the height to which the building can economically be built.

The height of buildings of this kind should not be determined in any arbitrary manner, but should bear some well determined ratio to the number of elevators which may economically be installed for the service of all floors above the first, the number of elevators being fixed, in turn, by the area which can economically be set aside for them. In other words, it is not wise to say "this building will be so many storeys in height," but, rather, "how high can this building be constructed, taking into account the otherwise unrentable space placed at the disposition of stairs and elevators?" The following answer is given to this question:

The best practice agrees in preferring, in a given space, a large number of comparatively small cars to a smaller number of larger cars. To be more specific, small cars are those having an area of platform of not more than 30 sq. ft. and accommodating, say, 15 people, This will give a car platform of 5 x 6 ft. and a shaft of, say, 6 x 7 ft. or, including the necessary grilles and dividing partitions, an area of about 50 sq. ft. If we have a known area to allot to elevators, and if we divide that area by 50, the quotient will be the number of shafts, or cars, which can be installed with economy. (In the planning of cars it will be well to arrange the

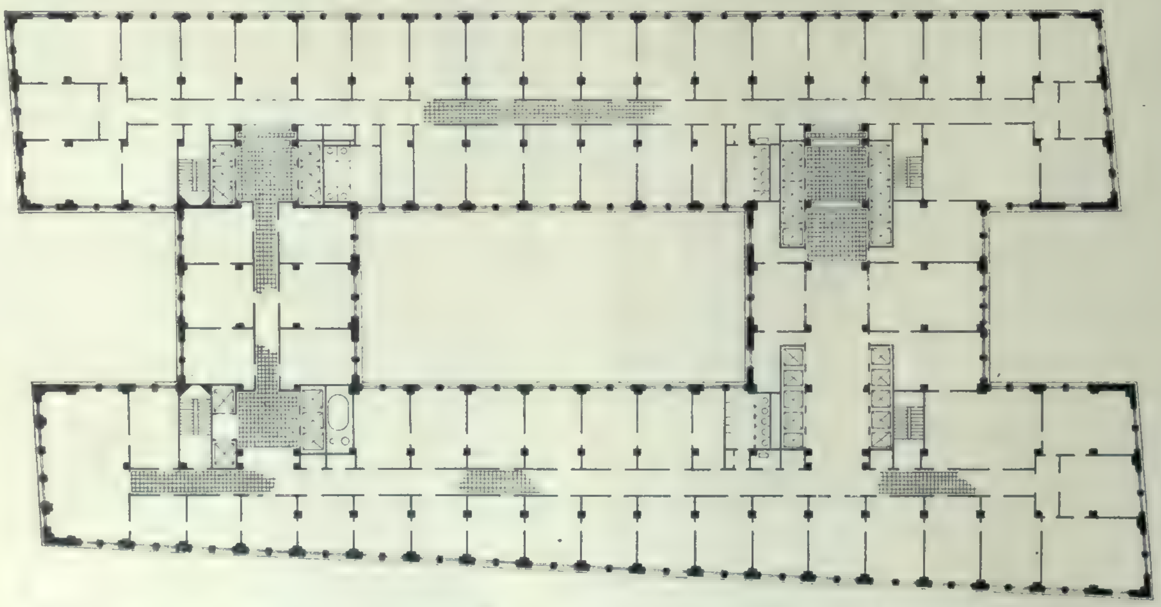


Fig. 5.—Typical floor plan for an office building with streets on all four sides—same building as shown in Fig. 4.

long side of the car adjacent to the landing, as this permits a greater width of door, it facilitates ingress and egress, and reduces the time required to fill or empty a car, the latter being one of the dominant factors for satisfactory service). With cars having a capacity of about 15 people, and with speeds and disposition of "run" as will be hereafter mentioned, the best present practice allows each car to serve about 15,000 sq. ft. of office space. By multiplying the number of cars (as above determined) by 15,000 and dividing the product by the number of square feet of rentable area in each storey, we may determine the number of storeys which can be served by these cars. This is the broad and general rule for determining the economical height of these buildings, although it is subject to various modifications to suit special conditions. For example, let it be supposed that one or more floors are to be occupied by a corporation employing a large number of clerks who arrive and depart at the same time; it is evident that the elevator service must be arranged to provide for this "peak" load, otherwise it will prove entirely inadequate.

Theoretically, perfect service demands that the time consumed in carrying any passenger from the ground to whatsoever floor he desires to reach, should, in all cases, be the same. This is, of course, impossible in practice; but the end to be sought is as close an approximation to this conditions as can be obtained. While the scope of this investigation does not permit a detailed study of the best manner of apportioning the run of cars, it will be briefly considered. The entire allotment of elevators is divided into a number of sections, one or more being devoted to what it called "express" service, the remainder consisting of "locals." The number of cars in each section and their speeds should be very carefully determined in order that the best possible solutions be obtained. For example, assume a building 30 storeys high, in which 30 elevators are installed. Ten of these might be allotted to "local" service from the ground to the tenth floor, inclusive; ten to "express" service to the tenth and "local" service to the twentieth floor; and ten, "express" to the twentieth and "local" to the top. The "express" cars might well have a speed of from 600 to 700 ft. per minute, while running "express," and a nominal speed of about 400 ft. per minute while running local. As the actual speed of any car while running "local" depends, in great measure, upon the storey height, the number of stops, and the facility with which passengers get on or off, it will be seen that the problem of apportioning service is, in practice, one of great complexity.

Inasmuch as the division of the elevator service into "express" and "local" sections permits the termination of the journey of certain sections at a storey far below the top, the space otherwise occupied by a car may be used for rental area. However, as the wise designer relegates his elevator service to the unrentable portion of his building, such a gain in rental area will be of little moment.

A brief return to the illustrative floor plans may prove illuminating. The elevator service, as there laid down, with its accompaniment of stairs, toilet rooms, flues, closets, etc. (the "machinery" of the building), can hardly be increased without encroaching upon well-lighted and available rental area, nor can it well be decreased, as the gain in rental area would be in a dark and unsatisfactory space.

Stairways and Elevator Shafts

Stairways, in this class of building, should be regarded solely as means of escape in case of fire or panic, and consequently may be placed in the dark and unrentable portions of the building. They should be proof against smoke as well as fire, and therefore should be enclosed in smoke-proof shafts with no openings other than self-closing doors. It would be well if these doors were distinctively marked, thus impressing themselves upon the memory of the tenant. These stair-shafts should have their exit at the street level into a large space set aside for the movement of tenants, with a direct and unmistakable access to the street. The consideration of these stairways as "fire escapes" and their consequent enclosure in shafts, will cause considerable economy in their construction, as it is only necessary that they be strong and durable. The bronze railings and marble fittings (so dear to the heart of the unthinking designer) may be used in other places—they are not necessary here.

It is also advisable that the elevators be enclosed in fire-and-smoke-proof shafts, similar in construction to those used for the stairways. The elaborate bronze grilles and costly wrought doors, commonly used as frontal adornments to these shafts, are not suitable for preventing the spread of a fire or the choking fumes of smoke or ammonia. A solid partition, with no openings except the necessary elevator door, is even more desirable.

Necessities and Conveniences

Buildings of this kind are also provided with artificial light, with heat, water, and with such other comforts and conveniences as are wise. The scope of this inquiry, however, does not permit a detailed investigation into these factors. It is sufficient to say that the use of gas—except in the stairways—is not customary and that the electric light is fed either from the Public Service Company's supplies or from the power plant installed in the building itself. In the latter case the building will be heated by the exhaust steam from this plant. Each office is provided with a wash basin, with cold (and sometimes with hot) water, while the various toilet rooms have the usual and necessary fixtures. Each floor should have at least one slop sink for the use of the cleaning force. Some system of vacuum cleaning is often found advisable and economical.

Maximum Height of Building

As an answer to the question of great popular interest "to what height may a building of this kind be built?" it may be said that there is no practical limit of height, provided funds are obtained with which to build it and tenants are found to occupy it. Given these essentials, there are no engineering problems with which the knowledge of the present day is not amply able to cope. In other words, if the funds are provided the engineer will produce a building for the possible tenant to practically any height desired. This answer applies more particularly to New York, where it is possible to carry the foundations to bedrock, which makes the foundation problem a comparatively simple one. In some cities the nature of the subsoil would be a governing factor in the design.

Cost of Office Buildings

The cost of buildings of this class and the opportunity afforded for an economical reduction of the cost are matters of interest and moment to the investor. As it would be useless to compare the gross cost of two buildings varying in size, scheme, and numberless conditions, or to predicate anything about gross cost, unless all conditions were known, such a comparison will not be attempted.

There is, however, a means of comparison—by the unit cost—which may be useful, and that unit has been, by convention, assumed to be the cost per cubic foot. In other words, we can safely compare the cubic foot costs of buildings if the conditions are known. In arriving at the cost, however (which cost is the gross cubic contents multiplied by the price per cubic foot), we must agree upon some method of determining the gross cubic contents. The following is thought to represent the best present practice: Multiply the area of the plot by the distance from the average ground level to a point 1 ft. above the lowest basement floor; add to this the cubic contents of the walk vaults, areas, etc.; then add to this sum the cubic contents of the building above the average ground level, omitting courts; the sum will give gross cubic contents.

The cost of these buildings may be further differentiated thus: Gross cost, which is the sum that the owner has expended at completion and which includes all fees, commissions, interest charges, taxes, etc.; and net cost, which is the builder's charge, including his profit and the designer's fee. Inasmuch as the difference between this gross and net cost depends upon many things with which the designer has nothing to do, we shall consider the cost—either the total cost of the building or the unit cost—as what has been called net cost.

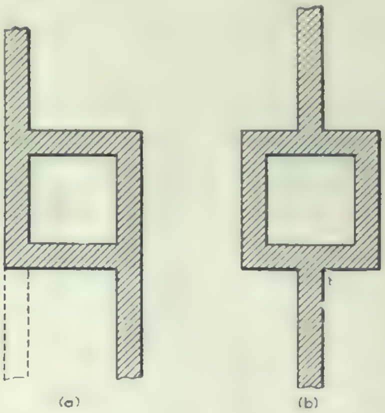


Fig. 6.—Arrangement of partitions at columns.

Without going into an exhaustive investigation of this matter and without quoting unverified data, it may be assumed that the cost of first-class buildings of this kind should not exceed 35 cents per cubic foot. By reason of a fortuitous combination of circumstances, this cost may be reduced to 30 cents per cubic foot. Perhaps 33 cents per cubic foot may be a fair working average, but no building of this kind should cost more than the first-named figure. It is quite true that many, in fact most, buildings have been built at a greater cost; but the reasons for this increased cost lie within the limbo of an economical and logical distribution of the plan, the structure of that plan, and the machinery which goes with it. The exterior finish of the building may greatly affect the cost, but we shall not further consider this item.

Opportunities for Economy

There is one opportunity for economy in the arrangement of the partitions which separate one unit-room from another, and the partitions which engage with the interior columns. Fig. 6 (b) shows the suggested arrangement. (See also the partitions marked "X" in Fig. 1 and the interior partitions shown in Fig. 3 (b). An inspection of Fig. 6 (b) shows eight angles about the intersection of the column covering and the partition, while Fig. 6 (a)—the suggested arrangement—shows but four. The interior rental area has not been reduced and the amount of partition or column covering has not been increased, yet this suggested change has worked a saving in the structure of between $8 and $9 per column per floor. A trifling matter, it may be said; trifling it is when compared with the total cost of the building, but when we consider 20 columns on 30 floors, a total of 600 columns, which will cost about $8 each, we see that there results a saving of about $4,800—an amount which the average owner does not consider to be "trifling."

There are numerous other opportunities for economy, apart from those herein mentioned, which will appear—after reflection and study—to the careful and appreciative designer who has at heart the material interests of his employer. While these items are apparently small, they will in their aggregate amount to so considerable a saving as to reduce the cost of a first-class building of this kind to the stated maximum of 35 cents per square foot instead of the 40, 60, 70 or even 80 cents per cubic foot, to which "dignity" some of them have arrived.

It should be remembered, however, that it is a far cry from economy to cheapness; that the latter, while apparently reducing the cost, will in reality increase it by adding to those repair bills which are alike a "curse" to the operating management and a "pain" to the employer. In fact, the path to true economy lies along those hard lines of painstaking effort, careful study of conditions, and laborious fitting of the means to the end—resulting, finally, in a structure which is a credit to the designer and a profit to the investor.

Concrete Protection in Salt Water

An outline of a special report, not yet given out by its author, Mr. W. B. McKenzie, right-of-way engineer of the Intercolonial, was presented at the recent convention of the American Railway & Bridge Association, held in Montreal. Mr. McKenzie stated that all along the part of the Atlantic Coast affected by frost concrete in salt water scales off between high and low tide, giving a figure of ½ in. per year as about the rate at which it chips off. The remedy proposed by him was a facing of salt-glazed vitrified brick, which is not affected by sea water. He would use hollow bricks with tongue-and-groove joints, so that the blocks could be laid, without mortar, under water, and would lock to serve as a form for the concrete. This facing would be continuously hollow from top to bottom, and additional openings 4 in. square in the back of each block would allow the concrete to flow in and bond the entire mass.

"Ferro-cement" is the name given to a new road-surfacing material that is reported in a contemporary as giving satisfactory service under automobile traffic in France. The material consists of a mixture of "iron straw," or threads of iron in a wiry or fibrous mass, with cement and sand. The iron is not a waste product, but is prepared by machines of special design.

During the ten months of the current year ending October 31st, the building permits issued at Vancouver represented an expenditure of $9,948,238, as compared with $16,319,162 for the corresponding period of 1912. The figures are supplied by Mr. S. H. Jarrett, building inspector.

Power house now being erected at a cost of $425,000 for the city of Regina. Architects, Messrs. Story & Van Egmond.

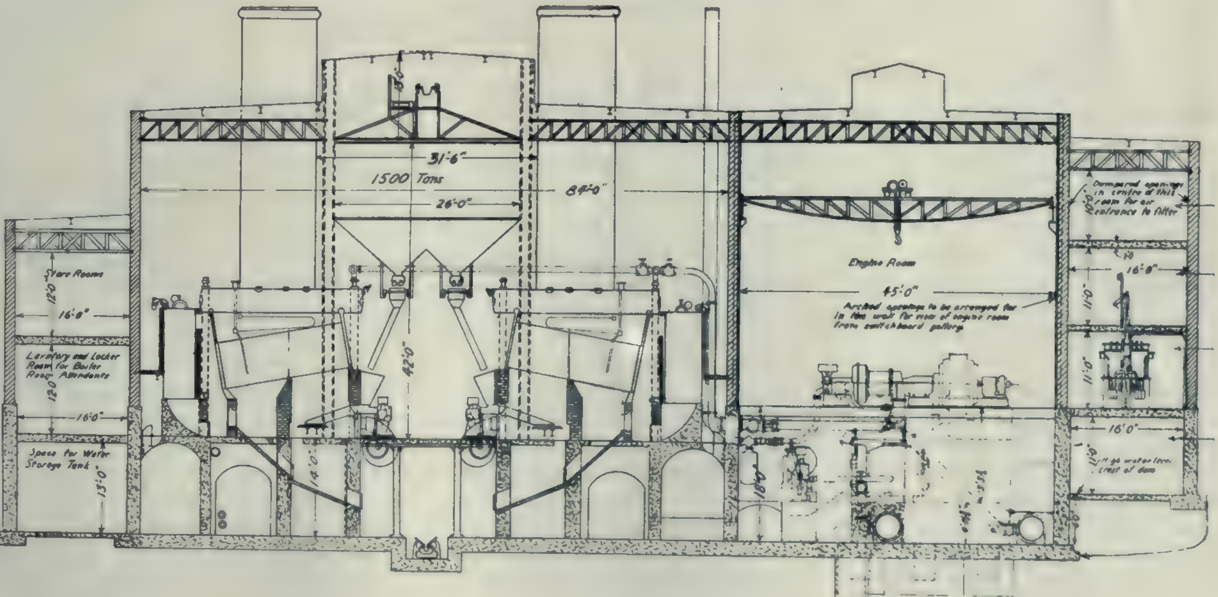
New Power Plant for the City of Regina

THE city of Regina recently desided to undertake the erection of a new power and light plant, at a cost of $425,000, the existing plant having become inadequate. Numerous improvements were desired, such as bunkers and carriers to facilitate the handling of the coal, also added facilities for the handling of ashes. The new power house, the erection of which has already begun, will be situated on the edge of Wascana Lake, within Regina city limits, and water from the lake will be used to cool the engines, instead of being drawn from the city mains as has been the practice under the old system.

The building itself, the foundations of which are now practically completed, will be 218 feet by 170 feet wide, covering an area of 28,000 square feet. When the work is completed and the new plant installed it is expected that the present rates for power will be materially reduced, The structure will be three storeys in height, of skeleton steel frame, enclosed with heavy red paving brick, trimmed with stone, the basement and foundations being of the same material. It will be fireproof throughout, and 68 feet high from the basement to the roof.

It has been necessary to remove 20,000 cubic yards of earth in excavating for the foundations, which contain about 6,400 cubic yards of reinforced concrete. Over 300 tons of structural steel will be used in the skeleton work of the building. The steel construction work is being done by the Western Steel Supply Company. The architects are Messrs. Storey & Van Egmond, of Regina.

One of the features will be the provision for visitors. Two special galleries overlooking the engine room are being constructed on either side of the switchboard room on the second floor. From these it


31'-6"
1500 Tons
26'-0"
84'-0"
Store Rooms
12'0"
16'-8"
Lavatory and Locker Room for Boiler Room Attendants
12'0"
16'-0"
Space for Water Storage Tank
13'-0"
14'-0"
42'-0"
Engine Room
45'-0"
Arched openings to be arranged for in this wall for view of engine room from switchboard gallery
Dampered openings in centre of this room for air entrance to filter
16'-8"
11'-0"
11'-0"
16'-0"
High water level crest of dam
18'-0"

Arrangement of equipment for Regina city power house, showing how coal is fed automatically to the boilers and the ashes forced out.

will be possible to obtain as unobstructed view of every machine in the room.

The most modern and economical stoking machinery is to be installed, so that there may be practically no smoke. This is the more remarkable in view of the fact that there will be a battery of 16 boilers capable of generating 8,000 boiler h.p., or practically twice that amount in electrical energy. There will be many other features to conserve human energy and make for general efficiency, including automatic stokers, ash conveyors, automatic coal conveyors, the latest type of machinery, tile-finished floor and walls in the engine room, concrete foundations for all heavy machinery (to prevent vibration), underground ducts for live wires, double wiring and piping throughout (so as to avoid delay in making repairs), a large electric traveling crane for lifting and placing heavy machinery, repair shop, up-to-date accommodation for all employees, and a chief engineer's office overlooking the engine and boiler rooms.

The chief engineer's office and permanent quarters will be another feature. It will be on the first floor at the west end of the building and will consist of office, three bedrooms, kitchen, toilet and a long gallery from which it will be possible to oversee both engine room and boiler room. Indicators in the office will keep the engineer constantly informed as to the exact condition of every machine, while telephones and electrical signals will give him instant communication with every workman in the building. In the same manner he will be able to control the old power house, which will be used as a sub-station. The kitchen in the engineer's quarters will be one of the most up-to-date in the city, as all of the cooking utensils will be electrical.

There will be two 1500-kilowatt steam-driven turbine generators, and in addition a 3,000 kilowatt generator of the same type. This, together with the machinery in the present power house, which will be left practically intact, will be sufficient to meet Regina's needs for some time to come. Ample room has been left for expansion.

Coal will be taken over the street railway lines in the cars in which it was brought to the city, weighed, and unloaded direct into the bucket conveyors, which will take it overhead to huge bunkers placed directly above each pair of boilers, having a combined capacity of 1500 tons. The bunker over each set of boilers will be separate, and when a new supply of coal is needed for any boiler a lever released by the fireman automatically discharges 200 pounds into the hopper of the Riley Automatic stoker. Every 200 pounds will be counted automatically, so that there will be a double check on the amount of coal used. The automatic stoker will feed the fire from underneath and in the same operation push the ashes and cinders away from the farther side. The ashes fall down a steep incline into the conveyors and are carried to the east end of the building where they are lifted about ten feet above the ground and there loaded into empty cars for removal.

As the coal is forced into the fire from underneath by the automatic stokers, a fan under the grate supplies the draft and the volatile, combustible parts are driven off and heated in their passage up and down through the coils which make up the boilers. In this passage the smoke-forming parts are mixed with air in direct proportion to the coal forced into the furnace, and as long as the adjustment remains perfect there will be no smoke. Economizers will be installed.

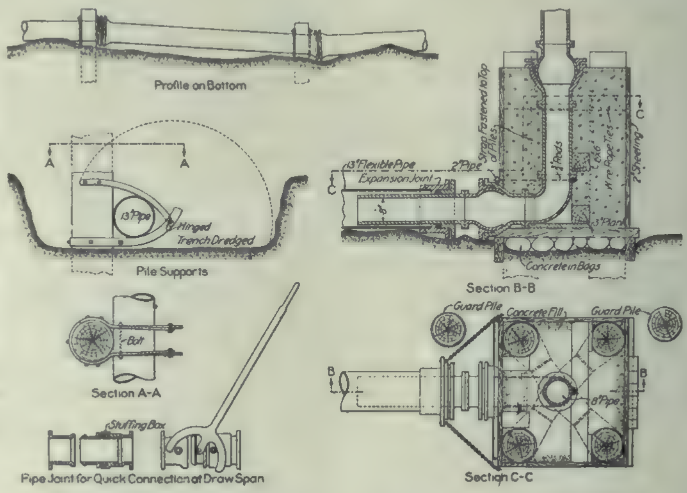
The boilers, like the piping and wiring, are so arranged that they can be cut off individually for the purpose of repairs without affecting the efficiency of the others.

Mr. E. W. Bull is superintendent of light and power at Regina.

Laying Submerged Water Main on Pile Supports at Richmond, B. C.

To convey the water supply of Richmond, B.C., across the north arm of the Fraser River there was laid in 1911 a 13-in. submerged steel main with flexible joints, having a length of 1,200 feet. Richmond's water supply is furnished by the city of New Westminster and amounts to about 900,000 gal. daily. On account of the extremely uneven nature of the river bed, its continual shifting and the great number of water-logged trees and snags the pipe joints were not able to withstand the strain upon them and leakage finally increased to such a degree that it was impossible to maintain the required pressure. It was recently decided, therefore, to raise the 13-inch main and relay it on a level, protected support in the bed of the river.

In order to maintain Richmond's supply in the meantime an 8-inch wood-stave pipe was laid across a bridge at floor level. This necessitated arrangements for stopping the flow when the draw was opened. After drawing up tentative plans for joints of several types to be used at the drawspan connections, it was decided to use a device which had formerly been successfully employed on drawspan connections on a 2-inch main. This device consists of three brass castings, as shown in the accompanying drawing, one of which is movable and actuated by a hand lever. The movable part works through a stuffing box, its tip being machined to a cone shape which exactly fits the opposite casting so as to make a tight joint; the parts are spherically ground. In case the drawspan settles and the closure is slightly out of its normal position the cone shape of the connection brings the two ends of the pipe into line. This joint has been in use about six months and is said to have given excellent service without requiring repairs of any kind. The drawspan is opened on an average of about fifteen times a day.



Details of submerged water main with flexible joints at Richmond, B. C.

In order not to subject the pipe to water ram by the too sudden closure of the valve on the reservoir side of the draw, a blowoff is provided which discharges into the river. When the drawspan is to be opened the full flow of the main is first turned into the river, after which the valve between the blowoff and the drawspan joint can be closed with ease. The total length of the 8-inch wooden main on the bridge is about 450 feet, and it has been found that the insertion of this length of smaller diameter pipe in the 2½-mile length of 13-inch line has reduced the capacity only very slightly, as the principle of the Venturimeter tube serves to increase the velocity through the smaller section. This 8-inch wooden main with the drawspan connections will be left in place as an emergency reserve after the new submerged main is in use.

Brackets for Submerged Main

In preparing to relay the 13-inch main it was decided to use an agitator-suction dredge to excavate a trench directly across the bed of the stream. To insure further the rigidity of the pipe piles were driven in this trench 16 feet apart provided with metal brackets for clamping the pipe to the pile at the level of the trench bottom. In designing the bracket the requirements called for strength sufficient to carry the weight of the pipe to the pile if the river bed should scour from beneath and a fastening device capable of easy adjustment by a diver. The bracket used is so shaped, as shown in the drawing, that should the pipe settle on it slightly out of line the curve of the bracket would guide it against the pile, after which the upper arm would be swung into the closed position and spiked by the diver. The piles averaged 50 ft. in length and were driven about 11 ft. below the bottom of the channel. The brackets were affixed on the upstream side of the piles before driving, and in order that all might have the same level after the piles were driven a level instrument and observer were placed at a convenient point and driving was stopped when marks previously placed on the piles were down to correct elevation.

Troubles with River Current

While the piles were being driven the pipes had been bolted together and were supported on the under side of a long raft. When the row of piles was in place this raft was extended from shore on the upstream side. It was found, however, that the river current, which had a velocity of about four miles per hour, held the raft so firmly against the piles that it was required to use a tug, steaming full speed against the broadside of the raft, to free it from the piles. After considerable difficulty the raft was removed into place and the pipes were filled with water.

Chain pulleys had been provided to ease the pipes down to their supports, but the current held the pipe so firmly against the piles that it was even necessary to weight it down with bags of sand before it would sink. When it had sunk about 2 ft. an obstruction was found at the south end. It proved to be a two-armed snag that had come downstream during the night and encircled one of the piles; this was removed by the tug. Although only four and one-half days elapsed between dredging the trench and laying the pipe, soundings over the pipe disclosed the fact that the channel had silted up at the extremities of the trench to a depth of 4 ft., and the pipe was this far above the brackets on the piles at these points. This was not considered serious, however, as the brackets lie open beneath the pipe, and any scour of the river bed can only let the pipe down on its supports. After the pipe was lowered into the trench, the piles were cut off level with the river bed.

Because of the reduced pressure on bends, and because the full 13-in. section was not deemed necessary for the required delivery, the vertical pipes at each end of the submerged main are 8-in. in diameter instead of 13-in. The bends are anchored in concrete, supported on four piles, as shown in the drawing.

A crew of ten men was employed in transferring the main. Navigation to points up the river was stopped for four days. The work of relaying the submerged main was done by the city of New Westminster, under the personal supervision of Mr. J. W. B. Blackman, city engineer.—Engineering Record.

Building of Glass Twelve Storeys High

SOMETHING of a novelty in commercial buildings has been commenced at the corner of Tenth avenue and Thirty-sixth street, New York City. The architects, Goldwin, Starrett & Van Vleck, have provided plans for a twelve-storey skyscraper, in which the entire front of the building and its interior sides are to be of glass. In fact, 78 per cent. of the walls will be of this material. There will be no openings in the glass facade except those in the front of the building for emergency purposes, but which will not be visible from the street. Ventilation will be accomplished through a specially devised system of ducts, through which will be forced cooled and washed air, let into the offices at whatever temperature the tenants may desire. Humidity will be an unknown quantity, as it will all be washed out of the air, which will be cool, dry and free of all dust. In the winter season this same system will furnish heated air.

Vibration, usually noted in buildings where heavy machinery is operated, has practically been eliminated, and anti-noise has also received attention in other directions. All floors are to be rubber tiled.

It is estimated that the structure will cost approximately $600,000, of which amount $78,000 will cover the cost of the glass. On the interior the glass will be a specially polished plate, and for the exterior surface will be specially treated plate that will not transmit heat waves into the interior.

Rust Upon Paint

FROM experiments made by Dr. E. Liebreich and Dr. F. Spitzer, as reported in Die Umschau, it appears, says The Times, that the general opinion that rust in iron is prevented by a cover of paint is not always correct, and that in fact the paint itself may be the cause of rust. During the experiments made it was found that polished steel bars, which had been given one coat of paint, and upon which distinguishing numbers were painted, rusted principally, and in some cases solely, in the place where they might have been considered doubly protected—namely, under the thicker layer of paint at the numbers. Five colours were then selected, and some iron plates were given one coat and some four coats of paint, each coat being perfectly dry before the other was applied. These were exposed during 24 hours to a jet of steam. The places with one coat remained intact, the others were completely rusted. It is surmised that this result is due to the fact that the varnish of the second coat dissolved the paint of the lower one and thus made it porous, and that the porosity increased with the number of coats applied.

The Rationale and Advantages of Lime Sterilization of Water[*]

By Charles P. Hoover[†]

If it is the lime in water that makes it hard, then why add lime to water in order to soften it? The writer is asked to answer this question by about one-half the people who visit the Columbus Water Softening and Purification Works.

The proposition of course does seem absurd to those who do not understand chemical reactions, but nevertheless the explanation is rather simple and the writer wishes to explain the action that takes place when lime is added to water before going into the main part of the discussion, namely, "Lime Sterilization of Water."

Strictly speaking, it is not lime (CaO) that makes water hard, it is the limestone, calcium carbonate ($CaCO_3$) which is held in solution by the carbon dioxide (CO_2) which is almost always present in the natural water. Water impregnated with carbon dioxide (drawn from the air and from plant life) flowing over limestone rocks, dissolves and holds in solution the limestone. After this limestone gets into the water, there are several ways of getting it out, as follows:

First.—If the water is boiled, the carbon dioxide is driven off and just as soon as the carbon dioxide is expelled, the limestone is precipitated because it is not soluble in water free from carbon dioxide.

Second.—Quick lime, calcium oxide (CaO), has a great affinity for carbon dioxide and if it is added to water it immediately absorbs the carbon dioxide present in the water, is itself converted back to limestone and precipitates along with the rest of the limestone which has become insoluble because of the absence of carbon dioxide, so that when water is properly treated with lime, or in other words, when just enough lime is added to water to absorb its carbon dioxide (CO_2) content, the limestone or calcium carbonate is eliminated by precipitation.

Quick lime is limestone (calcium carbonate, $CaCO_3$) that has been burned in a kiln until all of its carbon dioxide content has been expelled. The reaction is as follows:

$$\underset{\substack{\text{Calcium carbonate}\\ \text{or limestone}}}{CaCO_3} + \text{Heat} = \underset{\substack{\text{Calcium oxide}\\ \text{or lime}}}{CaO} + \underset{\substack{\text{Carbon}\\ \text{dioxide}}}{CO_2}$$

And when lime absorbs carbon dioxide, the reaction is simply the reverse:

$$\underset{\text{Lime}}{CaO} + \underset{\text{Carbon dioxide}}{CO_2} = \underset{\substack{\text{Calcium carbonate}\\ \text{or limestone.}}}{CaCO_3}$$

If more lime is added to water than is necessary to neutralize the carbon dioxide, then the water will contain excess lime or caustic alkalinity. At the Columbus Water Softening and Purification Plant it has always been the policy to add lime in quantities just sufficient to neutralize the carbon dioxide and an additional amount to precipitate the magnesium which is always present in the Scioto River water. The utmost care has always been exercised to reduce the hardness to the lowest possible figure and still not leave residual or excess lime in the softened water. It has been observed that bacterial tests made for the presence of intestinal bacteria in the softened water collected from the outlet of the sedimentation basins are negative 92 per cent. of the time in 1 c.c. Therefore an investigation was made to learn just why the lime softened water was so free from intestinal bacteria.

Excess Lime Method

Dr. A. C. Houston, chemist of the Metropolitan Water Board of London, Eng., in the eight Research Report of the Metropolitan Water Board, proposed an excess lime method of sterilizing water. His conclusions were founded on his observations that quick lime, added to raw Thames water in proportion of 1 part of quick lime to 5,000 parts of water, kills B. Coli in 5 to 24 hours and the microbes also of epidemic water borne diseases, for example, the typhoid bacillus.

He proposed purposely to overdose a part of the water with lime so as to bring about a known bacterial effect and then after a suitable interval, to mix this portion with enough water adequately stored or sterilized with ozone or hypochlorite, to neutralize the excess lime. He states in his report that the excess lime is responsible for the germicidal action and that if just enough lime is used to neutralize the bicarbonate alkalinity of the water, no bactericidal action is effected.

Sterilizing Action not Necessarily Due to Toxic Effect of Lime

The results of bacterial tests made on lime softened water containing no excess lime, at the Columbus Water Softening and Purifying Plant, during the past four years and also the results of numerous laboratory experiments lead us to believe that the action is not necessarily due to the toxic effect of the excess lime, but that intestinal bacteria are killed when just enough lime is used to neutralize the free and half bound carbon dioxide in the water. Bacteria belonging to the colon or typhoid group seem to require carbon dioxide for their development.

If two samples of water, one containing CO_2 and the other free from CO_2, be inoculated with typhoid or colon bacilli, these organisms will live in the carbonated water but die in the water free from CO_2. This was demonstrated in the laboratory of the water purification plant in several ways, as follows:

First.—Samples of well water free from intestinal bacteria but containing free CO_2 were divided in two portions. One portion was boiled until all the CO_2 was expelled and was then carefully cooled so as not to absorb CO_2 from the atmosphere. The other portion was not boiled. Both portions were inoculated with typhoid and colon bacilli. These organisms thrived in the water that had not been boiled or in other words, in the water that still contained CO_2, but they died out completely in 48 hours' time, in water that was free from CO_2.

Even supplying the boiled water with oxygen did not render it suitable for sustaining bacterial life.

The results of these experiments tend also to support the contention that excess lime is not the essential factor in producing a water unfavorable to the growth of intestinal bacteria, because in this case, lime was not used to absorb the CO_2.

Second.—Samples of softened water collected from the outlet of the sedimentation basins and containing no free or half bound CO_2 were inoculated with from 5,000 to 10,000 intestinal bacteria per cc. and after 24 hours these samples became free from these organisms; on the other hand, organisms inoculated into softened water after it had been carbonated with CO_2 thrived and even increased in numbers.

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[*] Engineering and Contracting.

[†] Chemist in charge of Water Purification Works, Columbus, O.

Over 1,000 bacterial tests were made on samples of river water first inoculated with enough crude sewage to introduce from 3,000 to 8,000 colon bacilli and 40,000 to 50,000 total numbers of bacteria per cc. These samples after being inoculated with sewage were then softened with lime. Bacterial analyses were made after 5 and 24 hours' contact and in order to find out whether or not the bacteria were simply dragged down mechanically by the precipitated chemical, or were actually killed, samples of clear supernatant solution were tested, then the samples were vigorously shaken and a second set of tests made.

The results of these tests indicate that lime has a selective action. Intestinal bacteria are destroyed but the reduction of total numbers of bacteria is not high. Intestinal bacteria are killed and not simply removed by the precipitated carbonate, because the numbers of intestinal bacteria were no higher in the samples that were shaken than they were in the supernatant samples. Twenty-four hours' contact is not sufficient to insure sterilization of intestinal bacteria, unless the water is over-treated with lime.

Effluents from several sewage disposal plants were treated with lime. The results of experiments on sewage effluents show that excess lime is not necessary to effect the elimination of intestinal bacteria provided a sufficient period of contact is allowed (48 to 72 hours). The results also show that the action is not complete when large amounts of organic matter are present.

Many other laboratory experiments were made and the results of these experiments as well as the results of analysis of samples collected at different points in the plant seem to indicate the following conclusions:

Conclusions Based on Experiments

1. When enough lime is added to water to absorb the free and half bound carbonic acid and to precipitate the magnesium content, the bacteria of the colon and typhoid group are killed in 48 hours after being so treated, provided the water does not contain large quantities of organic matter.

2. The germicidal action is effective in from 5 to 24 hours when an excess of ½ to 1 grain per gallon is added beyond that needed to reduce the temporary hardness to the lowest possible figure.

3. Intestinal organisms will not live in water containing no free or half bound carbonic acid.

4. Lime softened water inoculated with typhoid organisms or with crude sewage soon becomes free from them.

5. The action is selective in that certain harmless bacteria grow but the disease producing germs do not.

Advantages of Lime Treatment

The intestinal bacteria and pathogenic organisms are killed by the lime treatment, rendering the water safe bacterially. The water is softened and soft water is more satisfactory than hard water for practically all purposes.

When lime is added to a water containing calcium and magnesium salts, a precipitate of calcium and magnesium hydrate is formed. The precipitated carbonate is pulverulent and is not a very good coagulant but the precipitate of magnesium hydrate is gelatinous and has about the same coagulating properties as the hydrate precipitates of iron and alumina. This gelatinous precipitate of magnesium becomes entangled with the precipitated carbonate, forming a gummy mass that settles very quickly. If there is no magnesium present in the water, a very small amount of filter alum, aluminum sulphate, added to the water will prove effective in hastening sedimentation.

The average turbidity of the river water treated at the Columbus water purification works, for the years 1910-1911 and 1912, was 63 parts per million. After being treated with lime, soda ash and alum the water was allowed to settle for about 12 or 15 hours and the average turbidity of the settled water was less than 5 p.p.m., and from June 1, 1912, to January 1, 1913, the turbidity averaged less than 1 p.p.m., the settled water being so clear that the filters were kept in service on several occasions for a period of seven days without being washed, and did not then show a negative loss of head. During the summer months, when the raw water shows a high average hardness, 250 to 350 p.p.m., and low turbidity, the clarification is almost perfect.

Turbid waters can be successfully disinfected by softening with lime and then allowing the turbidity to settle out, along with the precipitated carbonates. Turbid water has never been successfully disinfected with hypochlorite, because the bacteria imbedded in the suspended matter are not destroyed.

The sterilizing action persists indefinitely. In a recent paper on water disinfection by chemical methods, Mr. Samuel Rideal states the advantages of using chemicals that persist in their disinfecting action in the following words:

> It is at the same time a disadvantage, if a disinfectant, however powerful in its first onset, is very evanescent, as many disease germs are strongly resistant and we know that the time factor is of extreme importance in sterilization.

Lime Softened Water for Swimming Pools.—Since lime-softened water is a poor medium for the development of typhoid and colon bacilli, it appears to the writer that for use in swimming pools a water treated with lime in quantities sufficient to neutralize the temporary hardness and to introduce 2 or 3 grains excess lime would prove to be a very satisfactory and safe water for bathing purposes.

The advantage of caustic water over water sterilized with hypochlorite is that the disinfecting action of the caustic persists and if the water should become contaminated with pathogenic organisms they will soon become attenuated and finally die because there is no carbonic acid in the water and carbonic acid seems to be essential for their development, whereas a water sterilized by hypochlorite might be all right at the time of being pumped into the pool, but as soon as all the hypochlorite has become dissociated the chemical offers no resistance to the development of disease producing organisms that might be introduced into the water by the bathers.

Sterilization of Water Mains.—During the recent floods at Columbus it was necessary to stop pumping for a period of twenty-four hours on account of a section of 36-in. pipe being washed out by the flood water. The distribution system was drained and the local health authorities advised the people to boil the water, fearing that the mains would become contaminated with surface water. Knowing from our experiments that B. Coli, B. typhosus, B. para-typhosus, and intestinal bacteria will not live long in caustic water the method of treatment after pumping was resumed and was as follows:

The water at the plant was treated with enough lime to neutralize the temporary hardness of the water and in addition enough to introduce from 1 to 2 grains caustic alkalinity. Samples of water were collected from all parts of the city and 24 hours after the water taken from all parts of the distribution system showed by chemical tests the presence of excess lime or caustic alkalinity, the water was found to be bacterially pure. This treatment is safe, it does not introduce any taste into the water and there is no evidence except by chemical tests to indicate the presence of causticity in the water.

Metal Roofing as a Protection Against Lightning

By Professor E. S. Keene[*]

PROTECTION from lightning is a subject that recurs with the coming of each springtime. In the violence of an atmospheric electric disturbance, accompanied by the awe-inspiring flashes of lightning so common with the thunderstorms of the northwest, there are few who have not desired the protection of a lightning-proof shelter.

The probability of an individual building being struck by lightning is really very slight, but there is always a possibility of such an occurrence, and also that the stroke may be attended with considerable violence; more than that, the building may take fire.

That lightning rods are a real protection to buildings from lightning has been proven so many times that their value is no longer questioned, but the possibility of obtaining experimental data is so limited that definite rules for the establishment of the rods and conductors have never been formulated. For many years lightning rods were looked upon with suspicion in this country, because their sale for a considerable period was used as a means to defraud the unwary.

The formation of lightning is very imperfectly understood, but experience with its vagaries and a knowledge of the laws of high-tension electric currents has established a fairly good understanding of the methods of constructing lightning conductors for all ordinary discharges. It is very well known that lightning is the discharge of a large amount of electricity in a very short space of time and that whatever affords it a passage to the earth is apt to be badly damaged, unless the vehicle happens to be a good conductor of electricity and of sufficient size to transmit the amount of electric energy the flash contains; in which case it passes away doing no damage at all.

As a storm develops the electrically charged clouds pass over the earth, and when the electrical intensity becomes great enough to break down the resistance of the intervening air, the resulting discharge will pass into the earth by the most convenient path. This is commonly some high object of the landscape, a building, a pole, a tree or any other object that extends up from the earth. If the object is a conductor of electricity and connected with the earth, the lightning will pass into the ground without the least damage being done, but if it is not a good conductor, the havoc that is wrought in an instant is sometimes appalling.

Buildings with metallic roofs that are properly connected with the earth are far better protectors from lightning than could be given by rods. Buildings that are completely covered with sheet metal and well connected with the earth are practically lightning proof. Covered in this manner, buildings have been known to be repeatedly struck by lightning without the least damage. The sheet iron granary, when well connected with the earth may be considered lightning proof. The ground connections mentioned above may be made of metallic rods that extend well in the earth and are securely fastened to the metallic covering of the buildings.

If, then, the roof of a building possesses a metallic ridge, eave-troughs and downspouts, these will afford very good protection if they are well connected and well grounded. A roof covered with a metallic screen, as a chicken screen, makes an excellent protector when properly grounded.

It must be remembered that the ground connection is a positive necessity, and too much care cannot be exercised in its construction. The earth is the great reservoir of electrical energy and it is always at zero potential. If a discharge of lightning can be directed into the moist earth by a conductor, its energy is soon dissipated, but the ground connection must be of considerable area and extend well into the moist earth. A piece of galvanized iron pipe, driven into the ground seven or eight feet, makes a good "ground." Large buildings must have two or more such "grounds." The connecting wires must be securely fastened to the ground connections.

In the matter of conducting wires, the U. S. Weather Bureau, in a bulletin on "Lightning and Lightning Protection," recommends a No. 3 galvanized iron wire (Brown & Sharp gauge) as amply sufficient in size for ordinary lightning protection. If metallic downspouts are used as conductors the connections should be made, with the "grounds," with riveted joints. Copper conductors give no better protection than iron if the iron is kept covered to prevent it from rusting.

Wire fences are often the cause of damage by lightning because of the method of construction. If the fence wires are grounded the danger from this cause will disappear. Ground wires may be made of ordinary fence wire and should be connected with each of the wires of the fence and extend into the ground three feet. Such "grounds" should be made for each 100 feet of fence.

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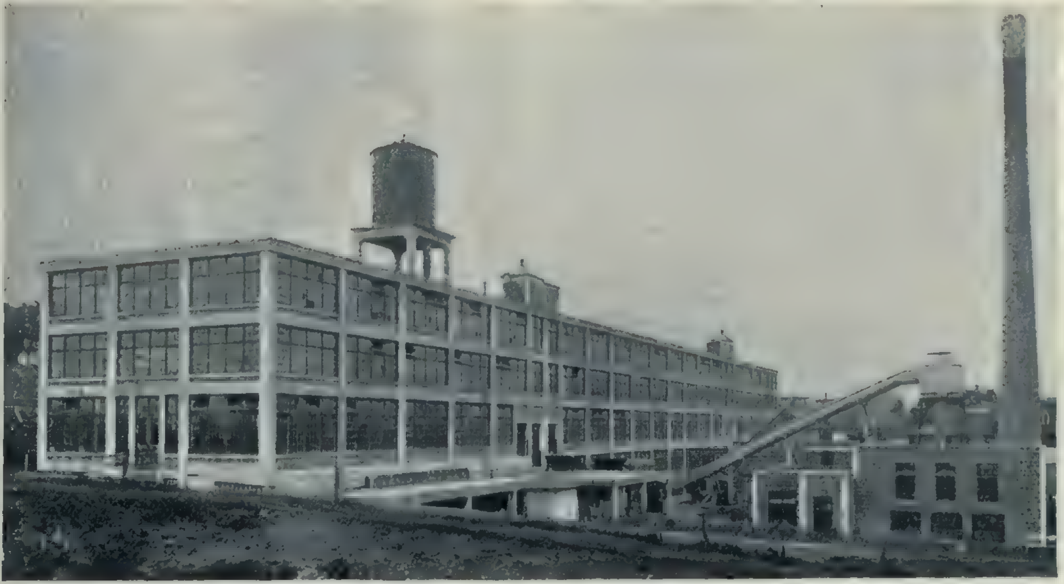
[*] North Dakota Agricultural College, Fargo, North Dakota.

Valuable deposits of clay, especially adapted to the manufacture of tile, sewer pipe and high grade brick, have been discovered in the neighborhood of Vegreville.

An improvement in granite-block paving has been adopted in Philadelphia in the repaving of Broad street between Cumberland and Silver streets. The street was laid with granite-block paving of the old type with large blocks and wide joints. The old pavement was removed and the old blocks were cut in half and relaid with the cut end uppermost, and the joints between the blocks were grouted with Portland cement mortar. The pavement obtained in this way has a much smoother surface than the pavement originally laid, and the cost of the work was a little less than half the cost of laying a new granite-block pavement.



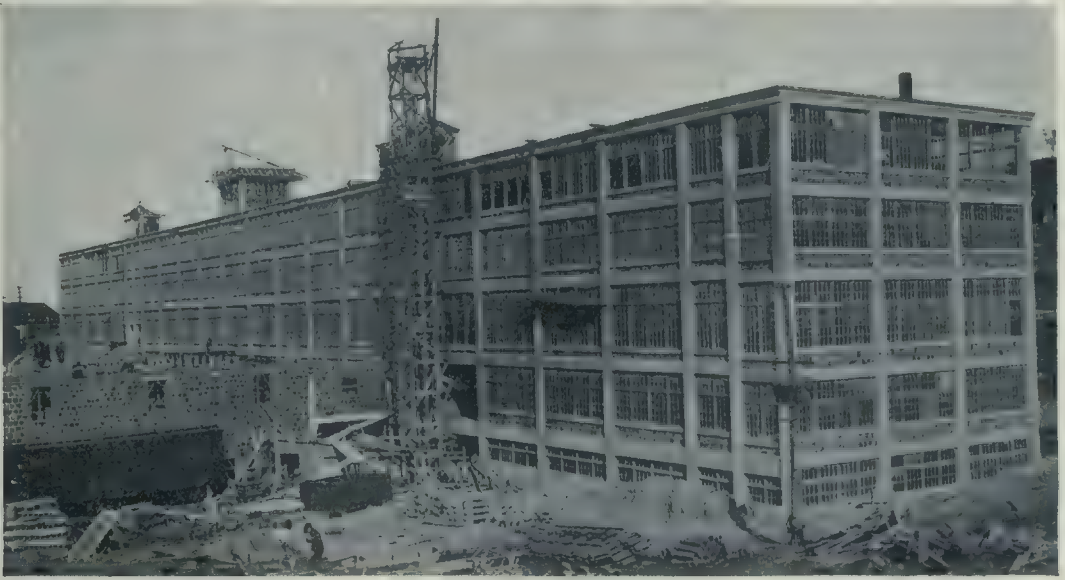
Reinforced concrete factory of T. S. Simms & Company, Limited, St. John, N.B.

New Reinforced Concrete Factory at St. John, N.B.

AMONG the new manufacturing plants recently put into operation in the Maritime Provinces is the brush factory of Messrs. T. S. Simms & Company, Limited, of St. John. This firm has been established in St. John for many years and has gradually built up one of the largest businesses in Canada for the manufacture of brooms and brushes. Outgrowing their old plant, the company was among the first to purchase a site in the new suburb of Fairville, and commenced building operations in the spring of 1912.

The main building, of reinforced concrete throughout, is four storeys in height, with a basement, and measures 52 ft. wide by 400 ft. long. The other buildings comprise a two-storey dry kiln 662 ft. by 52 ft., a boiler and engine house 70 ft. by 50 ft., with a one hundred and fifty foot chimney, and a one hundred thousand gallon concrete reservoir. The dry kiln and power house have reinforced concrete frames and hollow tile walls. Provision has been made in the layout of the plant by the engineers, Messrs. Lockwood, Greene & Company, of Boston, Massachusetts, for doubling its capacity when necessary.

As shown in the interior view, the ceilings are un-



The Simms factory under construction.

encumbered with beams, due to the use of the flat slab type of construction. The spacing of columns, about 17 ft. apart crosswise and 19 ft. longitudinally, affords a large area of clear floor space. The floors are designed for a live load of 150 pounds per square foot and have a granolithic finish, except in the woodworking department where a maple top floor is laid. The upper floors are reached by two stairways and two elevators, each well being completely enclosed by hollow tile partitions with automatic fire doors. The roof is formed over the ceiling of the top storey by a cinder fill graded to the proper pitch, and covered with a layer of cement on which tar and gravel roofing is applied.

Provision for the support of shafting, piping and other equipment is made by locating in the ceilings slotted inserts four feet on centres, similar inserts being placed in the floor in the basement.

The manufacturing processes carried on include everything necessary to convert lumber, broom corn and bristles into brushes, brooms and whisks, the material being received and shipped by rail.

Electricity is used throughout the plant for driving the machinery, for lighting, and even for heating the pitch. The motors are of the Canadian Westinghouse squirrel cage type, arranged on the group system. Open wiring is used on horizontal runs and conduits on vertical runs. Power is supplied direct by a Bellis and Morcom vertical compound engine, connected to a 188 kv.a. Siemens-Halske alternator which delivers three-phase energy at 600 volts, 60-cycles. Localized lighting by means of tungsten lamps is employed, the current being taken through transformers from the main generator. There is a small auxiliary direct current generator for supplying a few lights and for operating the heaters of the pitch kettles outside the regular working hours.

Steam at 125 pounds pressure is furnished by two 175 h.p. horizontal return tubular boilers. Some coal is burned, but a considerable amount of fuel is obtained from the waste broom corn, shavings, sawdust, and sweepings. A system of conveyors collects this material at various points throughout the factory and delivers it to the boiler room where it is automatically fed to the furnaces. Exhaust steam is utilized for the dry kiln and for heating the buildings which are equipped with the Dexter vacuum system.

An ample supply of good water is obtained from an Artesian well adjacent to the boiler house. For fire service, a one hundred thousand gallon reservoir, of reinforced concrete, is located in the yard from which the fire pump can draw its supply. Further protection is obtained by a 40,000 gallon tank placed on a structure above the roof of the main building.

The factory is thoroughly equipped with sprinklers throughout in order to reduce the fire risk as much as possible.

The contract for the buildings was executed by the Aberthaw Construction Company of Boston.

At a cost of over $500,000 a fine ten-storey building has been completed in Vancouver. The structure, which has been erected for Messrs. Henry Birks & Sons, jewellers, occupies a space 120 ft. x 102 ft. As little wood as possible has been used in the erection of the building, which is of fireproof construction, reinforced concrete and hollow tile being the material used. The exterior to the ninth storey is of light cream-colored terra cotta upon a base of polished British Columbian granite, the tenth storey and the coping and cornice being carried out in blue and grey terra cotta squares. In the interior, the entrance hall is finished in marble, with vaulted ceiling of Caen marble. Messrs. Summerhill & Putman, Vancouver, designed the building, the work of construction being done by the A. K. Bentley Company.

A Skyscraper of 1601

According to press despatches from Paris it has been discovered there that the originator of the "skyscraper" or gratteciel was not an American architect, but a Frenchman who lived three centuries ago. At the Bibliotheque Nationale there is preserved a volume written by this architect, whose name was Jacques Perret of Chambery, in 1601, describing a skyscraper of the author's invention.

"This grand and excellent pavilion, in which one can lodge 500 persons in comfort and luxury," was to be of 160 ft. frontage, 145 ft. in width and with walls 10 ft. thick. The edifice was to rise 12 storeys and have a little pavilion on the roof surrounded by terraces and was thus to reach an altitude of 350 ft., which," says L'Illustration, "is, of course, hardly to be compared with the gigantic buildings of 480 to 700 ft. which Pierre Loti saw on his recent visit to New York City. At the same time Perrat's design is certainly the design of the American skyscraper 300 years later—an audacious idea conceived by a Frenchman."

New Post Office for Westmount

WORK is now proceeding on a new post office for Westmount, P.Q., designed by Mr. Alphonse Piche, architect, of Montreal. The building will be situated at the corner of Western and Greene Avenues, having a frontage of 102 feet on the former street and 90 feet on the latter street. It is of classic design, with massive columns, dome and pediments. The foundations are of concrete and the exterior of cut stone on a steel frame. There will be two storeys and a basement, the upper storey affording accommodation for the caretaker. The ground floor is divided into various departments for the use of the officials. Marble and oak will be largely employed in the interior finish, the floor being mosaic. Mr. John Quinlan is the general contractor, the contract price being $104,000.

Sketch of Westmount post office now under construction.

The city of Birmingham, Eng., has purchased thirty motor omnibuses, 30 and 40 h.p., two-deck type, which will be operated as an adjunct to the municipal street railway system.

The Canada Building, Saskatoon

THERE are several points of interest in the design and construction of the Canada Building at Saskatoon, which has just been completed. The plan reproduced herewith is practically typical of all the other upper floors excepting the third which is laid out for doctors and dentists.

The interior finish of the building is the best that can be obtained. All corridors in the upper storeys are wainscotted to a height of 7 ft. with selected Vermont marble. The corridor floors are terrazzo with marble borders. The offices are furnished in quater-cut oak, stained "fumed." The woodwork of the corridors is selected Honduras mahogany.

The Canada Building, Saskatoon, completed recently.

There are three high-speed Otis-Fensom elevators serving the nine storeys, the elevator cars being expressly designed by the architects to harmonize with the rest of the finish of the lobby and corridors.

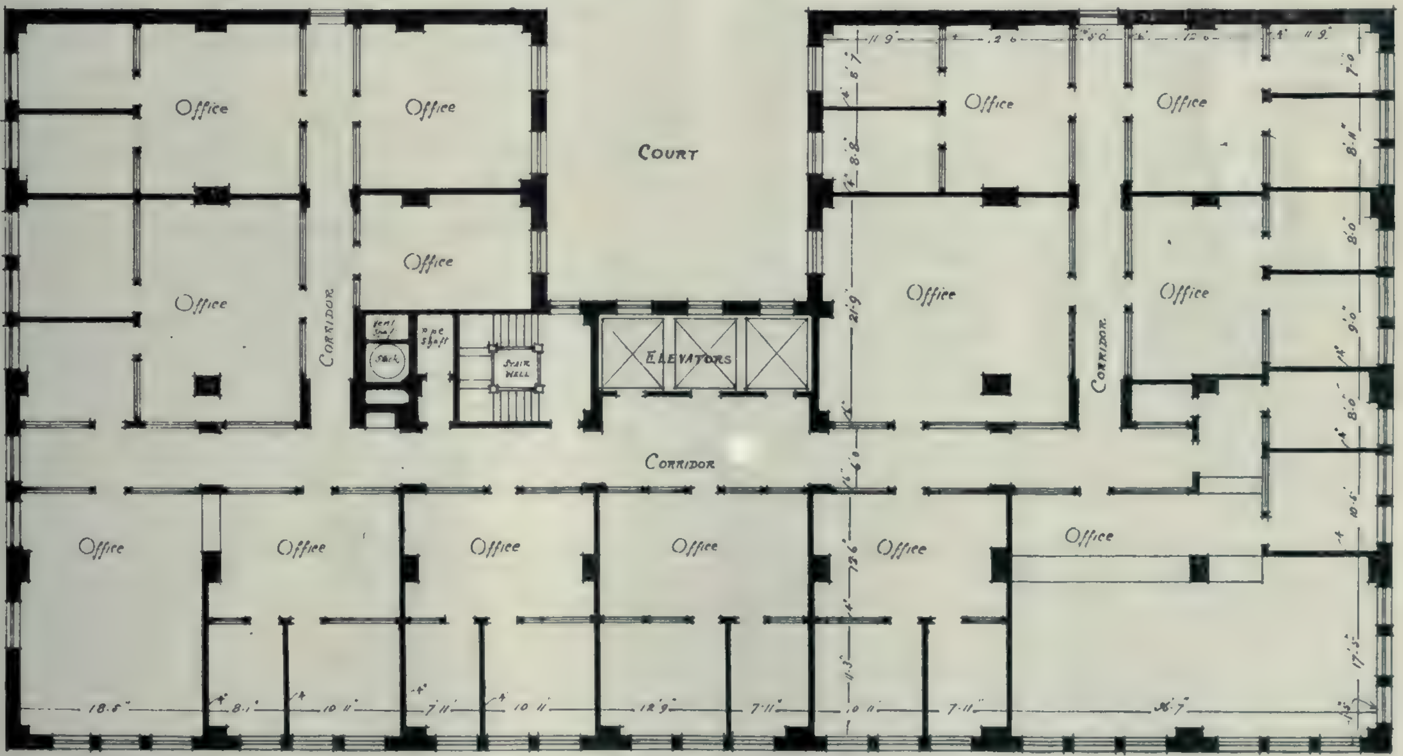
The entrance lobby is completely finished in marble, except the ceiling, which is heavily coffered and ornamented. The floor is pink Tennessee marble with a wainscotting of Botticino marble to a height of 9 ft. 6 in., above which, extend to the ceiling, panels of Pavanazzo marble, bordered with Tavernell.

The elevator fronts are of heavy ornamental iron. A beautifully ornamented stairway reaches from this entrance lobby to the second storey. From the centre of the celing hangs an electrolier of solid bronze 6½ ft. long and 3½ ft. wide, containing some hundred lights.

The public portions of the basement are finished in marble and Caen stone. The exterior is finished in ornamental terra cotta and pressed brick of the same shade. The store fronts all contain concealed awning devices, which, when the awnings are rolled up, show no trace of the device from the outside.

More than 500,000 tons of road material and loam are being unloaded from barges by a huge locomotive crane erected on the Panama-Pacific Exposition site at San Francisco and placed in freight cars for distribution. The engine handles material at the rate of 3,000 tons a day. It is estimated that more than thirty miles of perfect roads will be located within the main exposition grounds. The red rock is expected to fit the general color scheme, suitably contrasting with the exterior coloring of the exhibition palaces.

The Hotel Vancouver, at present being erected for the Canadian Pacific Railway, will be a building of sixteen storeys and one of the finest of its kind on the Pacific coast. The main portion of the structure will be of steel and concrete floor slabs, the base of the exterior of granite and the upper part of clay burnt brick and terra cotta. The work was designed by Mr. F. S. Swales. Messrs. Skene & Christie are the contractors.



Typical floor plan, Canada Building, Saskatoon.

ARCH: JAMES CHISHOLM & SON, WINNIPEG

Hydrated Lime—What it is and How it is Used

BY RICHARD K. MEADE*

Within the past few years "hydrated lime" has become a well-known term in constructional work. The following article, by an authority in the field, presents a comprehensive discussion of the part hydrated lime plays in the field of cementitious materials.

WITHIN the last few years the users of cement have heard a great deal about "hydrated lime." This is because, unlike quick-lime, it can be used with cement and when so used, confers upon the resulting concrete certain good properties, notably rendering it more nearly impervious to water, lightening its color and making it take a clearer impression of the molds and flow into the latter more easily. The question is therefore often asked by cement users: "What is hydrated lime?"

When a chemical compound is combined with water the chemist gives it the name "hydroxide" or "hydrate." Hydrated lime or lime hydrate is therefore a compound of lime and water. Thus we see that the name "hydrate" as applied to lime really means some property of the lime and is not merely an indefinite term, like the word "Portland" for example, which was applied to cement because the concrete made from it looked to the inventor like stone from the quarries at Portland, England.

Lime Putty

"Lime putty" or the paste resulting when lime is slaked in a mortar box is also hydrated lime. Chemically, there is no difference between the two. Practically, the difference is this. When the mason slakes lime in a mortar box, he adds to the contents of this sufficient water not only to combine with the lime, but also an excess; the latter remains after the lime is slaked and forms with the slaked lime a paste or putty. In the manufacture of hydrated lime, however, just sufficient water is added to slake the lime and what small excess is employed is driven off by the heat of slaking.

When lime slakes it merely combines chemically with water. Fifty-six parts of pure lime combine with 18 parts of water. These proportions are as fixed as the laws of gravitation. If we mix with the 56 lbs. of lime a little over 18 lbs. of water, the lime will take up only 18 lbs. of water, and, provided the quantity of water is not much greater than 18 lbs., the excess of this will be driven off by the heat generated when the lime slakes. If we use a great excess of water, say 50 lbs., the 56 lbs. of lime will still take up only 18 parts of water, some little will be driven off by heat and the rest of the water will remain mixed with the hydrated lime to form a paste or putty.

Hydrated lime therefore, is nothing more or less than dry slaked lime. In its manufacture, the quantity of water used to slake the lime is so regulated that the small excess over and above that needed by the lime is driven off by the heat generated in the slaking of the lime.

Manufacture of Hydrated Lime

In the process of manufacture used in this country, the lime is first crushed to the size of a pea. It is then introduced into a machine called a "hydrator," in which the water is added and the mixture stirred by means of paddles or plows until the lime has slaked to a perfectly dry powder. This dry powder is then generally passed through some separating system which removes from the fine powder all of the coarse pieces. These latter consist of unburned limestone, silicious cores and unhydrated lime.

The advantages possessed by hydrated lime over lump lime are numerous. There is, however, one objection to it, viz.: that it is not quite so plastic as lime slaked to a putty in a mortar box, hence many plasterers prefer lump lime. This is particularly true of high calcium limes. Masons and plasterers, however, are fast learning that the objection raised as to plasticity is more than balanced by the convenience with which hydrate can be handled.

When lime is exposed to the air it absorbs not only water, but also carbon dioxide and does what is known as "air slake." If water only were absorbed, the effect would be only to convert the lime into hydrated lime, but where carbon dioxide is absorbed the effect is to form carbonate of lime. Carbonate of lime and limestone are chemically the same thing and of course neither of them has any binding effect. In the formation of carbonate of lime, practically speaking, the lime reverts back to its original condition before its was burned. When lime air slakes the lumps break up and fall to a fine powder. If this powder is analyzed it will be found to consist of a mixture of carbonate of lime and hydrated lime and when tested will be found to have only a part of its original usefulness. Masons therefore formerly had a strong prejudice against fine lime. When hydrate first came out, it found much opposition, probably some of it fostered by the lump lime people, because its finely powdered condition led many to believe that it was air slaked lime. This prejudice has now disappeared, however, as hydrated lime is so extensively used that masons and plasterers are familiar with it and know the vast difference between the two—viz.: that air slaked lime is lime that has reverted to limestone and that hydrated lime is dry water-slaked lime.

Difficulty of Keeping Quicklime

The property which lime has of absorbing water makes it not only a hard but a dangerous thing to keep. It also requires an expensive package. Some lump lime is shipped in bulk but much of it, particularly the better grades, is shipped in barrels. Lime will keep much longer in barrels than it will in bulk, but even in these it air slakes rapidly and becomes worthless. Furthermore the barrels are expensive. Hydrate, on the other hand, may be shipped in paper, cotton or burlap sacks.

Hydrated lime is much more bulky than cement and consequently the sacks must be bigger. Instead of a bag 18 in. x 36 in. such as is used for 95 lbs. of cement, the burlap bags used for hydrated lime are generally 25 in. x 42 in. While, of course, a bag of hydrate is no heavier than is a bag of cement, it is much harder to handle, owing to its size. The burlap bags are so open that the hydrate dusts through them badly and while little of the material is actually lost, the handling of the burlap bags is hard on the men, consequently the introduction of cotton sacks within the last few years into the lime trade. These are made of much lighter goods than are the cement sacks.

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Keeping Quality of Hydrated Lime

Hydrate will absorb carbon dioxide if spread out in a thin layer. In sacks, however, which are piled together the loss of hydrate from air slaking is very slight. The outer layers of lime undoubtedly serve to protect the rest of the package. In some tests made of hydrate kept all winter in a dry storehouse, the loss was found to be on an average 3 per cent.; some of the outside bags showed as much as 5 per cent. and some of the inside bags as little as 1½ per cent. In the same length of time a lot of lump lime would have been rendered practically worthless.

One of the great advantages of hydrated lime is, therefore, its keeping qualities. This makes it especially desirable where only a small quantity of lime is used at a time, and over an extended period, allowing the user to purchase lime by the car load.

The lime industry is a seasonal one and generally the seasons are short. The lime manufacturer with kilns only is forced to shut these down when the trade is dull as it is in the winter. If, however, he has a hydrating plant he can run his kilns all the year around, storing his product as orders fall off and rushing it out when trade is brisk.

Fire Risk from Quicklime

The fire risk from storing quicklime is well known by lime dealers. A ton of lime on slaking will give as much heat as 75 lbs. of good coal. If water has a chance to get at the lime and any combustible material such as the barrels in which the lime is kept, the floor and sides of the lime shed, etc., is in contact with the lime, fire is very apt to occur. Many instances of the burning of sheds and storehouses in which lime was stored have come to the writer's attention. Sometimes the fire is caused by a leaky roof and sometimes by the rising water of a flood. Often leaky barges and boats carrying lime have been set on fire and burned at sea by the heat generated by the slaking of lime.

With hydrated lime there is no fire risk. Since the hydrate has once slaked it cannot slake again. It has the same relation to lime so far as ability to generate heat goes, as ashes have to coal.

Purity of Hydrated Lime

Generally speaking, hydrated lime is much purer than lump lime. This is particularly true of hydrates made by the air separator or the screen process, but is not true of hydrate made by the mill process. In hydrates made by the former process, the impurities are separated from the hydrate, while in the latter they are ground in with the lime. These impurities consist of silicious cores, unburned limestone and unhydrated lime, the latter usually occurring from the overburning and semi-fusing of the lime.

The silicious cores and the unhydrated lime are what cause the "popping" of plaster, the action being similar to the "unsoundness" of cement and from the same cause, viz.: the hydration and consequent expansion of the lime after the plaster has hardened. Where the mill process is used to make the hydrate, the cores are ground very fine and consequently can slake quickly and, if not present in too large quantity, before the mixture hardens. With a well made hydrate, therefore, the builder runs less chance of a bad job than with mortar often hastily slaked in the mortar box.

One of the strongest recommendations for hydrate so far as the user is concerned is unquestionably the ease with which it can be used. The builder is saved the expense of carting mortar boxes around. He is saved the delay of waiting for the lime to slake. He always has at hand slaked lime. The streets are not blocked by boxes and barrels full of lime paste. Instead of this, the hydrate has only to be mixed with water and sand and this can be done as well on the sixteenth floor of a sky-scraper as on the ground. For brick and mortar work, it is hard to conceive of any mason using lime putty when the ease with which hydrate can be made into a mortar is considered. Hydrate is particularly well adapted for "patching jobs" and to rush work.

One of the strongest claims for hydrate is the fact that it can be used with cement. It is only necessary to mix the two and any desired proportions can be employed. For laying brick and stone a mixture of 25 parts cement and 75 parts lime is quite popular. (One bag of cement to three 100-lb. sacks of hydrated lime). The addition of the cement does not appreciably detract from the plasticity of the mortar, while it adds greatly to the strength, particularly at early periods. For stucco, the proportions are generally reversed, (one 100-lb. sack of hydrated lime to three sacks of cement), the hydrated lime adding to the plasticity of the mortar and making it spread more easily. It also makes a lighter colored stucco and adds to its density. For waterproofing, about 15 parts of hydrated lime and 85 parts of cement are used, (or one 40-lb. sack of hydrated lime to two sacks of cement).

The addition of hydrated lime to cement mortars acts as a sort of lubricant and causes the latter to flow more readily and to fill the forms and molds more perfectly. It also causes the forms to leave the concrete more cleanly.

Hydrated lime, however, delays somewhat the set of concrete in which it is used and such concrete will not harden quite so rapidly as will plain concrete. It may often be used to retard the set of quick-setting cement.

Much has been said about the water-proofing properties of hydrated lime and concrete in which it has been used is certainly more resistant to water than where it has not been employed. In the laboratory, concrete made with hydrated lime shows quite a high rate of absorption when immersed and, if the Chapman block test is applied to cement-hydrated lime mixtures, these show some improvement over cement alone but still show that water will be soaked up quite rapidly by such concrete.

On the other hand, hydrated lime in practice has given good results and in my estimation the reason for this is found in the fact that mortars in which hydrated lime is used flow very freely. Consequently they may be worked in around the aggregate thoroughly and along the face of the forms, resulting here in a surface similar to the trowelled top of a cement sidewalk. For making tanks, pits, etc., watertight, hydrated lime will give excellent results. It is not, however, an infallible remedy against damp walls, etc.

Hydrated lime should not be used in concrete subject to sea-water as the writer's experiments show that concrete in which hydrated lime is used is more subject to attack than plain concrete.

Glossary of Terms Used in Road Construction

(Continued from last issue.)

Gabbro.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Ganger.—The foreman of a gang of labourers.

Gangmaster.—One who hires a gang of men to perform some specified work.

Gangway.—A temporary bridge or access usually constructed of wooden planks.

Gantry.—See "Gauntry."

Garbage.—A word sometimes applied to house refuse.

Gas Tar.—The tar which condenses in the pipes, etc., when gas is distilled from coal.

Gauge.—A standard of measure. The term "gauge" has been adopted by the Engineering Standards Committee to designate the standard group of sizes into which broken stone has been divided, and the term "size" has been adopted for the sub-division of the "gauge."

Gauging.—The act of measuring or dividing into sizes.

Gault.—A stiff marl or calcareous clay.

Gauntry.—Sometimes spent "Gantry." A species of crane or hoist.

Gelatinous.—Resembling jelly; viscous.

Glutinous.—Viscous, viscid, tenacious, resembling glue.

Glutrin.—The trade name of a material for binding in carriageways.

Grab.—A description of dredger or machine for removing soils.

Grade.—Sometimes used instead of the word gauge.

Grade Line.—Sometimes used to describe the line of gradient.

Gradient.—The longitudinal degree of slope, inclination, or fall of a road. Sometimes wrongly called the "grade."

Grading.—A term used to indicate the shaping of a road when under construction. Also used to describe the sorting of materials according to their sizes.

Graduate.—"To prepare gradually; to temper or modify by degrees."

Grafting Tool.—A sharp, narrow spade used for digging clay.

Grain.—The veins or fibres of wood, etc.

Gramme.—The French standard unit of weight equals 15.4325 grains Troy.

Granite.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee. Used also as one of the rocks coming under the group.

Granolite.—The trade name of an artificial stone.

Granomac.—The trade name of a bituminous macadam.

Granophyre.—Comes under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Grant-in-aid Roads.—Certain district roads, towards the maintenance of which county councils make grants to district councils.

Granular.—"Consisting of, or resembling, granules or grains."

Granulite.—Comes under the trade name of "granite," as settled by the Engineering Standards Committee.

Grating.—A frame of iron bars covering a gully or other opening; sometimes also called a "grid" or "grate."

Gravel.—Small stones or fragments of stone, or small pebbles, generally much water-worn, often intermixed with sand, clay, loam, etc. This material is generally known as rover-gravel or pit-gravel. The Engineering Standards Committee have not yet dealt with it.

Greasy.—Used to describe the surface of a carriageway when under certain climatic conditions it becomes slippery.

Greedy.—Used to describe a stone or other substance which imbibes a large quantity of bituminous liquid. For instance, a limestone may be described as "greedy of tar."

Green.—Fresh or new.

Green Oil.—See "Anthracene."

Greenstone.—Comes under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Grey Royal.—The trade name of a special granite sett.

Greywacke.—Comes under the trade name of "Grit," as settled by the Engineering Standards Committee.

Grid.—See "Grating."

Grip.—A cutting or trench provided at the side of the road to drain off the surface water. Sometimes called a side grip. Also used to describe the "hold" of a horse's hoof on a carriageway.

Gripmac.—The trade name given to a manhole cover which, it is claimed, retains the road surface against the frame.

Grit.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee; sand or gravel of rough but small, hard particles, used for "gritting" or "sanding" the surface of a carriageway.

Grout.—Or Grouting. As a verb this word is used to designate the act of filling either joints or interstices with a bituminous or cementitious mixture. As a noun it is used to describe the mixture or material used for the purpose of grouting.

Growing Soil.—Sometimes used to designate the actual soil of a foundation.

Grub.—Or Grub Up. To dig up by the roots, or root out by digging.

Guide Post.—See "Signpost."

Gully.—An opening in the channel or water table at the side of a carriageway to take the surface water. (A gully is really a channel, and it should be called "gully hole," or "gully pit.")

Gummy.—See "Viscous."

Gunter's Chain.—A measuring chain of 100 links of 7.92 in. each equals 66 feet in length.

Gutter.—See "Channel.

Guy.—A rope used to steady a shear legs or other similar erection.

Hacking.—See "Scarifying."

Haft.—A handle.

Ha-Ha.—A sunk fence or ditch.

Hahnite.—The trade name of a dust palliative.

Hairpin.—A term used to designate a very sharp and complete turning (like the head of a hairpin) in a road.

Halt.—A stopping place or station on a light railway.

Hand Broken.—Stone broken by hand with a hammer.

Hand Pitched.—A term used to designate a foundation, or bottom, or bottom course, of a carriageway constructed of large stones, placed carefully by hand.

Handspike.—A bar of wood used as a lever.

Hanging Road.—A road with a crossfall from one side to the other, and not higher in the centre.

Hardcore.—Materials, such as brickbats, clinker, rubbish, etc., used for the bottom course or foundation of a carriageway.

Hardwood.—A generic term for a wood that can be used for paving without any previous treatment, to distinguish it from softwood.

Harsh.—A term sometimes employed to designate a rough and hard surface of a carriageway.

Haunches.—The sides or flanks of a carriageway; sometimes also called "quarters."

Hectare.—A French measure containing 2.4711 acres.

Heel.—A term applied to that part of a footwalk which is furthest from the kerb.

Herring Bone.—A term applied to a method of paving obliquely to the left and right alternately.

Highway.—A generic term to include the whole road between the hedges or walls. "A public road, a way open to all passengers."

Hogback.—A convex hill, similar in shape to the back of a hog.

Hogging.—A name sometimes given to a red marly gravel, used as a binder.

Holding.—A tenure.

Homogeneous.—"Of the same kind or nature; consisting of similar parts, or of elements of the like nature."

Hopper.—A funnel or receptacle.

Hornblende Schist.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Hornfels.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Hornstone.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Humid.—Moist, damp, containing sensible moisture, wet or watery, consisting of water or vapour.

Hummock.—A rounded hill or small hillock.

Hygroscopic.—Having the property of imbibing moisture from the atmosphere.

Imbricate.—To overlap. Sometimes used to designate the overlapping of the finished surface of a carriageway so as to prevent an edge being left.

Immerse.—To plunge or dip anything into a liquid so that it is completely submerged.

Immobile.—Incapable of being moved.

Impalpable.—Incapable of being felt by touch, such as very finely-ground cement.

Impenetrable.—Incapable of being penetrated.

Impermeable.—Not permitting the passage of a fluid; waterproof.

Impervious.—Sometimes used instead of "impermeable."

Imponderable.—Without weight.

Impregnate.—To infuse or saturate. Creosote, for instance, is infused into soft-wood paving blocks.

Inadherent.—The state or quality of not being capable of adhering.

Incline.—An ascent or descent.

Incorporate.—To mix or blend.

Incarnate.—To make thicker.

Indentation.—A depression sometimes applied to the track or hollowing made by a wheel.

Indissoluble.—Incapable of being dissolved.

Indivisible.—Not capable of being divided.

Indurate.—To make hard.

Inert.—Sluggish, inactive.

Infiltration.—Slow penetration of moisture.

In Situ.—The exact place, or on the spot.

Insoluble.—See "Indissoluble."

Instable.—Liable to give way; changeable.

Interattrition.—Used to designate the movement of the stones composing a carriageway amongst themselves, due to the movement set up by the traffic, thus causing an attrition or grinding action among the stones.

Interstice.—A space intervening between one body and another, otherwise in close connection. The word "interstices" is used to describe the voids or spaces between the broken stones of a carriageway, etc.

Invert.—An arch reversed or turned upside down.

Ironstone.—Coming under the trade name of "Limestone," as settled by the Engineering Standards Committee.

Islet.—Sometimes used to designate a refuge or place of safety for pedestrians on a carriageway.

Jarrah.—An Australian hardwood used for paving.

Jodelite.—The trade name of a preservative for wood blocks.

Journals.—The ends of shafts of an engine resting on bearings or enclosed by couplings.

Jumper.—A long iron chisel used for boring holes in rocks.

Karri.—An Australian hardwood used for paving.

Keck.—To tip a cart or wagon. A "kecking beam" is used to back against when tipping.

Kennel.—The watercourse or gutter of a street. See "Channel."

Kentish Rag.—A dark, tough limestone.

Keratophyre.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Kerb.—Sometimes spelt "curb." The stone or other material used at the sides of a carriageway to support the footway.

Keroselene.—A volatile hydrocarbon which first passes over when petroleum, coal tar, etc., are distilled.

Kerosene.—A liquid hydrocarbon distilled from coal, bitumen, etc.; closely related to paraffin oil.

Kettle.—A pot or boiler in which bituminous mixtures are heated.

Keyed.—Held together by a bond.

Kidney.—The name given to small, rounded, water-worn boulders, formerly much used for paving.

Kilogramme.—A French measure of weight equal to 35.27 oz.

Kilometre.—A French measure of distance equal to 1093.6 lineal yards.

Kiton.—The trade name of a bituminous binder.

Lagging.—The planks supporting the bricks, concrete, etc., in tunnel work. Also the non-conductive covering of boilers, steam pipes, etc., to prevent radiation of heat.

Lamina.—Thin scales or layers.

Lamprophyre.—Coming under the trade name ot "Basalt," as settled by the Engineering Standards Committee.

Landers.—Temporary troughs of wood for the conveyance of water, sewage, etc., during the construction of works.

Lane.—A narrow way or passage between hedges, walls, or buildings.

Larch.—A softwood much used for paving.

Larry.—A wagon, sometimes called a lorry.

Lateral.—"Pertaining or belonging to the side," or "Proceeding from the side," such as lateral branches, lateral roads, etc.

Latten.—A thin lath.

Launder.—See "Lander."

Layer.—A word sometimes used instead of "course" or "crust," etc.

Lay-out.—The planning or alignment of a net-work of roads, etc.

Leat.—A trench or conduit of water to or from a mill.

Lifting.—The act of raising the surface of a carriageway by pickaxes or by a scarifier; also called "chequering," "scarifying," "hacking," "stocking."

Ligneous.—Made of wood.

Limestone.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Lithofalt.—The trade name of a compressed paving block of an asphaltic or bituminous composition.

Lithomac.—The trade name of a special method of mixing and laying an asphaltic macadam.

Litre.—A French measure of capacity equal to 61.028 cu. in.

Litter.—Sometimes used to designate dry rubbish on roads.

Loam.—Native clay mixed with sand or lime, or decayed vegetable and animal matter.

Longitudinal.—Lengthwise, as opposed to transverse or across.

Lorrie.—A long open wagon. Sometimes spelt "lorry."

Lyantine.—The trade name of a process of making carriageways.

Machine-broken.—Used to denote stone that has been broken in a machine, and not by hand.

Macadam.—A generic term used to describe a method of carriageway construction with broken stone, gravel, etc., bound together with smaller stone, gravel, etc., and water; also used to designate the broken stone or metal of which a carriageway is formed. (The word is derived from the name John Loudon Macadam, one of the first men since the days of the Romans to construct roads on scientific lines).

Machine-breaker.—Sometimes used instead of "stone-breaker" or "stone-crusher" to designate a machine for breaking stones.

Magna.—The trade name of a special granite sett.

Main Roads.—A rather loose term, but now generally applied to roads maintained by county councils.

Malm.—A rich soil resting on the upper green sand.

Malm Brick.—A yellow sandy brick.

Manjak.—Pure bitumen.

Marbit.—The trade name of a bituminous binder or dust palliative.

Marble.—Coming under the trade name of "limestone," as settled by the Engineering Standards Committee.

Marl.—Calcareous and argillaceous earth.

Mastic.—A generic term applied to anything gummy or adhesive. (It is the name of an Eastern gum).

Mastic Asphalte.—A term applied to asphalte melted and laid in an adhesive condition on a carriageway or footway, as distinguished from "compressed asphalte."

Matrix.—"That which encloses anything" (from mater—mother). Used in road making to designate the material which fills the voids, and is sometimes called the "filler." One terminology of this word gives it as follows: "A composition either to form a cushion or binding material for the aggregate." (This term is very loosely used, and requires revision.)

Mattress.—A term sometimes used to designate a thin blanket or cushion of fine bituminous material laid on the surface of a carriageway.

Mature.—To ripen or make ready by process of time. Tarmacadam is sometimes stored in order to mature.

Maul.—A heavy wooden mallet used generally for setting kerb.

Maund.—A basket.

Meaty.—A term sometimes used to designate a rich mortar, concrete, or bituminous mixture.

Medium.—"Instrumentality of communication; agency of transmission." Sometimes rather loosely used in road nomenclature to designate a material used in conjunction with other materials.

Mere.—A pool or lake.

Mesh.—The open space between the threads of a sieve or screen.

Metal.—A term used to designate the broken stone of which a carriageway is constructed.

Metalling.—Sometimes used instead of "metal," or generally to indicate the act of putting the broken stone on the road.

Metre.—A French measure equal to 3.281 lineal feet.

Mews.—A lane or alley in which stables are situated.

Mexphalte.—The trade name of a bituminous mixture.

Microgranite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Milligramme.—A French measure of weight equal to .0154 of a grain.

Millimetre.—A French measure of length equal to .03937 of an inch.

Mixer.—A machine for coating stone with tar, etc.

Molten Asphalte.—A thin term for "mastic asphalte."

Momentum.—Mass multiplied by velocity in units of distance.

Monkey.—The dropping weight of a pile driver, or similar appliance.

Monolithic.—Formed of a single mass of stone.

Morass.—A swamp or marsh.

Mortar.—A mixture of lime and sand with water.

Mosaic.—A kind of inlaid work made with small sections of stones.

Mould.—Fine, soft earth.

Mudstone.—Coming under the trade name of "schist," as settled by the Engineering Standards Committee.

Mush.—A term applied to describe the mud on a tar-treated road (probably derived from the word "emulsion.")

Mushroomed.—A term sometimes used to describe a wood pavement that has become raised owing to insufficient allowance for lateral expansion.

Mylonite.—Coming under the trade name of "Hornfels," as settled by the Engineering Standards Committee.

Naphthalene.—A hydrocarbon formed during the distillation of coal gas.

Near Side.—The left side.

Nonskid-Macrete.—The trade name of a pavement.

Nonslip.—The trade name of an artificial flag or paving stone.

Norite.—Coming under the trade name of "gabbro," as settled by the Engineering Standards Committee.

Nozzle.—The orifice or outlet of a pipe or hose.

Nucleus.—The central mass about which matter is collected; the stones of a concrete compose the "nucleus."

Oblique.—"Slanting, not direct;; aslant."

Obsolescence.—The state of becoming out of date or obsolete.

Odometer.—An instrument for measuring distance.

Offset.—A perpendicular measured from a point in a line in surveying.

Ohl Process.—The trade name of a system of road construction.

Oil.—A viscous liquid insoluble in water. There are animal, vegetable and mineral oils,,also fixed, volatile and essential oils.

Oil Tar, or Water-gas Tar, is derived from carburetted water-gas plant. It contains a large proportion of water which is difficult to separate.

Oleaginous.—Having the qualities of oil.

Orderly Bin.—A receptacle at the side of a road for the road-scavenging materials (vide "Bin").

Outlet.—A means of egress, a place of exit, a vent.

Output.—The quantity of material, etc., put out or produced in a specified time.

Packing.—A term used to designate the foundation of a carriageway constructed of stones which are hand-packed or pitched.

Paddles.—The arms in a mixing machine which stir and mix the materials.

Palliative.—"That which mitigates, alleviates or abates." The term is applied to certain dust-layers which only last a short time.

Parapet.—The side wall of a bridge or embankment; sometimes applied to the footwalk; especially in the North of England.

Parbuckle.—A method of levering objects into trenches with a rope.

Patch.—"To mend hastily." The term is applied as a verb to denote the repairing of a carriageway by small instalments, as opposed to "resurfacing." As a noun it is applied to small worn portions of a carriageway.

Path.—A track trodden by feet (Gr. patos, a trodden way); hence the word footpath, footway, pathway, pavement, etc.

(To be continued)

Erratum

Chain.—In the definition of this word on p. 58 of the Contract Record of November 12, the last word ("units") should read "links."

Personal Mention

Mr. R. P. Durham, vice-president of the John S. Metcalf Company, Limited, Montreal, is on a business trip to Europe.

Mr. G. F. Porter, engineer of construction of the St. Lawrence Bridge Company, Montreal, has been elected a member of the American Society of Civil Engineers.

Mr. F. A. Creighton, formerly city engineer of Prince Albert, Sask., has opened an office in the Carlton Building, Winnipeg, and will engage in consulting practice.

Prof. C. M. Carson, formerly chief of the Department of Chemistry at the university of New Brunswick, has been made head of the Department of Chemistry at the Michigan College of Mines.

Mr. S. H. Reynolds, of Victoria, B.C., formerly Assistant City Engineer of Winnipeg, has been appointed a Commissioner of the Administration Board of the Greater Winnipeg Water District.

Mr. Walter V. Appleton, formerly assistant to the superintendent of motive power, Intercolonial Railway of Canada, has been promoted to be General Master Mechanic of the headquarters at Moncton, N.B.

Mr. W. G. Chace, M.Can.Soc.C.E., of the firm of Kerry & Chace, Limited, consulting engineers, Toronto and Winnipeg, has been appointed Chief Engineer for the construction of the Greater Winnipeg Water Supply System.

Mr. John G. Sullivan, Chief Engineer of the Western Lines of the Canadian Pacific Railway, Winnipeg, was elected second vice-president of the Cornell Society of Civil Engineers at their annual meeting in New York recently.

Mr. R. O. Wynne-Roberts, M.Inst.C.E., Consulting Engineer, Regina, was in Toronto last week. After visiting London, Ont., and other points he returned west at the week-end, travelling via Chicago, and was due in Regina on Sunday night.

Mr. W. A. McLean, chief engineer of highways and a commissioner of the Ontario public roads, has been scheduled to take part in the proceedings of the tenth annual convention of the American Road Builders' Association, which opens at Philadelphia on December 9th.

Mr. J. W. Weller, chief engineer in charge of the new Welland Ship Canal construction, visited Ottawa last week in connection with tenders received by the Department of Railways and Canals for Section 5 of the canal, extending from Allenbridge to Port Robinson. The contract will be let shortly.

Obituary

Mr. Arthur J. Frith, principal of engineering at the Armour Institute, died on November 10th at Chicago.

Mr. George C. Watson, a well-known Toronto builder, passed away suddenly last week in his 76th year. The late Mr. Watson was a resident of Toronto for a quarter of a century and enjoyed the popularity of many friends in the building trade.

Mr. Lindsay, Secretary of the Vancouver Builders' Exchange, in a speech before a gathering of builders and members of allied trades said that Vancouver was the last of the large cities to organize a builders' exchange along modern lines. The by-laws of the organization have been based upon those of the Montreal, Winnipeg and other exchanges. Mayor Baxter, who followed, expressed the hope that next year it will be possible to accomplish four million dollars' worth of improvements. On the subject of additional loans he said that nothing would do more to increase the financial standing of the city than the quiet completion of what was already in hand without any more borrowing. The Mayor believed that the recent financial stringency had been a benefit rather than an injury to the city. He favored larger investments in industrial enterprises of which the prospects in Vancouver were better than ever.

Mainly Constructional

The News in Brief—From Coast to Coast

The American Institute of Architects will hold its forty-seventh annual convention at New Orleans on December 2-4.

The Toronto city council will be asked to submit a by-law on January 1st, for the contemplated erection of a $200,000 hospital in Toronto east.

Mr. Justice Lebeuf, in the Circuit Court, Montreal, has decided that a contractor is not obliged to heat a building in course of construction.

According to a report by the Controllers, the city of Montreal has spent $2,344,324 upon sidewalks and new streets during the past three years.

The Hon. R. Rogers, Minister of Public Works, announces that the largest dry dock in the British Empire will be built on Halifax Harbor, probably on the Dartmouth side.

St. Matthias Anglican Church, which was recently opened at Winnipeg, will accommodate about 1,400 people. The design is modified Gothic, the building being of brick with cut stone trimming.

Middlesex County Council have in contemplation the carrying out of extensive improvements to roads and bridges at London, Ont., at an outlay of $700,000 and a by-law will be submitted to the ratepayers soon.

The town of Sudbury, Ont., has decided to extend its power-house, pumping station at a cost of $8,606 and the necessary by-law authorizing the borrowing of the money has been passed by the municipal council.

Good progress is being made by Canadian Explosives, Limited, in the construction of their new powder works on James Island, Vancouver. The new plant, when completed, will be one of the largest and most modern in Canada.

A new organization to be known as The Marshall-Izlar Supply Company has been started in the city of Calgary. The concern will be devoted to supplying the requirements of building, railway construction and mine development.

It is stated that the city of Hull will oppose any attempt on the part of Ottawa to get the bill for the Gatineau lakes water supply through the Quebec legislature unless several clauses in the measure are either amended or withdrawn.

Montreal's city council has been asked by the Toronto Civic Guild to unite with other cities in requesting the Hon. Robert Rogers, Minister of Public Works, to throw open for competitive plans the designing of the new public buildings at Ottawa.

A new post office is to be erected at Westmount, Montreal. The style of architecture is classic with the columns, dome, pediments, etc., of cut stone. The foundation has been put in and work begun on the superstructure. Mr. Alphonse Piche is the architect.

Messrs. Armstrong, Whitworth, of Canada, Limited, the Canadian branch of the English shipbuilding and armour plate firm, which is constructing a plant in Montreal, was incorporated at Ottawa last week with two million dollars capital. The company, it is stated, will carry on the manufacture of iron, brass and steel machinery and shipbuilding. Sir Percy Girouard, K.C.M.G., Messrs. Sexton William Armstrong Noble, of London, Eng., George Green Foster and John Augustine Mann, and Mr. M. J. Butler, of Montreal, are named as the incorporators.

The architectural firm of Stevens & Lee, hospital specialists, Toronto and Boston, are to prepare a general plan for the Hamilton city hospital to be erected on the mountain top. The design of the building is to embody the latest in hospital construction and provision will be made for additional units in later years.

During the sitting of the Quebec legislature recently, the interesting statement was made that in five years there will have been constructed under the new Roads Act two thousand miles of macdamized roads in the province. Of the $10,000,000 provided by the act of 1912 the municipalities have applied for over $8,000,000.

The seventh Annual Convention of the American Society of Agricultural Engineers will be opened in Chicago on December 29th. Amongst the papers to be presented will be those dealing with the subjects of "Farm Sanitation with special reference to Water Supply," and "Concrete Drainage and Irrigation."

The Dominion Bridge Company, which is known to have had a very heavy year's business, last week closed a contract for the steel work for the new 23-storey Royal Bank Building which is now under way at the corner of King and Yonge Streets, Toronto. The contract is said to be the largest of its kind ever awarded in Canada.

The stringency in the money market is reflected by the action of the directors of the Unity Building Company, of Montreal, who have decided to defer payment of bond interest which is said to have fallen due some days ago. The capital of the company is said to be $600,000, of which $300,000 is stock and $300,000 six per cent. bonds.

The Montreal council have decided to seek powers from the Provincial Legislature to abolish the local improvement tax by which the cost of street paving is paid by fronting proprietors. Some two years ago the law was changed, and it has been agreed that the cost of paving streets since 1911 shall be charged to loan account.

The inauguration of a parcel post system in Canada is likely to lead to large structural addition being made to post office buildings in many parts of the country. This is one difficulty which the post office department is meeting with in preparing for the new system, as, in many cases, extra buildings will have to be rented until permanent ones are erected.

Building permits issued in Quebec during the month of October last reached the sum of $253,235, which, compared with the figures for the corresponding month ot last year, show an increase of $171,885. From January to October of this year, the building permits have reached the sum of $1,829,080. This shows an increase over the same period last year of $920,390.

The Westmount, P.Q., Council are asking the provincial legislature for power to assess the cost of sewers, drains, streets, sidewalks, parks and playgrounds against the owners of real estate within a fixed area or specified limits. They also seek power to acquire land on Westmount Mountain by mutual agreement or expropriation for the purpose of a site for a waterworks and reservoir.

An order is stated to have been made for winding up the Superior Portland Cement Company, of Orangeville. The company was incorporated in 1892, with a nominal capital stock of $500,000, of which $400,000 is subscribed. The statement of affairs filed shows liabilities of $607,626, including $400,000 stock, $100,000 debentures and accounts payable of $26,500, bills payable, $30,650, and owing to the Bank of Hamilton, $45,000. The assets are nominally the same as the liabilities, but include $80,000 spent in organizing expenses, $80,000 for installing plant, $124,000 for the real estate, $150,000 for the plant, and some $27,000 profit and loss.

The new steel cable suspension bridge which spans the Kootenay river at Brilliant, B.C., has been practically completed. The bridge was designed by Mr. J. R. Grant and the firm of Cartwright, Matheson & Company, of Vancouver, consulting engineers, and constructed by the Doukhobor Society. The cost, including labor and all material, is given as $45,000, of which the government contributed $20,000.

The development of the leading Mormon centre of Canada is now foreshadowed by the completion of architects' plans for the $300,000 temple to be erected at Cardston, Alta., by the Mormon Church. Contracts are being closed with Cranbrook (B.C.) quarrymen for the delivery of the requisite amount of cream-colored marble. Excavation for the main structure is to be started early in the coming year.

The value of the building permits issued in Hamilton from October 31st last year to the same date this year was $5,083,050, being a decrease of $299,850 under 1912, but $909,945 over 1911. Mr. Anderson, building inspector, presenting his annual report to the board of control said it was a matter for congratulation that Hamilton could close its building year less than $300,000 behind the record set by prosperous 1912.

A by-law has been passed for the erection of a dry-dock and shipbuilding plant at Sault Ste. Marie, Ont., at a cost of $2,000,000. The work is being carried out for the Lake Superior Dry Dock and Construction Company, who also purpose erecting a dry dock, etc., on the site of the present Bellevue Park. A bonus of $20,000 a year for twenty years will be granted by the ratepayers toward the cost of the scheme.

It is reported that Sir Richard McBride, premier of British Columbia, has completed an arrangement with the Standard Oil Company to give them a charter at the coming session of the provincial legislature to build a railway through Alaska. This line will run in connection with the Chicago, Milwaukee and St. Paul Railway with headquarters in Seattle, Cincinnati, linking the Pacific Great Eastern to Fort George.

The question of the acceptance by the Montreal Controllers of the Elder Ebano Asphalt Company's contract for the supply of asphalt without advertising for other bids was before the City Council. Three aldermen complained that their requests for facilities to examine the correspondence between the controllers and different concerns with regard to the supply of asphalt to the city, previous to awarding the contract to the Elder Ebano Asphalt Company, had been ignored.

Expenditure by the Dominion public works department last year aggregated $18,844,223 according to the annual report now being issued. Of this amount $10,177,831 was spent on harbors, including dredging, and $7,420,885 on public buildings. Large buildings now under construction include a post office at St. John, costing $381,800; Quebec post office, $385,000; Montreal examining warehouse, $999,000; Brantford post office, $244,308; Toronto customs, $4,000,000; and Ottawa customs, $1,500,000.

Owing to continued complaints of the inadequacy of the service, the Montreal Tramways Company have submitted to the Council a scheme revolutionising the transportation facilities of the city. The plans include the opening up of a new artery in the down-town section, building a boulevard almost the entire length of the city, north and south, the construction of subways under railway tracks, and also underground lines, one running north and south, one east and west under St. Catherine Street, and a shorter line in the business district. The city would be expected to widen streets, guarantee bonds for the subways, and give a new franchise for forty years, those at present in force being surrendered. Two experts are to choose the exact location of the subways, and the company agree to run a freight service, principally at nights, for the convenience of contracting trades.

The Remington Arms-Union Metallic Cartridge Company of Bridgeport, Conn., has started work on its new Canadian plant at Windsor, Ont. The buildings are to be of the heavy type of brick, sawtooth construction. The roofs and gutters will be entirely of Asbestos-Steel, the new type of construction for roofs and curtain walls evolved by the Asbestos Protected Metal Company of Beaver Falls, Pa. Asbesto-Steel is a combination of concrete and rectangularly corrugated sheets of Asbestos Protected Metal.

An action by Mr. C. Dufert, architect, Montreal, to recover $175 from Mr. M. H. Schacter, Montreal, has failed. The plaintiff prepared plans for a building which the defendant contemplated erecting, but was refused payment on the ground that the plans were not acceptable, and also in virtue of an agreement that there was no obligation to pay unless they were suitable. This agreement was denied by the plaintiff, but the judge held that it was proved, the plaintiff admitting that he had frequently prepared sketches for which he received no payment.

Rapid progress is being made with the Armstrong-Whitworth plant at Longueuil, for which Mr. E. G. M. Cape is the contractor. The plant will cover an area of 35,000 square feet and contain the following departments: Raw material, crucible department, steel casting department, rolling mill, hammer mill, tempering and hardening department, twists, drills, milling cutters, taps, dies, boiler house. The building is constructed of steel and concrete and as soon as it is covered the company will commence to install equipment. The plant should be in operation about May 1st.

According to a report from Mr. Thomas Tremblay, City Engineer, the city of Sherbrooke, Que., appears to be passing through a period of considerable constructional activity. The following are amongst the larger contracts that have been given within the past few months, and which are now in course of construction:—school on Council Street, planned for the Catholic School Commissioners, at a cost of $40,000 (Mr. L. N. Audet, architect, and Mr. Alfred Dion, general contractor); school on St. Louis Street, for the same board, Mr. J. W. Gregoire being the architect and Mr. Alfred Dion the general contractor for the building which will cost $40,000; office building on Wellington Street to cost $20,000. The owner and architect of the last-named structure is Mr. J. W. Gregoire and the contractors are The Sherbrooke Construction Company.

The Cook Construction Company have made considerable progress with the enlargement of the Montreal aqueduct. The contractors are dredging the earth with drag line dredges, and these are said by the company to be more efficient than steam shovels. At the time the contract was let the proposed use of the dredges was strongly criticised, but the company expressed willingness to put up guarantees over those originally asked for. The system consists of an engine operating an arm from which is suspended by wire ropes a bucket, which is filled with material as it drags along the ground. The contents can be deposited over a very wide range, and it is claimed that the system has the advantage over steam shovels of a longer range and more economical working. Several engineers and contractors have recently inspected the system, which is to be used on the construction of the new Welland Canal.

An important point relating to the rights of property owners in connection with underground railways has been raised in the action of the Canadian Northern Montreal Tunnel Company vs Dame E. E. Archambault, wife of the Hon. H. B. Rainville, before Mr. Justice Beaudin, Montreal. The company desire to build an electric line under the property of the respondent, in Montreal, and claim that a tender of $1,000 is sufficient for such a right. The company also ask for arbitration, and desire the judge to give possession of the land on a tender of $1,500 to cover claim and costs. The respondent asks for $125,000 to be deposited, and the Court has ordered this to be done. An affidavit for the company was signed by W. F. Francis, J. S. Archibald, S. P. Brown and C. C. Mitchell, while on the other side affidavits were made by several real estate experts and P. W. St. George; V. P. Boucher, J. O. Marchand, R. A. Brassard, J. Obalaski, and others. Expert evidence is to be called from Europe and the United States.

Although the Montreal building permits for the year show a considerable increase in value on those for the corresponding period in 1912, the contracting business has not been as brisk as it was last year. Many schemes for the erection of large buildings, especially of the office class, have been held up pending better financial conditions, and it is doubtful whether some will now materialize. Ten storey office building has been a little overdone; some of those recently erected are not more than half occupied, and with two or three now nearing completion, there will be plenty of space available for some time. There is, however, a dearth of medium priced houses and flats, notwithstanding the large number erected this year; it is asserted that there is little profit in buildings of this description owing to the high price of land, labour, and material, together with the rates of interest on borrowed capital. Supply men have naturally felt the falling off in the contracting business, and at no time this year has there been the shortage in bricks and other material which handicapped contractors in 1912.

Canadian Railroad Development

The Canadian Northern Railroad is reported to be planning the immediate construction of a line from Toronto to an entrance to Buffalo.

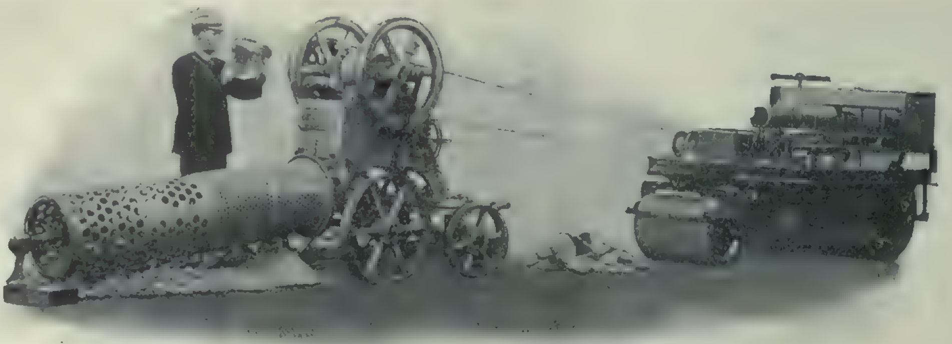
The Dominion Government, in its endeavour to hasten the work of the Hudson Bay Railway, will probably begin construction next spring from Port Nelson, so that work can be going on from both ends. The engineer, Mr. McLachlin, is in charge of the terminal work.

At the next session of Parliament application will probably be made for an act to incorporate the Pacific, Pease River and Athabaska Railway Company, Limited. The company will seek power to construct a line at the mouth of the Maas River, B.C., ending at a point in Prince Albert, a total distance of about 1,500 miles.

The contract for the substructure of the bridge over the Fraser River at Hope has been let to Armstrong, Morrison & Company, Limited. The bridge will be one thousand feet long with three spans and two abutments. It will connect with the C. P. R. main line on the north side of the river. The contract for the upper structure has not yet been awarded.

Power is sought from the Federal Legislature by the Shefford, Bagot and Missisquoi Railway Company to construct a line through the Counties of Missisquoi, Brome, Shefford and Bagot from a point on the border line between the province of Quebec and the State of Vermont, to a point to connect with the Intercolonial Railway between Bagot and St. Eugene. It is also proposed to build two branch lines.

The completion of the great high level bridge over the Saskatchewan River, built by the Canadian Pacific Railway, has relieved that company of the expense of transferring



Barford and Perkins motor roller driving stone breaker.

freight traffic from their south side terminals over the E. Y. & P. line. Consequently tariffs to Edmonton on non-competitive traffic have been cancelled and new tariffs are being issued which will effect a saving to Edmonton consignees on such traffic from $5 to $10 a car.

Mr. J. D. McArthur, who has the contract for the Hudson Bay Railway from Le Pas to Port Nelson, was in Ottawa last week in consultation with the Department of Railways and Canals about next season's work. So far Mr. McArthur has graded over 150 of the total 400 miles, and before this season's operations close steel will be laid on 130 miles of the grade. The work of laying steel has been delayed owing to the difficulty found in obtaining and distributing the ties.

The Ungava Railway Company is to apply to parliament at its next session for incorporation, with power to construct a railway from the Hudson Bay Company post, at the mouth of the Great Whale River, or from a point below the mouth of the Great Whale River and the mouth of the Nastapoka River on the eastern coast of the Hudson Bay, whichever may be found most desirable, in an easterly or southerly direction to Aylmer Sound, on the Gulf of St. Lawrence, or to some other point on the Gulf of St. Lawrence.

The contract awarded A. J. MacDonald and Nettleton Bruce Eschback Company, Maywood, P.O., Victoria, B.C., for work for the Canadian Northern Railway, calls for fifteen miles of construction on the Patricia Branch and from Selkirk water to completed grade on main line at switch 5. The work includes 300,000 cubic yards earth excavation, 150,000 cubic yards rock excavation, 100,000 cubic yards embankment (borrow), 1,000,000 ft. B.M. timber in trestle and 18,000 lin. ft. piling. The work will not be sub-let. With completion of this contract the Canadian Northern Railway will have a main line from Victoria to Alberni, 140 miles.

Publications Received

Reinforced Concrete Construction. Vol. 2, By Geo. A. Hool, Assistant Professor of Structural Engineering in the University of Wisconsin. Drawings by Frank C. Thiessen, Instructor in Structural Engineering in the University of Wisconsin. McGraw-Hill Book Company, Inc., New York City. Price $5.00. This volume on reinforced-concrete construction treats of the design and construction of retaining walls and buildings. It has been prepared to meet the need of students having varying qualifications, and on this account is more comprehensive in some respects than the ordinary text-book dealing with these subjects. The designing work is given in detail and an effort has been made to gain clearness by the selection and arrangement of the subject matter and by numerous drawings and photographs. Part 1 is devoted to retaining walls and Part 2 to buildings. Section 1 of Part 2 deals with design and Section 2 with construction. At the end of Part 2 there is a chapter containing a complete example of an estimate for a concrete building. The text throughout the various chapters is well arranged for reference and the illustrations are among the best we have seen in a work of this kind.

Water Ballast Motor Rollers

The accompanying cut illustrates the manner in which the water ballast motor rollers manufactured by Messrs. Barford & Perkins, of Peterborough, England, can be used for driving stone breakers. A large number of these rollers are in successful use and it is interesting to note that contracts have been made by the manufacturers with the authorities of a number of foreign powers, in addition to the British Government. As far as the application of these rollers to Canada is concerned the city of Winnipeg has recognized their merits by purchasing three of them. The fuel used is paraffin and the independence of coal and water is an important feature. The motor is of heavy design and especially adapted to this kind of work. The constructional features of the roller were detailed in our issue of August 20, 1913.

Readers of the Contract Record are advised to write to Canadian Billings & Spencer, Limited, Welland, Ont., for a copy of their catalogue of drop forgings manufactured from steel, brass, iron and copper. The excellence of the company's manufacture is attested by the fact that the firm's products are used by many of the leading manufacturing plants. Contractors will be particularly interested in their drop forged turnbuckles and machine wrenches, complete lines of which are always carried in stock. Quotations are submitted by the company upon receipt of models or prints.

The British Manufacturers' Association, Limited, with head offices in London, England, have opened a branch at 803 McGill Building, Montreal, under the management of Mr. R. J. McLean. The company have branches in Brazil, Argentina, and Egypt, and are agents for several prominent British firms manufacturing steam engines, steam and water turbines, machine tools, high grade steel, forgings and tool steels.

The United States Steel Products Company have succeeded in producing and offer the trade, through their representatives, B. & S. H. Thompson & Company, Limited, Montreal and Toronto, a rust-resisting sheet known as Apollo-Keystone copper bearing steel sheets. They are especially adaptable for all weather-exposed parts of buildings and all articles subject to corrosion.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brockville, Ont.
Boilers and pumps required by Town Council (Water & Light Dept.). Manager, E. J. Philip. Tenders now open for two 300 h.p. water tube boilers, one electric driven turbine pump.

Camrose, Alta.
Street Improvements, cost $10,000, by City Council. Mayor, F. P. Layton. Sec.-treas., O. B. Olson. Ratepayers will vote on by-law December 8th.

Crowland Twp., Ont.
Waterworks system contemplated by Twp. Council. Clerk, H. L. Pratt, R. R. No. 1. Welland. Arrangements will be made to secure estimates.

Galt, Ont.
Extension to watermain contemplated by Town Council. Clerk, Jos. McCartney. Extension to present 12 in. main on West Main St., from Opera House to Queen St., thence to Park Lane and to Blair road via Samuelson street.

London, Ont.
Pavement contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Chairman No. 3 Com., B. W. Bennett, 368 York St. Engineer-in-charge, W. N. Ashplant, City Hall. Eight blocks cement pavement from G. T. R. tracks to Ottawa Ave.

Medicine Hat, Alta.
Extension and improvements to waterworks system planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $175,000 for the above work.

Ratepayers will vote on by-law Nov. 29th to raise $50,000 for grading and gravelling of streets and for purchasing road construction plant and machinery. Clerk, H. Baker. Engineer, A. K. Grimmer.

City Council, Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $60,000 for the construction of surface and storm sewers throughout the city.

Medonte Twp., Ont.
Road improvements, cost $2,430, contemplated by Twp. Council. Clerk, T. D. Robinson, Moonstone, Ont. By-law to be voted on.

Milton, Ont.
Septic tanks contemplated by County of Halton. Clerk, Wm. Panton.

Niagara Falls, Ont.
Paving planned by City Council. Mayor, C. C. Cole. Clerk, W. J. Seymour. Engineer, E. J. Anderson, City Hall. Tenders received by Clerk. 1¾ miles paving.

Ottawa, Ont.
Pavement, cost $30,000, planned by City Council (Works Dept.). Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Asphalt pavement, Bronson Ave., on 6 in. concrete foundation, with 12 in. gutters. Surface drainage to be done by day labor. Surveys made.

Chlorination buildings, Lemieux Island, cost $7,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. Messrs. Alexander and Campbell have refused to accept the contract. Tenders received until Nov. 20th.

Contemplated purchase of c.i. gulley grates and frames by City Council (Works Dept.) Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. $10,000 to be allowed in estimates for 1914 to provide new pattern gully grates and frames to replace the old patterns throughout the paved streets of the city. Tenders will be called.

Subway, repaving, drainage, etc., cost $15,000, planned by City Council (Works Dept.) Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Repaving Bank street with sandstone blocks, raising and relaying concrete walks, drainage for embankments, new gullies, etc. Work to start next year. Plans drawn.

Point Grey, B.C.
Cement sidewalks planned by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. Sidewalks and curbs on Second Ave., Trimble and in Eburne on 6th St. and Saskatchewan Ave. By-law passed.

Preston, Ont.
Permanent roadway contemplated by Town Council. Mayor, Otto Hemuth. Clerk, H. C. Edgar.

Alterations and extension to waterworks system contemplated by Town Council. Clerk, H. C. Edgar. By-law to be submitted to ratepayers Dec. 15th to raise $53,000 for above work.

Sudbury, Ont.
Completion of trunk sewerage system planned by Town Council. Clerk, George Elliott. Ratepayers will vote on by-law Dec. 1st, to raise $14,950 for completion of trunk sewerage system.

Toronto, Ont.
Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders close Dec. 2nd. Plans at Works Dept. Sewers on Woodbine, Annette, Clendennan, Glendonwynne, Edgewood, Eastern, Elmwood, Dundas, Chandos, Lauder, Glenholms, Blackburn and Quebec. Midway District Sewerage Scheme outlet (Danforth, Ashdale, Gillard and Felstead).

Pavements planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 2nd. Asphalt on Brown, Curson, Hartford, Homewood, Janet, Melgund, Rose. Concrete on Miles Place. Curbing on Melgund Rd. Grading on Eglinton and Boston Aves. Plans at Works Department.

Sidewalks planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 2nd. Concrete walks on Alberta, Bracondale, Gertrude, Ossington, Pendrith and Spadina Rd. Plans at Works Department.

Gradings recommended by Board of Control. Commr. of Works, R. C. Harris. Eighth, Second, Ladykirk, Indian Grove and two lanes, estimated cost $21,693.

Sewerage and water system, Mimico, contemplated by Town Council. Clerk, Andrew Dods. Consulting Engineer, T. Aird Murray, Lumsden Bldg., Toronto. By-law may be submitted to spend $70,000 now. Cost of complete system estimated at $340,000.

The Board of Control will shortly call tenders for Moore Park Drainage System (Eastern Dist.), estimated cost $88,300. Moore, Heath, Rose Park, St. Clair, Rosehill, Welland, Ethel, Hudson, Harper, Spring and McClinton. Commr. of Works, R. C. Harris.

The Board of Control will shortly call tenders for Moore Park Drainage System (Western Dist.), estimated cost $465,000. Moore, Heath, Rose Park, St. Clair, Rosehill, Welland, Grace, Wilhelm, Lexie, Kinsman, Clifton, Pleasant, McLennan, Garfield, Rosedale Heights, Sighthill, Fern and Ridge. Commr. of Works, R. C. Harris.

CONTRACTS AWARDED

Meaford, Ont.
Revetment wall, cost $30,099, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Alex. Green & John Woolich, Owen Sound.

Ottawa, Ont.
Chlorination buildings, cost $7,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, Alexander & Campbell, 587 Lisgar.

Point Grey, B.C.
Sewer, cost $90,000, planned by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. General contractors, R. McLean & Co., 744 Hastings W., Vancouver. Contract for major portion of Augus St. sewer, including outfall.

Stamford Twp., Ont.
Waterworks system, cost $30,000, planned by Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, C. Gardner, Niagara Falls, Ont. General contractor, John Lang, Port Colborne, for 6 in. pipe, at $2.25 per ft., and 8 in. pipe, at $3.00 per ft. Tenders received by Engineer until Dec. 1st for ¾ in, 1 in. 4 in., 6 in., 8 in. and 10 in. pipe; cast iron and rolled steel. Pumping plant, electric motors, automatic devices for capacity of 500,000 gals. per day, also sand pipe.

Swift Current, Sask.
Sewer and water mains planned by Town Council. Engineer, G. D. Mackie. General contractors, Moose Jaw Constr. Co.

Railroads, Bridges and Wharves

Province of B. C.
G. T. R. has been authorized to construct bridge across Nechaco River, at mileage 371.4, Prince Rupert Easterly.

Burlington Channel, Ont.
Renewal of south pier planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 15th. Plans, etc., at offices of J. G. Sing, Dist. Engineer, Confed. Life Bldg., Toronto, Post Office, Hamilton, Postmaster, Burlington, and at Dept., Ottawa. 270 ft. concrete superstructure.

Calgary, Alta.
Work started on temporary station and freight shed by C. N. R. General contractors and carpenters, Carter, Halls, Aldinger Co., 7th Ave. and 1st St. W. Frame construction, electric lighting, stove heating.

Edmonton, Alta.
Bridge, cost $60,000,. Saskatchewan River, planned by City Council and C. P. R. Clerk, C. Cox. City Engineer, A. Latornell. General contractors, Carter, Halls, Aldinger & Co., Union Bank Bldg. Work about completed.

Bridge across Saskatchewan Ave. contemplated by Prov. Govt. and City of Edmonton. Deputy Minister, Jno. Stocks, Public Works Dept. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox, Civic Offices. Negotiations are under way for the building of the bridge, thereby providing a direct approach to the Parliament Building.

Hamilton, Ont.
The G. T. R. has been authorized to construct siding into premises of Dominion Tar & Ammonia Co., Ltd.

Sidewalks, bridge, etc., contemplated by McKittrick Syndicate. Survey of 700 acres to be annexed. Syndicate will build bridge costing about $100,000 and will bear cost of local improvements.

Hope, B.C.
Bridge over Fraser River for Kettle Valley Railway Co. President, J. W. Warren. Sub-contractors, Armstrong, Morrison & Co., Ltd., 543 Granville St., Vancouver. Contract for superstructure to be let later. 1,000 ft. long, 3 spans, 2 abutments.

Kalso, B.C.
Wharf and pile boat for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. No action to be taken on this matter.

Leamington, Ont.
Cement work for John A. Campbell. Owner contemplates erecting cement breakwater along the lake shore, putting cement floor in a big onion barn and other work.

London, Ont.
Improvements to roads and bridges, cost $700,000, contemplated by Middlesex County Council. Clerk, Edmund Weld. By-law to be submitted.

Megantic, Que.
Dam planned by Town Council. Clerk, Jos. Ray. Engineer in charge, Ed. A. Evans, 92 St. Peter St., Que. Tenders received by Clerk until Jan. 5th, 1914. Concrete construction.

Montreal, Que.
Steel sheds required by Harbor Commissioners. Secretary, David Sneath, 57 Common St. Tenders received by Secretary until 12 o'clock noon, December 10th, for the construction of two steel wharf transit sheds, sections 24 and 25, Harbor of Montreal. Plans, etc., at office of F. W. Cowie, Chief Engineer.

Nelles Corners, Ont.
The G. T. R. has been authorized to construct siding into premises of Grand Gypsum Ltd.

Ottawa, Ont.
Steel wire rope required by Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats. Tenders close Dec. 1st for rope to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards.

Copper and brass bars, etc., required by Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats. Tenders close Dec. 15th for copper and brass bars, sheets and tubes, to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards.

Tenders close Dec. 3rd for steel and iron bars, plate and angles, to be delivered at Dockyards at Halifax, N.S., and Esquimalt, B.C. Plans at Dept. and Dockyards. Dom. Govt. Dept. of Naval Service. Deputy Minister, C. J. Desbarats.

Toronto, Ont.
C. P. R. has been authorized to construct bridge No. 92.7 on Toronto subdivision, near Donlands.

Woodward's Cove, N.B.
Breakwater planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 16th. Plans, etc., at offices of F. G. Goodspeed, Dist. Engineer, St. John, Geoffrey Stead, Dist. Engineer, Chatham, N.B., Postmaster, Woodward's Cove and at Dept., Ottawa.

CONTRACTS AWARDED

Toronto, Ont.
Steel conduit, cost $540,000, Island, planned by Board of Control. Mayor, H. C. Hocken. General contractors, Roger Miller & Sons, Lumsden Bldg. 84 in. steel conduit on Island.

Vails Point, Ont.
Wharf, cost $6,983, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, W. A. Grier and A. J. Creighton, Owen Sound.

Public Buildings, Churches, Schools, etc.

Prov. of Alberta
Claremont School Dist. No. 3018. Treas., Alex. Blue, Saskalata. The Board of Trustees will borrow the sum of $1,500 to purchase and fence a school site, build and equip school house and erect outbuildings.

Brandon, Man.
Five cottages, cost $20,000, for Prov. Govt. Dept. of Public Works. Architect, U. V. Horwood, Winnipeg. General contractors, Willows Constr. Co., Brandon. Roofed.

Brantford, Ont.
Public school, cost $50,000, Rawdon St., planned by Board of Education. Sec., of Board, A. K. Bunnell. Chairman Building Committee, M. E. B. Cutcliffe, 93 Dufferin Ave. Architects, Taylor & Bodley, Hope Chambers. Tenders received by Secretary until November 28th.

Calgary, Alta.
Hospital, cost $30,000, planned by City Council. City Clerk, J. M. Miller. Architects, Lang & Major, Board of Trade Building.

New church, cost $35,000, Ogden, for Church Trustees. Architects and general contractors, Alberta House Builders, Grain Exchange Bldg. 30 x 60, electric light, hot air heating, fir floors, wood fibre plastering.

Dundas, Ont.
Public school contemplated by Board of Education. Chairman, C. E. Dickson. Architect not yet appointed. Site will be purchased. Brick construction.

Edmonton, Alta.
Church, cost $70,000, for Robertson Presbyterian Church Congregation. Pastor, Rev. D. G. McQueen, 408 4th. General contractor, R. Grant, 1626 Jasper Ave. Plumbing and heating, McKnight & Frost, 9th St. One storey, 96 x 135, electric lighting, steam heating, maple floors, wood fibre plastering, stained glass. Plastering.

Arts building for University of Alberta. President, Dr. Tory. Architect, Mr. Burgess. Work done by day labor. Foundations in. To be continued in spring.

Dormitory for University of Alberta. President, Dr. Tory. Architect, Mr. Burgess. Work done by day labor. 4-storeys, 83 x 206, brick and stone construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, maple floors, wood fibre plastering, fire extinguishers. Heating and plumbing may be let. Foundations started. To be completed by Sept. 1st, 1914.

Fort William, Ont.
Addition to orphanage, cost $25,000, for Roman Catholic Denomination. Architect, H. R. Halton. General contractor, C. Mathieu. Plastering.

Guelph, Ont.
Re-building labor hall contemplated by Lot Singular, Western Hotel.

Halifax, N.S.
New church for St. Matthias Anglican Church Congregation. Rector, Rev. T. H. Perry, 2 Quinpool Rd. Architects, Harris & Horton, Keith Bldg., 41½ Barrington St. Brick construction, slate roofing. Tenders will be called shortly.

Hamilton, Ont.
New church contemplated by Ryerson Methodist Congregation. Pastor, Rev. J. B. King. To be erected in front of present Sunday School building.

Hamilton West, Ont.
Hall for Wm. Buckley. General contractors, Knight & Dickson. Two stys., frame construction, electric lighting, plumbing.

London, Ont.
Contemplated purchase of garbage equipment by City Council. Mayor, C. M. R. Graham. Supt. Garbage Collection, W. C. Dodd.

Labor Temple, $6,000, for The Arbeiter Ring. President, Jacob Wolfe, 258 Dundas St. Architects, McBride & Gilbert, Edge Block. Two storeys, white brick construction, stone and concrete foundation, electric lighting, maple floors, plumbing, lime and sand plastering. Plans in progress.

Medicine Hat, Alta.
Market buildings and weigh scales, $25,000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th.

Montreal, Que.
Post office, Maisonneuve, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, C. Dufort, 192 St. Catherine W. Plans to be completed this winter. Tenders called in spring.

Fire station, cost $57,900, planned by Board of Commrs. Sec., L. N. Senecal. General contractor, C. E. Deakin, 41 Mayor. General contractor will sub-let some trades. Excavating.

Church and presbytery, $40,000, at Verdun, for St. Wilbrods' Congregation. Father MacDonald, Verdun. Architect, J. E. A. Benoit, 1200 Wellington St. General contractor, J. O. Hamelin, 246 Church Ave. Heating and plumbing, Conroy Bros., 291 Centre St. Stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, birch and pine floors, lime and sand plastering. Foundations in.

Orillia, Ont.
The Board of the Orillia Collegiate Institute has decided not to let contract for heating system, instead, they have instructed architect to prepare plans for a system of mechanical ventilation and a remodelling of the radiators, estimated cost $3,000. Contract to be let in spring and work done in summer holidays. Sec., T. W. Robbins. Architect, J. H. Robinson.

Ottawa, Ont.
School, $85,000, planned by Public School Board. Architect, W. B. Garvock, Creighton St. School. Three stys., gas and electric lighting, steam heating, maple floors. Roofing.

Plans will likely be presented to Parliament for the establishment of plant for refining of silver ore.

Oxford Centre, Ont.
School, $6,000, planned by School Bd. Sec., Conrad Sipple, R. R. No. 2, Tavistock. Architect, J. S. Russell, 21 Downie St., Stratford. Tenders received by architect until Dec. 13th. Plans at Gazette office, Tavistock, or at architect's.

Port Rouge, Que.
College, cost $60,000, planned by School Commrs. of Pont Rouge. Sec., E. Hamel, M.P. Architect, J. S. Beyeron, 103 St. John St., Que. New plans in progress.

Quebec, Que.
Isolation hospital, Mastai, cost $75,000, planned by City Council (Health Dept.). Mayor, N. Drouin. Sec., Jos. Cote, City Hall. Architect, J. L. Pinsonnault, City Hall. New plans in progress.

Three cottages for Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders close with Sec., 4 p.m. Dec. 1st for the construction of 3 Immigration Detention Cottages at Savard Park, Quebec, Que. Plans, etc., at office of Chas. Chapais, Dist. Engineer, Quebec, and at Dept., Ottawa. Stone foundation, brick construction, shingle roofing, cornices, birch floors, plumbing, wood lath, wood fibre, asbestic or other approved plastering, sheet and plate glass, hot air heating, electric lighting.

Regina, Sask.
New church, cost $50,000, for Methodist Church Congregation, 14th and Rae St. Architects, Clemesha & Portnall, Scarth St. Tenders will be called in early spring. Brick and artificial stone construction.

Stable, cost $23,900, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Minkley & Traub. Heating, plumbing and electrical, Paulin & Swayze, 1778 Rose St. Interior fittings, Economy Foundry Co., Ltd., 619 Somerset Bldg. Walls up.

Water fountain planned by School Board. Supt., T. E. Perrett, c/o Alexandra School, Hamilton St. Water fountain for Albert School. Prices wanted.

St. Marys, Ont.
Barracks, cost $15,000, contemplated by Salvation Army. In charge, Major McGillivray, London. Two storeys, 70 ft. long, concrete block construction, concrete and stone foundation, electric lighting, maple, pine and concrete floors, plumbing, lime and sand plastering, seating capacity 250.

Prov. of Sask.
Contemplated, School. Owner, Berndt School Dist. No. 3066. Treas., W. A. Smith, Elbow. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting and equipping a school.

Contemplated, school. Owner, The Wright School Dist. No. 3044. Treas., Jno. Sweeny, Horizon. The Board of Trustees will borrow $1,000 for the purpose of erecting and furnishing a school.

Contemplated, school. Owner, Albermarle School Dist. No. 2845. Treas., Wm. T. Young, Rosetown. The Board of Trustees will borrow the sum of $1,800 for the purpose of erecting and furnishing a school house.

Contemplated, school. Owner, Hardwood School Dist. No. 3040. Treas, C. W. Wilson, Valence. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting and furnishing a school.

Contemplated, school. Owner, Progress School Dist. No. 2952. Treas., M. S. Sandberg, Buffalo Head. The Board of Trustees will borrow the sum of $1,500 for the purpose of erecting a school building and outbuilding.

Contemplated, school. Owner, Porcupine School Dist. No. 758. Treas. Michael Ribalkin, Whitebeech. The Board of Trustees will borrow $1,200 for the purpose of erecting and equipping a school building.

Stouffville, Ont.
Library contemplated by Village Council. Interested, R. P. Coulson. Site to be selected.

Sudbury, Ont.
Ratepayers will vote on by-law Dec. 1st to raise $22,737 for completion of fire hall and municipal buildings. Clerk, George Elliott.

Swift Current, Sask.
School planned by City Council. Sec.-Treas., J. T. Dodds. Architects, Reilly, Dawson, Hancock & Reilly, 512 Western Chmbrs., Regina. Foundation, Moore & McWilliams, $6,491. Tenders will be called about Nov. 30th for general contract.

Tide Lake, Alberta.
School contemplated by School Dist. No. 2937. Treas., B. J. Adams. The Board of Trustees will borrow the sum of $1,500 to fence school site. Build and furnish a school house and dig well.

Toronto, Ont.
School, George St., for Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov 28th for plumbing and hot water heating. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Parkdale, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon, Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Kimberley, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th, for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Enlarging school, Strathcona, planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Tenders received by Sec. until noon Nov. 28th for metal and glass partition in St. Clair Ave. School. Sec. Board of Education, W. C.Wilkinson, City Hall.

Tenders received by Sec. Board of Education, W. C. Wilkinson, City Hall, until noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control Homewood School. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Enlargement of school, Western Ave., planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Nov. 28th. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Regal Rd., for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Tenders received up to noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, etc., cost $125,000, Brunswick Ave., for Loretta Abbey, Wellington W. Architect, N. C. Beggs, Cosgrave Bldg. Stone, Canadian Art Stone Co., 353 Pape Ave. Walls up one-storey.

School, Shirley, for Board of Education, Sec., W. C. Wilkinson, City Hall. Tenders received until noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School, Howard, for Board of Education. Sec.-Treas., W. C. Wilkinson, City Hall. Tenders received up to noon Nov. 28th for plumbing, heating and ventilating, electric wiring and heat control. Specifications, etc., at office of Supt. of Bldgs., City Hall.

Vancouver, B.C.
Synagogue, cost $16,000, for Jewish Congregation. Rabbi, Dr. B. H. Rosengard, Hotel Dunsmuir. Architect to be chosen, and plans prepared at once.

Vermilion, Alta.
Government office, cost $25,000, contemplated by Dom. Govt. Dept. of Public Works. Sec., R C. Desrochers, Ottawa. Dom. Architect, Parliament Bldg., Ottawa. Site purchased, work to start in spring.

Victoria, B.C.
Jail, $80,000, planned by City Council. Clerk, Wellington J. Dowler. Tenders to be called on completion of plans.

White Rock, B.C.
School planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Croy & Wishart.

Winnipeg, Man.
Drill hall planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architect, Owners. General contractors, Carter, Halls & Aldinger, Union Bank Bldg. Only excavating will be done this year.

Law courts planned by Prov. Govt., Dept. of Public Works. Prov. Architect, V. W. Horwood, 261 Fort St. General contractors, National Construction Co., Donalda Bldg. Walls up.

Suburban fire stations, $60,000, contemplated by Board of Control. Secretary, M. Peterson. Ratepayers will vote on by-law Dec. 12th.

Public lavatories, cost $50,000, contemplated by Board of Control. Secretary, M. Peterson. Ratepayers will vote on by-law Dec. 12th.

CONTRACTS AWARDED

Avonlea, Sask.
School planned by Board. Sec.-treas., T. H. Clay. Architects, Storey & Van Egmond, Regina. General contractor, W. H. Richardson, Avonlea. Two stys., brick construction and foundation.

Calgary, Alta.
Three cottage schools, cost $37,200, for Calgary School Board, City Hall. Architect, H. McClelland, Supt. Bldg., City Hall. General contractor, T. R. Yearger. Heating and plumbing, Campbell & Hellier, 1008 17th Ave. W. Schools on Ogden, Bridge and Mt. Pleasant Sts.

Examining warehouse planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Stone, Shelly Quarry Co., 1790 9th Ave, W. Painting, Taylor Painting & Decorating Co., Sibley Block.

Edmonton, Alta.
Market building, cost $44,750, planned by City Council. Mayor, Mr. Short. Clerk, C. Cox, Civic Office. General contractors, Alson & Johnson, Gen. Del. Heating and plumbing, Sommerville Hardware Co., 1st St.

Grinrod, B.C.
School planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Donham & Gildemeister.

Montreal, Que.
Church for St. Luke's Congregation. Rev. W. R. Cruikshanks, 115 Drummond. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg. Excavating and foundation, Grosvalet & Lefebvre, c/o Architect.

Ottawa, Ont.
Geodetic survey building, cost $61,948, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, W. H. McGillivray, 458 McLaren St.

Regina, Sask.
Grace church rectory, cost $6,755, for Anglican Church Congregation. Rector, Rev. E. C. Earp, 2360 Smith St. General contractors, Smith Bros. & Wilson, Hamilton St. 2½-storeys, brick construction and foundation, shingle roofing, electric lighting, hot air, maple floors. Contract awarded.

Revelstoke, B.C.
Masonic hall, cost $7,800. General contractor, O. W. Abrahamson. Two stys., 88 x 30, frame construction.

Toronto, Ont.
School, cost $36,000, for Separate School Board. Chairman Bldg. Com. Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Masonry and brick, M. Manley, 1058 College St. Carpenter, M. J. Madden, 62 Wilson Ave. Plastering, A. J. Madden, 1139 Dufferin St. Painting, T. J. O'Connor, 64 St. Clarens Ave. Roofing, Douglas Bros., 124 Adelaide W. Concrete work, Queen City Concrete Co., 179 Broadview. 12 room building, brick construction, gas and electric lighting, steam heating, ventilating system, ornamental iron, seating, etc.

School, cost $17,000, for Separate School Board. Chairman Bldg. Com., Joseph Cadaret, 24 Duke St. Architect, C. J. Read, 404 Confed. Life Bldg. Masonry and brick, S. Young, 41 Hazelton Ave. Carpenter, T. J. Sullivan, 552 Ontario St. Painting, J. J. O'Hearn, 249 Queen W. Roofing, W. E. Dillon Co., George St. Plastering, Beaver & Sons, 62 Winchester St. Concrete, Queen City Concrete Co., 179 Broadview Ave. Four-room school.

Business Buildings and Industrial Plants

Assiniboia, Sask.
Store, $6,000, for Hub Clothing Co., Weyburn. Tenders received by owners. One storey and basement, 25 x 70, brick or concrete construction, cement foundation, maple floors, galvanized iron roofing, electric lighting, plate glass, store fronts and fixtures. Work may start this year.

Burlington, Ont.
Skating rink, cost $10,000, is contemplated by Burlington Hockey Rink Co. (W. J. Brush). Architect not yet chosen. Frame and steel construction.

Caledonia, Ont.
New Company (W. H. Huchinson) formed to build gypsum mill. Machinery and electrical power to be installed. Will also have G. T. R. switch. Plans in progress.

Calgary, Alta.
Hotel, cost $65,000, for Col. Jas. Walker. General contractors, Jones & Lyttle, 6th St. W. and Bow River. Excavating. Sub-tenders are being received by general contractors.

Warehouse, cost $10,000. Owners and general contractors, Gray & Campbell, Ltd., 10th Ave. W. Supt., J. J. McQuire, 1735 11th Ave. W. Architect, J. J. O'Gara, McLean Blk. Electrical, Budden, Beared & Cannon, Ltd., 525 17th Ave. W. Two storeys, 50 x 120. Walls started.

Two stores and apartments for Dr. Edmunds, 319 Bruner Block. Architects, Heibbell & Kelly, 2002 I.O.O.F. Bldg. General contractors, Jones & Lyttel, 6th St. W. Two or three storeys, 50 x 100. Provision will be made for 2 more stys. Excavating.

Stores and apartments, cost $30,000, for Mrs. Daintrey, 14th Ave. and 14th St. W. Architects, Hubbell & Kelly, 2002 I.O.O.F. Bldg. Tenders will be called in about 10 days. 45 x 91 and 25 x 75, terra cotta and brick construction, concrete foundation, composition paper roofing, electric lighting, steam heating, fir floors, wood fibre plastering, store fronts, sky lights, cornices, vacuum cleaners.

Cobourg, Ont.
Drying plant for Cobourg Drying Co. Supt., J. E. Hall. Building purchased and machinery to be installed. Work to start by April 1st, 1914.

Crofton, B.C.
Lumber mill contemplated by Empire Lumber Co., Victoria. Vice-president, C. C. Yount.

Edmonton, Alta.
Warehouse, cost $9,000. Owner, architect and general contractor, P. Manning, 35 Main St. Two storeys, 63 x 110, brick and frame construction, concrete foundation, shingle roofing, electric lighting, stove heating, fir floors, wood fibre plastering. Foundations in.

Warehouse, cost $70,000, for Nicholson & Bain, 656 3rd St. Architects and general contractors, Fyshe, McNeil & Martin, Lougheed Block, Calgary. Steel, Ryerson Steel Works, Chicago, Ill. Heating and plumbing, Heintz & Hooper. Six storeys, 50 x 150. Walls up.

Office building for Edwin Auld, 1459 Victoria Ave. Tenders will be called about Jan. 1st, 1914. Seven storeys, 25 x 150, steel construction.

Store and offices, cost $40,000, for Capt. A. Palmer, England. Architects, Magoon & MacDonald, Tegler Block. General contractors, Dunlop Construction Co., 205 Hart Block. Steel Manitoba Steel & Bridge Co., Winnipeg. Heating and plumbing, McKnight and Frost. Three storeys, 53 x 75. Walls up. To be finished about February.

Stores and apartments, cost $60,000, for G. D. Scott, 661 15th St. Architect, E. Underwood, Chisholm Block. Work being done by day labor under supervision of J. Armstrong, Leland Hotel. Interior trimming.

Offices, cost $7,500, for E. L. Ferris, 43 Jasper Ave. E. Architect and general contractor, J. R. Ferris, 43 Jasper Ave. E. Two storeys, electric lighting, hot air heating, wood fibre, plastering, store fronts. Roofing.

Bank and office building, cost $150,000, for Bank of British North America. Architect, R. W. Lines, Canada Permanent Bldg. General contractors, masonry, carpentry and roofing, Nesbitt & Miller, 315 Jasper Ave. E. Steel, Manitoba Bridge Co., Winnipeg. Heating & plumbing, Ross Bros., 39 Greesback St. Elec., Burnham Frith Elec. Co., Howard Ave. Elevator, Otis Fensom Elevator Co., Montreal. Walls started.

Hamilton, Ont.
Extension to Jockey Club Hotel, at a cost of $40,000, is contemplated in the spring.

Iroquois Falls, Ont.
Stores and residences. Owner and general contractors, Abitibi Pulp & Paper Co. Owners contemplate building a large number of stores and houses. Plans drawn. Work to start early next year. Tenders have not yet been called.

London, Ont.
Rebuilding warehouse of Ontario Spring Bed & Mattress Co., 90 York St. Manager, S. Williams. Work to be done by company's staff. Will require lumber, flooring, tin roofing, glass, machinery, etc. Work of clearing up ruins has commenced.

Storage cell, etc., planned by City Council (Fire & Light Com.). Mayor, C. M. R. Graham. Clerk, S. Baker. Fire Chief Aiken, Central Fire Hall. Tenders received for storage battery and rectifier, 6 volts, 100 amperes, to be used in connection with alarm system.

Medicine Hat, Alta.
Murdock McLeod, Moncton, N.B., contemplates erecting factory at a cost of $10,000, for manufacturing clothes, etc. Brick construction.

Montreal, Que.
Bank, cost $11,000, for Home Bank of Canada, Transportation Bldg., Montreal. Architects, Turner & Careless, Board of Trade Bldg. General contractors, Archambault & Conway, 332 Bleury. General contractors will receive tenders for roofing, plastering, painting, heating, plumbing and electrical after Nov. 18th. Three storeys, 25 x 65, concrete foundation, solid brick construction, slate roofing, gas and electric lighting, stove and hot water heating, maple and pine floors, lime and sand plaster, plate glass. Excavating.

Hotel for The Shubert Co., New York, N.Y. Architect, D. J. Spence, 46 Beaver Hall Hill.

Stores, Westmount (Victoria and Sherbrooke), for F. P. Buchanan, Victoria Ave. and Sherbrooke. Architect, H. E. Shorey, 56 Beaver Hall Hill. General contractor, A. F. Byers, 340 University. General contractor doing all trades. Foundations in.

Garage, cost $15,000, for Miss E. Beaudry, care architect, C. St. John, 244 St. Catherine Street East. Tenders for General Contractor received by Architect to close shortly. Three storeys, 65 x 25, concrete foundation, waterproofed, brick construction, felt and gravel roofing, electric lighting, hot water heating, mill floors (5 in.), lime and sand plaster, freight elevator.

Bank and offices, cost $14,000, Verdun. Owner, Bank of British North America, 30 St. James St. General contractor, C. J. Brown, 4263 St. Catherine St. Tenders received by General Contractor for plastering, painting, heating, plymbing, electrical and interior fittings.

New Glasgow, N.S.
Cold storage warehouse contemplated by, Jno. T. Nickerson, Liverpool, N.S. Work may not be started until spring.

New Westminster, B.C.
Jno. K. Mackenzie & Bruce Loopman have purchased the Colonial Hotel and will have alterations made.

North Sydney, N.S.
Store and office, cost $15,000, for McCallum & McMillan. Architect, B. A. Huntsman, Sydney. General contractor, F. C. Redding. Painting, H. Clarke. Heating and plumbing, Hartigan & Co., Sydney Mines. General Contractor will receive tenders for electrical work and interior fittings until Nov. 30th. Two storeys, 60 x 53. Foundations in.

Oakville, Ont.
Planing mill for Davis & Doty. 45 x 100, machinery and electric motors required. Work started.

Paint factory, for J. Langmuir & Co., 1372 Bathurst St., Toronto. Work, day labor. One storey, 76 x120, brick construction, felt and gravel roofing, electric lighting, steam heating, birch and concrete floors, boilers. Walls going up.

Ottawa, Ont.
Business Block, cost $100,000, for Mrs. Cowie, Albert St. Arch. C. P. Meredith, 126 Sparks St. Felt and gravel roofing, electric lighting, steam heating. Walls up.

Theatre, $40,000, for H. Brouse, Bank St. Architect, W. Herbert George, Castle Bldg., Queen St. Foundations in. Subtenders to be called shortly. Solid brick construction.

Stores and residences, cost $12,000, for Oakland Land Co., c/o W. J. Spratt, Sunnyside Ave. Mason, Docherty Bros., Willard St. Carpenters, James & Ramsay, Pansy Ave. Other contracts not let yet, Two storeys, 50 x 50. Excavating.

Church, cost $6,000, Lyon, for St. Peters Evangelical Lutheran Congregation. Pastor, Mr. Clemmens, 250 Lyon. Architect, Herbert Shleacow, Room 45, Sparks Chmbrs. Carpenters, Alexander & Campbell, 587 Lisgar. Electrical not let yet. Foundations in.

Factory, cost $6,000. Owner, architect and general contractor, Wm. F. Frazer, 279 Arlington Ave. Electrical and motors, W. R. McCallum & Co., 263 Laurier W. 50 x 60, concrete and stucco construction. Walls going up.

Office and warehouse, cost $10,000, for J. T. Blythe, 394 Bank St. General contractors, Alexander & Campbell, Lisgar St. 40 x 70, Roofed.

Coal sheds, stables, storage, etc., cost $30,000. Architects and general contractors, J. G. Butterworth & Co., 86 Sparks St. Elec., Costello & Crowe, 86½ Lyon St. Stabes, walls up. Storage, roofing.

Penticton, B.C.
Evaporator contemplated by H. B. Cossart (care Greer & Wanless) and L. B. De Gero.

Prince Albert, Sack.
Ice house, $5,000. Owner, architect & general contractor, R. Gilmore, 418 E. 14th St. One storey, 50 x 110, mill construction, concrete foundation, composition paper roofing, ventilating system, concrete floors. Capacity 4,000 tons. Plans in progress.

St. John, N.B.
Nail and wire fence factory for a syndicate, c/o Gordon Johnston, 103 Princess St.; Harry Marvin, 144 Douglas Avenue. Architect, Garnet Wilson, 50 Princess St. 1½ storeys, 125 x 50, concrete foundation, brick construction, electric lighting, birch floors, steam heating. Plans in progress.

Spuzzom, B.C.
Sawmill, etc., contemplated by J. C. Shields, 212 Winch Bldg., Vancouver. Owner has purchased timber tract containing approximately 150,000,000 B. Ft., near Spuzzom on the C. P. R. Besides a sawmill, a flume will be built from the limit to the C. P. R. and a planing mill where the flume meets the C. P. R.

Timmins, Ont.
Bank, cost $10,000, contemplated by the Imperial Bank of Canada. Architect, W. E. Binning, Cochrane. Recommendation has been made to bank. Work may be started this winter. Two storeys, 30 x 40, brick veneer construction, concrete foundation, felt and gravel roofing, electric lighting, hot water heating, birch floors, lime and sand plastering, bank fixtures, vaults.

Toronto, Ont.
Theatre. Owners and general contractors, Wilson Lumber Co., 1 Spadina Ave. Architect, A. H. Start, 105 Melville Ave. Mason work done by day labor. Carpenter, Chas. Spall, 279 Palmerston. Seating capacity, 500. Two storeys, 30 x 70. Walls going up.

Warehouse for H. Rotenburg, University and Anderson. Architect, I. Feldman, 199 Yonge St. Tenders close with Architect about Nov. 27th. Six storeys, brick construction, felt and gravel roofing, gas and electric lighting, steam heating, galvanized iron, fire escapes, elevator, boilers.

Residence, stable and dairy, cost $9,000. Owner and general contractor, W. Hodgkinson, 663 Carlaw Ave. Owner will sub-let some trades. 2½-storeys, 28 x 46, brick and steel construction, concrete and brick foundation, shingles, felt and gravel roofing, gas and electric lighting, hot water heating, oak, birch, concrete and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantels, store fixtures. Plans drawn.

Victoria, B.C.
Alterations and additions to hotel, cost $17,500, for Thos. R. Danes. Architect, H. C. Feree, 220 Sayward Bldg. General contractors, Parfit Bros., 1303 Gladstone. Mill construction. Work in progress.

Winnipeg, Man.
Stores, cost $6,000. Owner and general contractor, T. Ryan, 44 Princess St. One storey, 70 x 50, brick construction, stone, brick and concrete foundation, felt and gravel roofing, electric lighting, stove heating, maple floors. Plans drawn.

CONTRACTS AWARDED

Caledonia, Ont.
Warehouse for The Aalbastine Co., Head Office, Paris, Ont. General contractors, Schultz Bros., Brantford. Mason, James Blake, Caladonia.

Kingston, Ont.
Alterations to skating rink for Queens University. General contractor, W. J. Chapman, Queen St. Changes to be made in the seating.

Montreal, Que.
Store and flats, $5,000, at Maisonneuve, for Mrs. A. Dubois, 4th Ave. and Notre Dame E. Architect, L. R. Mont Briant, St. Andre St. General contractor, Jos. Trudel, 1st ave. Three storeys, 27 x 30 concrete foundation, frame and brick construction, felt and gravel roofing, gas

(Continued on page 71)

Tenders and For Sale Department

TENDERS

Sealed tenders will be received up to seven o'clock precise, **Saturday, November 29th, 1913**, for the construction of a steel bridge with concrete pillars across the Beaudette River in the Parish of St. Telesphore, Soulange, Co., P.Q.

Tenders must be accompanied by a certified cheque for 10 per cent. of the amount, and should be addressed to the Secretary-Treasurer of the Municipality of the Parish of St. Telesphore, Soulange Co., P.Q. The Council is not held to accept the lowest or any other tender.

Plans and specifications can be seen at the office of the Secretary-Treasurer.

Separate tenders can be prepared, one for the concrete pillars, and the other for the steel superstructure or for both.

JAS. ED. CHARLEBOIS,
Secretary-Treasurer.
St. Telesphore, Nov. 6, 1913. 46-48

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon, on **Tuesday, December 2, 1913**, for the construction of the following works:

Sewers

Midway District Sewerage Scheme Outlet, from Gillard avenue and Felstead avenue to Danforth avenue and Lamb avenue, via Felstead avenue and Lamb avenue, and on Danforth avenue from Ashdale avenue to Leslie street.

Midway District Sewerage Scheme Outlet, from Gillard avenue and Felstead avenue to Danforth avenue and Hillingdon avenue, via Felstead, Ashdale and Danforth avenues.

Woodbine avenue, from Kingston road to Danforth avenue.

Annette street, from Quebec avenue to Pacific avenue, and from Keele street to Dundas street.

Clendennan avenue, Glendonwynne road to Annette street.

Glendonwynne road, Clendennan avenue to Humberside avenue.

Edgewood avenue, from the bridge to Small St.

Eastern avenue, from Heward avenue to Pape avenue.

Elmwood avenue, from Davenport road to Ashburnham avenue.

Dundas street, 83 ft. west of Lansdowne avenue to 150 ft. 6 in. further west.

Chandos avenue, Lightbourne avenue to 437 ft. west.

Lauder avenue, from Rosemount avenue to Regal road.

Glenholme avenue, Rosemount avenue to Regal road.

Blackburn avenue, Gerrard street to Mount Stephen street.

Quebec avenue, from Clara street to Glendonwynne road.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, November 20, 1913. 48

FOR SALE

One 60 cycle, 25 horsepower, 1333 r.p.m., 220 volt, Form U S Induction Motor, C.G.E. manufacture, in good repair. Equipment includes one 4-pole single throw knife switch with Noark enclosed fuses, pulley, gliding base and starting compensator containing oil-switch in base.

Standard Wire Fence Company,
47-48 Woodstock, Ont.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of South Pier at Burlington Channel, Ont.," will be received at this office until 4 p.m. on **Monday, December 15, 1913**, for the renewal of South Pier at Burlington Channel, Wentforth County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department, at the District Engineer's office, Confederation Life Building, Toronto, Ont.; at the Post Office at Hamilton, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 15, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—46299. 47-48

Tenders for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 2nd, 1913.**

*1. Asphalt (Refined).
2. Crushed Limestone (all sizes).
3. Cedar Posts.
4. Portland Cement.
*5. Granite Setts.
6. Hardware (Pipe Fittings, Valves, Tools and General).
7. Iron Castings, Manholes, etc.
8. Limestone Dust.
9. Lumber.
*10. Paving Blocks, Vitrified.
11. Lubricating Oil, Coal Oil, Gasoline.
12. Rubber Valves, Packing Hose, etc.
13. Sewer Pipe, Vitrified.
14. Sewer Bricks.
15. Sand and Gravel.
16. Street Tablets.
*17. Treated Wood Blocks.

*Will be called later.

Specification and tender form for any of the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto.
November 18th, 1913. 48

Toronto Harbor

Equipment Wanted

We are in the market for
Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment
for use on our work in

PROPOSALS WANTED

from
Experienced Contractors
for
Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to
CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

48-49

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. 48

WANTED

A 3 to 5 ton double drum Hoisting Engine with swinger and boiler complete.

Also a 3 to 5 ton timber stiff leg derrick.

Sun Brick Co., Limited,
1023 Traders Bank Building,
Toronto, Ontario
48-49

Tenders for One Overhead Hand Operated Travelling Crane

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, December 16th, 1913.

One Overhead Hand-Operated Travelling Crane, having a working load of 40,000 pounds, for Main Pumping Station, foot of John Street.

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
November 18th, 1913. 48

Business Buildings and Industrial Plants

(Continued from page 69)

and electric lighting, hot water heating, pine floors, lime and sand plaster, wood lath.

Winnipeg, Man.

Elevator repairs, at Transcona, cost $30,000, for C. P. R. General contractors, New York Foundation Co., c/o Barnett & McQueen, North Transcona.

Windsor, Ont.

Addition to bakery, cost $12,000, for Neal Baking Co., Salter Ave. Architects, Watt & Blackwell, Bank of Toronto Bldg., London. General contractors, Canadian Frost & Winchester Co., Ltd., Ouellette Ave.

Stores and apartment house, cost $40,000. Architects, Watt & Blackwell (in trust), Bank of Toronto Bldg., London. General contractor, V. Williamson, Walkerville. General Contractor will call sub tenders later.

Residences

Edmonton, Alta.

Two residences, cost $6,000. Owner, architect and general contractor, W. A. Passmore, 42 4th St. E. Two storeys, 24 x 28, frame construction, concrete foundation, shingle roofing, electric light, hot air heating, wood fibre plastering, one built in fireplace. Excavating.

Apartment house, cost $15,000, for Mrs. Z. Frontaine, 1st Ave. S. Plastering not let. Painting, heating and plumbing, Strathcona Plumbing & Heating Co. Electrical, Burnham Firth Electric Co., Howard and Rice St. Three storeys, frame construction, concrete foundation, felt and gravel roofing, electric lighting, maple floors, wood fibre plastering. Walls up three storeys.

Farnham, Que.

Semi-detached residences planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 9th. Plans, etc., at offices of R. L. Deschamps, Overseer, Dom. Public Bldgs., Post Office, Montreal, J. Belanger, caretaker, Public Bldg., Farnham, and at Dept., Ottawa.

Montreal, Que.

Six flats, cost $6,000, at Rosemount. Owners and general contractors, Trudeau & Laframboise, 182 St. Catherine E. Architects. Audet & Charbonneau, 15 St. James St. Brick, Durocher & Amel, Rosemount. Foundations in. Other trades to be given shortly. Three stys., 37 x 54.

Nine flats, cost $7,000. Owner and general contractor, G. Vermette, 780 Berri. Work done by day labor. Three storeys, 42 x 58, concrete foundation, felt and gravel roofing. Foundations in.

30 flats, cost $20,000. Owner and general contractor, A. Campbell, 190 Selby, Westmount. Plastering, will call tenders Jan 1st. Heating and plumbing, E. Mallett, 1602 Notre Dame W. Three stys., 35 x 61, concrete foundation, felt and gravel roofing. Foundations in.

10 flats, cost $23,000. Owner and general contractor, J. H. Hand, 609 Belmont Ave. Architect, W. S. Wright, 204 St. James. Roofing, D. Nicholson, 679 St. Paul. Electrical MacDonald & Wilson, 99 Drummond. Two storeys, 120 x 71, felt and gravel roofing, hot water heating. Roofing.

Residence, cost $15,000, for W. J. Brennon, 421 Mount Pleasant. Architects, Gordon & Aird, 115 Stanley St. Plastering, MacIntyre Plastering Co., 55 Latour Electrical, W. J. O'Leary & Co., 36 Recollect. Plastering.

Residence, cost $23,000, at Westmount, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Foundations in. Architect will call for some trades next week, probably plastering and roofing.

Cottages, cost $16,000, at Westmount. Owners and general contractors, White Construction Co., 306 Coronation Bldg., St. Catherine W. Concrete foundation, stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, hardwood floors, lime and sand plaster, plate glass. Excavating.

Residences, cost $24,000, at Outremont. Owner and general contractor, T. Forest, 131 De L'Epee Ave. Architect, J. E. Branchaud. General contractor wishes tenders on plastering, brick, painting, heating, plumbing and electric at once. Three storeys, 84 x 78, concrete foundation, Scotch brick construction, felt and gravel roofing, electric lighting, hot water heating. Excavating.

Residence, cost $19,000, for Miss B. Papineau, 92 Notre Dame E. Architect, R. Gariepy, 25 St. James. General contractors, Heon Roy & McLeod, care architect. Two storeys, 36 x 56, stone and brick construction, gas and electric lighting, hot water heating, hardwood floors, marble tiling, plate glass, built-in fireplaces, mantels. Foundations in.

Montreal West, Que.

Semi-detached cottages, cost $10,000, for W. S. P. Burns. Architects, Benoit & Girard, 215 St. Catherine W. Project has been dropped, will probably go ahead in spring.

Ottawa, Ont.

Residence, cost $5,000, contemplated by J. W. Stanley, 146 Breezehill Ave. Brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and pine floors, water heaters.

Residence, $6,000. Owner and general contractor, J. D. Wilson, 17 Clarey. Mason, R. Saunders, Lees Ave. Other contracts not let. 2½ storeys, brick veneer construction. Foundations started.

Residence, $10,000, for Dr. Quinn, care Architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor and carpenter, T. A. Shore, 41 Chamberlain. Plastering and painting, day labor under supervision of architect. Three storeys. Walls up two storeys.

Residence, cost $6,000, for D. W. Gatourey. Architect, F. C. Sullivan, Castle Bldg., Queen St. Work being done by day labor under supervision of Architect. Electrical not let. Walls up.

Residence, cost $10,000. Owner and architect, W. E. Noffke, Central Chmbrs. General contractor, Owner, by day labor. Electrical, W. R. McCallum & Co., 263 Laurier W. Walls up.

Regina, Sask.

Residence, $5,000. Owner and general contractor, A. C. Froom, 2235 Osler St. Two storeys. Foundations in.

Residence, cost $5,000. Owner and general contractor, R. J. Nicholson, 2247 Cameron St. Brick and frame construction, shingle roofing, electric lighting, hot air heating. Foundations in.

Sudbury, Ont.

Residence, cost $6,000. Owner and general contractor, H. D. Evans, College St. 2½-storeys, 36 x 20, brick construction, shingle roofing, electric lighting, hot air heating, birch floors, plumbing, hard wall plastering, wood lath. Foundations in.

Toronto, Ont.

Apartments, cost $12,000. Owner and general contractor, M. Shienkman, 405 Runnymede Rd. Masonry and carpentry, day labor. Heating, Dom. Radiator Co., Dufferin St. Plumbing, M. Burman, 142 Evelyn. Electrical, Emas Electrical Co., 703½ Queen W. Three storeys, 40 x 60. Walls going up.

Two detached residences, cost $5,000. Owners and general contractors, Kerr & Martin, 311 Woodville. Will sub-let some trades. 2½-storeys, 20 x 38, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplace. Plans drawn.

Apartments, cost $35,000. Owners, general contractors and carpenter, Donnenfield Bros., 336 Clinton St. Mason, T. H. Jones & Co., 314 Clinton St. Owners will sub-let roofing, plastering, painting, heating, plumbing and electrical Three storeys, 42 x 64, brick and steel construction, concrete foundation, waterproofed, felt and gravel roofing, gas and electric lighting, hot water heating, birch, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Excavating.

Windsor, Ont.

Residence, cost $7,000, for Dr. A. E. Bowman, V.S. Architects, Leybourne & Whitney. Tenders received by architect until Nov. 29th. Hospital plans not yet started. Two storeys, 33 x 31, brick veneer construction, brick foundation, shingle roofing, electric lighting, hot water heating, oak and maple floors, water heaters, hard wall plastering, art glass, built-in fireplaces.

Winnipeg, Man.

Apartment Block, cost $65,000, for D. H. Bradley, care architect, A. B. Scarlett, 797 Jessie Ave. General contractors, Winnipeg Stone Co., Elmwood. Roofing.

CONTRACTS AWARDED

Calgary, Alta.

Residence, cost $9,000, for R. A. Darker, 805 Centre St. Architects, Holman & Gotch, Dom. Bank Bldg. General contractor, D. Cunningham, 1509 15th Ave. W. 1½-storeys, 44 x 44, brick veneer construction, hollow tile walls, concrete foundation, shingle roofing, vacuum vapour heating, fire and hardwood floors, electric lighting, wood fibre plastering, vacuum cleaner.

Montreal, Que.

Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury. Heating and plumbing, Wm. Budd, 1914 Esplande Ave. Electric to be given shortly.

Power Plants, Electricity and Telephones

Bowness, Alta.

Electrical machinery required by Bowness Improvement Co. Engineer-in-charge, T. L. Turnbull, 202 8th Ave. W., Calgary. One 200 kw. traction motor; one 4-panel switchboard; one 250 kv.a. generator; one gas engine. Tenders will be received until Dec. 31st.

Castor, Alta.

Gas wells and lighting extension. By-law passed by Town Council Nov. 8th, 1913, to raise $20,000 to complete the above work. Commissioner, L. B. Brown, Grand Ave.

Guelph, Ont.

Contemplated purchase of street cars by City Council (Railway Board). Clerk, T. J. Moore. Ratepayers will vote on by-law to raise $17,000 for purchase of two new cars for the Elora Road and Waterloo Ave. line.

London, Ont.

Addition to hydro sub-station planned by City Council (Water & Light Commission). Chairman, Philip Pocock. General manager, Comsn., H. J. Glaubitz. Tenders will not be called until spring.

Medicine Hat, Alta.

Extension to power and electric lighting contemplated by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. Ratepayers will vote on by-law Nov. 29th to raise $150,000 for the above work.

Niagara Falls, Ont.

Power plant and raceway contemplated by a Syndicate. Engineer, Fred Walker, 39 Broadway, New York City. Surveys being made.

Ottawa, Ont.

Standards and lamps required by City Council (Elec. Dept.) Engineer, Supt. J. Brown. "White Way System" from Gladstone ave. to Bank St. Bridge, distance 6,400 lin. ft. or 1.21 miles. Total length of lights will be 2.42 or almost 2½ miles.

Preston, Ont.

Alterations and extension to electric lighting system contemplated by Town Council. Clerk, H. C. Edgar. By-law to be submitted to ratepayers Dec. 15th to raise $18,000 for above work.

Regina, Sask.

Pumps required by School Board. Architect, J. H. Puntin, Room 308 Darke Block. Tenders received by architect for automatic air pressure electric force pumps, to regulate water pressure for Connaught, Benson and Wetmore schools.

Sudbury, Ont.

Extension to power house and pumping station, $8,000, contemplated by Town Council. Clerk, George Elliott. Ratepayers will vote on by-law Dec. 1st.

Extension to electric lighting system, $9,844.48, contemplated by Town Council. Clerk, George Elliott. By-law will be submitted to ratepayers Dec. 1st.

Toronto, Ont.

Board of Control, Commissioner of Works R. C. Harris, recommend new civic lines on Greenwood, Glen Rd. and Mt. Pleasant Rd., Christie, Lansdowne and Lake Shore Road. Estimated cost $1,000,000.

Winnipeg, Man.

Power house, $5,000, planned by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Claydon Bros., Furby Place. 40 x 40, brick construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating. Excavating.

Power house, $158,000, planned by Provincial Govt., Dept. of Public Works. Provincial Architect, V. W. Horwood, 261 Fort St. General contractors, National Construction Co., Donalda Bldg. Foundations going in.

Fire apparatus required by Board of Control. Secretary, M. Peterson. Chief, J. E. Buchanan, Fire Dept. Two 60 h.p. motor hose wagons with steel bodies. One 80 h.p. motor aerial ladder truck, 75 ft. Tenders received by Board until December 15th. Specifications, etc., at office of Engineer.

Fire apparatus required by Board of Control. Secretary, M. Peterson. Chief, J. E. Buchanan, Fire Dept. Two horse-drawn, hook and ladder trucks. One 20 h.p. automobile runabout; 30 fire alarm boxes, 5,000 ft. 2½-in. cotton, rubber lined fire hose. Tenders received by Board until November 28th.

500 kw. motor generator set for generating station at Point du Bois required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. Tenders received by Board until Nov. 19th. Specifications, etc., at office of engineer.

Vacuum cleaner required by Board of Control. Secretary, M. Peterson. Tenders received by Chairman, Board of Control until 11 a.m., Nov. 26th, for the supply and installation of a vacuum cleaning machine for the King George Isolation Hospital. Specifications, etc., at office of the Secretary of Municipal Hospital Commission, Morley Ave.

Welland, Ont.

Extension to hydro electric system, cost $20,000, planned by Town Council. Clerk, C. M. Webber. Secretary Hydro Commission, H. E. Timmerman. By-law passed and equipment required.

CONTRACTS AWARDED

Calgary, Alta.

Transformers required by City Council. Clerk, J. M. Miller. Electrician, R. A. Brown. Contract awarded to General Supplies Ltd., 1233 2nd St. E. Canadian Maloney Co. and Canadian General Electric Co., Ltd., 325a 8th Ave. W.

Guelph, Ont.

Plumbing, heating, etc., planned by Prov. Govt., Dept. Public Works. Sec., H. E. McNaughten, Parliament Bldgs., Toronto. General contractors, Stevenson & Malcolm Co., Guelph, for plumbing, heating, wiring and ventilating in dining hall at Ontario Agricultural College.

Plumbing, heating, etc., required by Prov. Govt., Dept. Public Works. Sec., H. F. McNaughten, Parliament Bldgs., Toronto. General contractors, Stevenson & Malcolm Co., Guelph, for plumbing, heating, wiring and ventilating in Poultry Bldg. at Ontario Agricultural College.

Plumbing, heating and wiring for Provincial Govt., Dept. Public Works. Sec., H. F. McNaughten, Parliament Bldgs., Toronto. General contractors, Stevenson & Malcolm Co., Guelph, for plumbing, etc., in Husbandry Bldg., at Ontario Agricultural College.

ERIE MACHINE SHOPS

Send for our Catalogue of Asphalt Rollers and Mixers.

P. W. DIFTLY, Proprietor

"Our 20th Century Roller"

1303 Peach Street, - Erie, Pa.

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

14 Strachan Avenue - Toronto, Canada

A. Angstrom - Montreal Representative - 509 Canadian Express Building

Royal Bank Building, Toronto

View showing Missisquoi Marble

Quarried - In - Canada

RIGHT here in Canada architects and contractors can obtain marble with all the richness and depth of color that is to be found in the finest imported product.

Missisquoi Marble is quarried in ten distinct varieties which afford excellent opportunity for executing the most elaborate color schemes.

MISSISQUOI-LAUTZ CORP'N LIMITED

Head Office, PHILIPSBURG, QUE. **MONTREAL Office, 208 Read Bldg.**

Mills, PHILIPSBURG, QUE., BRIDGEBURG, ONT. Quarries, PHILIPSBURG, QUE.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	30	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.15
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete
Appliance Co., Ltd.
Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

Carbonizing Coating Paint

The most durable and least expensive Paint made for preserving Iron or Steel in Bridges, Buildings, Structural Shapes, Gas Plants, etc.

Galvanum Paint

The only Paint that will adhere for years to Galvanized Iron roofing, siding, cornices, etc.

Concrewaltum Paint

The only Paint that will beautify and make walls, ceilings, tile, concrete, brick and stone walls moist-proof and sanitary. Produced with strong luster finish or semi-luster, or flat finish. Can be frequently washed without injury.

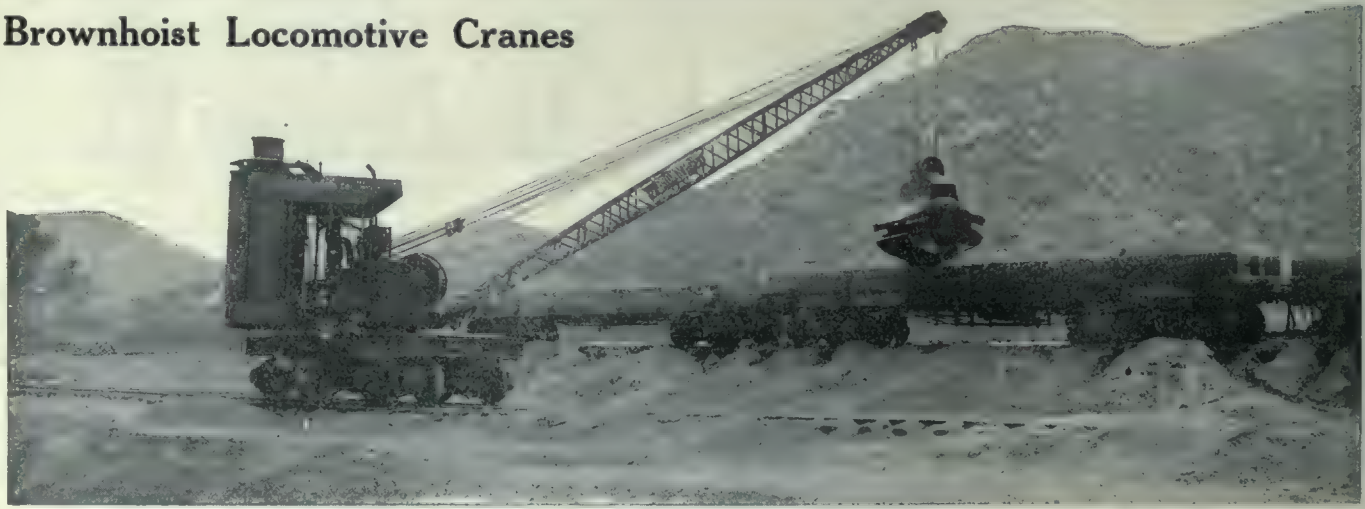
Manufactured in the United States and England by

The Goheen Manufacturing Co.

CANTON, OHIO., U.S.A., and Dock House, Billiter St., LONDON, E.C., ENG.

For sale by SANDERSON PEARCY & CO., LIMITED, Toronto, Ontario, Canada

Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.

New York Pittsburgh Chicago San Francisco The Colby Engineering Co., Portland, Ore.

ESTABLISHED 1886

Contract Record
and Engineering Review

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Alphabetical Index of Advertisers Page 16

Vol. 27 December 3, 1913 No. 49

Canada's Financial Position Fundamentally Sound

NEVER yet has a cloud appeared on the horizon but some gloomy weather expert has predicted a storm; never has money been tight in any country but gloomy financiers have foreseen a state of general bankruptcy, the country "going to the dogs," and so on. To counteract the influence of this exaggerated pessimism it is necessary perhaps to indulge in somewhat exaggerated optimism. The one is an infinitely greater constructive force than the other. Optimism sets up ideals and transmits the enthusiasm to work for them. Pessimism robs a man, a community and a nation of even that which they seem to have.

Looking around we find plenty of ground for optimism. Sir Frederick Williams-Taylor, the new general manager of the Bank of Montreal stated recently that the key to the financial situation in Canada was to be found in the attitude of London towards the Dominion. If we place confidence in this authority, and if we appreciate the extent of Canada's indebtedness to England, it is gratifying to note the success of the Montreal city loan of $7,500,000. The subsequent quotation at a premium of ¾ of one per cent. indicates a vastly improved sentiment in England towards Canadian affairs.

Sir Frederick Williams-Taylor, to whom we have referred above, interviewed recently upon his return to London after a visit to Canada, emphasized his opinion that Canada's financial position was financially sound and that all outward indications justified her in proceeding with the utmost confidence. He characterized London's attitude toward Canada as "watchful to a degree, with enthusiasm in a state of suspended animation." The observation is a significant one—one that urges a sane and conservative yet confident policy on our part.

The over-subscription of Montreal's seven-thousand-dollar loan in London is of outstanding importance as indicating restored confidence. This reassuring effect upon England's financial interests is attributed largely to the first-hand information taken back to London by the new general manager of the Bank of Montreal, whose word, for many years, has carried weight in quarters where Canada's financial interests are most concerned. Here, in authoritative places, the opinion is expressed freely that with the lessons of the past there will follow, an advent of easier money, which should be due with the passing of 1913, a period of sound enterprise and greater constructional development than ever. The change in the attitude of British investors demonstrated during the last month is not the least of the factors which will bring about a further strenuous era of building activity.

British Investments in Canada

IN the previous article passing reference is made to the subject of British investments in Canada. In this connection it may be interesting to give the following extracts from a speech delivered by Sir George Paish, Editor of the London Statist, when in New York last month:

"Canada for a long time to come will have to depend upon foreign capital—I would say almost entirely upon British capital—for the major portion of the capital supplied to Canada comes from the United Kingdom. I was delighted to hear Mr. Foster (the Acting Premier of Canada) say that the United States had provided $20,000,000 for the development of Canada. You will, I am sure, be interested to know that the mother country of which you are all so proud, has provided Canada with a sum of considerably over £400,000,000.

"You all know, of course, that the mother country has supplied almost the entire capital needed for construction of the railways of Canada, and that the prosperity of Canada has resulted mainly from the construction of those railways. The opening up of those vast lands in the West, and the cultivation of that great wheat area are bringing to Canada an amount of wealth difficult to calculate. I remember when I was here on the occasion of my last visit four years ago, the wheat production of Canada was only about one-half of what it is to-day. And we are now looking forward to Canada producing wheat possibly for the people of the United States, but certainly the greater part of the wheat we ourselves need in the mother country.

"You will, of course, appreciate that the investments of the United Kingdom in Canada are not entirely philanthropic. We put our money there for the purpose, first of all, of getting interest upon it. But underlying that is this point, that we put our money into Canada in order to supply the British people with the food they need for their subsistence. I need scarcely say that we also put our money in other countries for the same purposes. You will perhaps be interested to know that the greater part of the capital provided for the construction of railways in all the young countries of the world is supplied by the investors of the United Kingdom. It is essential for the welfare of our people that we should do so. I, think the amount of capital we have provided for railway construction in the agricultural countries of the world is $2,000,000,000, a very great sum, but it is upon the supply of food that the prosperity of the mother country depends, and it is of the greatest importance that we should supply capital for the development of Canada, Argentine, Brazil—indeed of all countries, I would say, even of the United States, for the purpose of insuring for ourselves the food and raw material we need. The fact that the United States sells to Canada so great a quantity of goods is in part due to the fact that British capital flows so freely into Canada. Briefly expressed the position in the United Kingdom is as follows: We supply the capital, America in large measure supplies the goods, and Canada obtains the advantage.

"During the last two years, Canada has made unexampled progress, but I think the progress is small in comparison with the progress that will be made in the future. Perhaps for a few years it may be necessary for Canada to go rather slow, but that will prove to be only a period of recuperation and of preparation for a much greater advance in the future."

The Wall Street Journal remarks that the United States has $600,000,000 invested in Canada.

The Story of a Wayne County Concrete Road

THE success which has attended the activities of the road Commissioners of Wayne County has made that section of the state of Michigan famous. Concrete has been adopted as the standard construction and all other forms have been abandoned. The Commissioners defend their selection of concrete on the ground of the general satisfaction derived from it and the low cost of maintenance as compared with other types. The concrete roads of Wayne County have attracted thousands to that locality, engineers, contractors and municipal authorities from all parts of Canada and the United States having gone there to study methods and results. The recent American Road Congress, which lasted a week, was held in Detroit, it being generally considered that the city and its environs offered the most useful object lessons to the delegates.

The story of a Wayne County Concrete Road is told in the Seventh Annual Report of the Commission and reproduced below in extenso. We are indebted to Mr. Edward N. Hines, Chairman of the Wayne County Road Commission, for the accompanying illustrations.

"After investigating a road with regard to traffic conditions, distances between objective points, number of people in the locality, etc., we recommend to the Board of Supervisors at their annual October session that the road be adopted and improved as a county road. The Board of Supervisors rejects, alters or adopts our recommendation. If the road is adopted, a record is put into our minutes setting forth our determination to take over the road as a county road; the road is given a name, usually the one by which it is known locally; that portion of our minutes showing our determination to adopt the road is published for three successive weeks in some newspaper having a circulation in Wayne County, and served upon the officials of the township in which the road is located. The road then becomes a county road with full authority vested in the county to improve and maintain it. A survey is made, plans and profile prepared, and these together with specifications and application for state reward are filed with the State Highway Department. Bids are asked for by advertisement (a prefunctory proceeding, as we have not contracted for any road construction for several years, nor have any proposals been received) which when they are received, we have the authority to accept, awarding the contract to the lowest responsible bidder, or to reject and do the work by day labor.

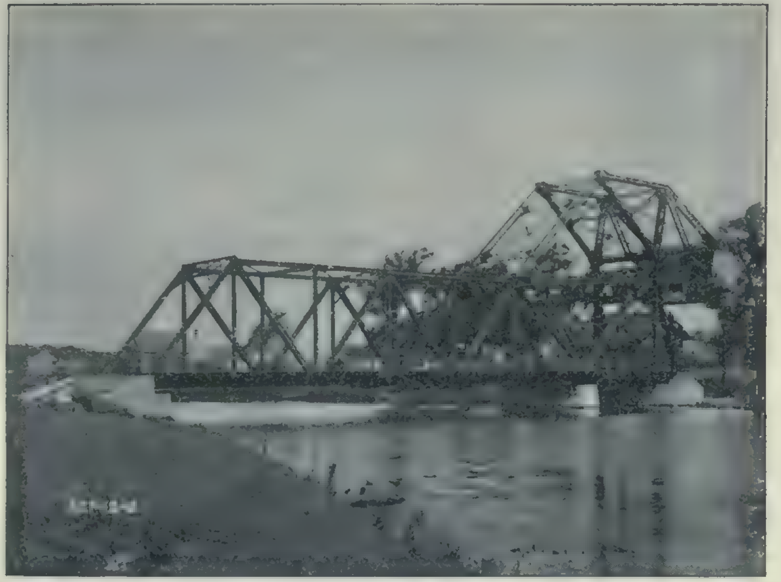
"After the road has been staked out, we prepare and shape the subgrade doing the major portion of such work with scarifiers and graders, the hauling power for which is furnished by steam engines or rollers. Careful attention is given the grade to eliminate soft spongy places, and a ten ton roller is used to roll it hard. To produce a good concrete road, thorough drainage is necessary in addition to a good subgrade. Both proper grade and drainage are difficult to cope with in Wayne County as the county for the most part is flat and situated in a valley not easily drained. The subsoil is largely of heavy sticky clay with some loose, deep sand.

"The hauling to the subgrade is done either by teams or with large cars hauled behind a roller or other trailer. These cars each hold seven tons of stone or sand. Materials are unloaded wherever conditions permit by means of steam shovels, and construction work progresses toward the base of supplies. We stock materials in the fall so that breakdowns and car shortages at the gravel pits will not interfere with spring work after getting under way. Camps are established wherever necessary in which the men are housed and fed at cost.

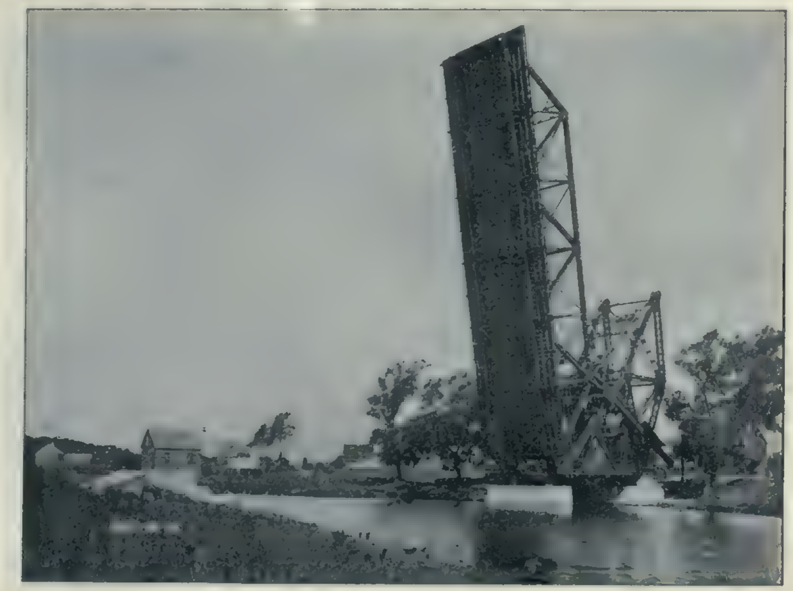
"Furnishing adequate quantities of water for carrying on the work is a serious problem, and in many instances we have been compelled to pump long distances. Two or three inch pipe lines are laid to the nearest source of supply, and the water pumped to the job by gasoline engines. In building out of Romulus this fall water was pumped from the Huron River, five miles away. On Grand River Road it was pumped six miles from the River Rouge. Long hauls over bad roads and scarcity of water are big factors in increasing our costs.

"After the preparation of the subgrade, which is flat, 2 x 6 inch side rails either of metal or wood protected at the top by a two-inch angle iron, are staked to the line of the grade along each side of the road. As the forms are subsequently used to support the templet and bridge from which the finishers work, care is exercised to get them rigid. We use a concrete mixer that travels under its own power, and from which a twenty-foot boom projects capable of being swung in the arc of a semi-circle. The dumping bucket is carried out on this boom under power which saves much handling. To prevent absorption of water from the concrete, the subgrade is thoroughly wet down. After receiving twelve complete revolutions in the mixer the concrete is dumped in place on the natural subsoil, no cinders, sand or other materials being used on the grade. The bucket is dumped carefully to avoid separation of the aggregate, and to make as little shovelling as possible necessary to roughly level the concrete for the work of the templet. We use a 2:3:6 mix, that is two cubic feet of cement, three cubic feet of sand, and six cubic feet of pebbles. The mix is wet, and of such consistency that men working in the concrete sink four or five inches. Clean material is an absolute

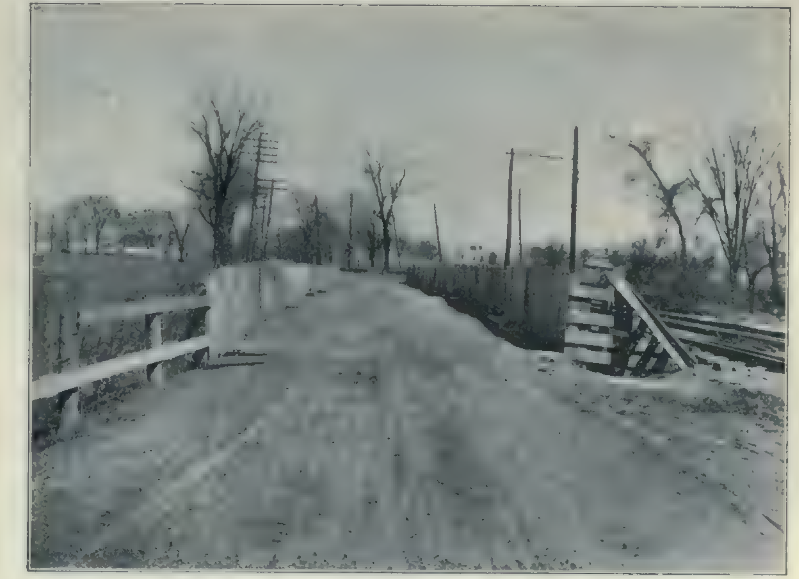
ROAD WORK IN WAYNE COUNTY



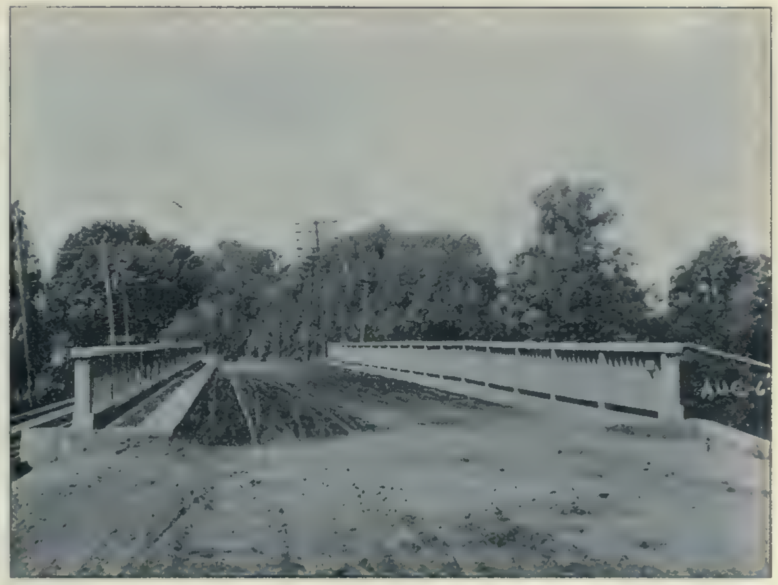
Bascule bridge over River Rouge—Closed.



Bascule bridge over River Rouge—Open.

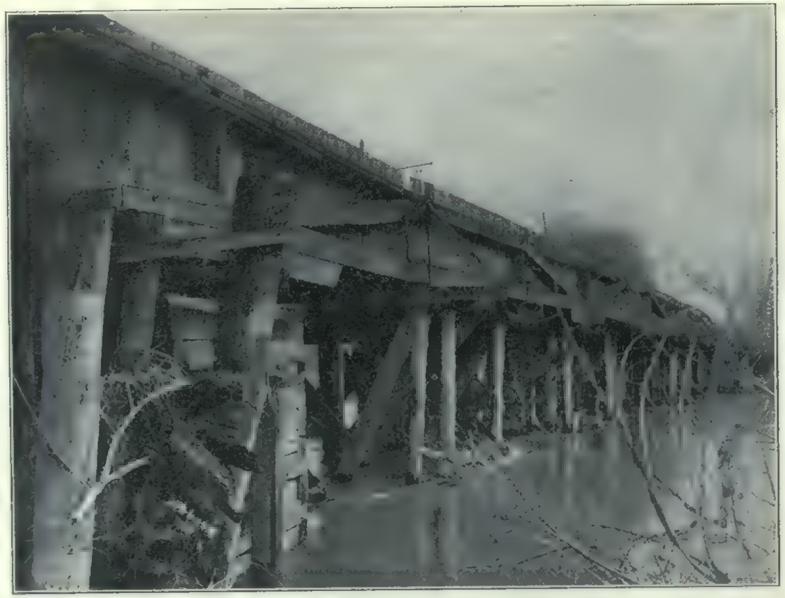


Wayne County highway before improvement.

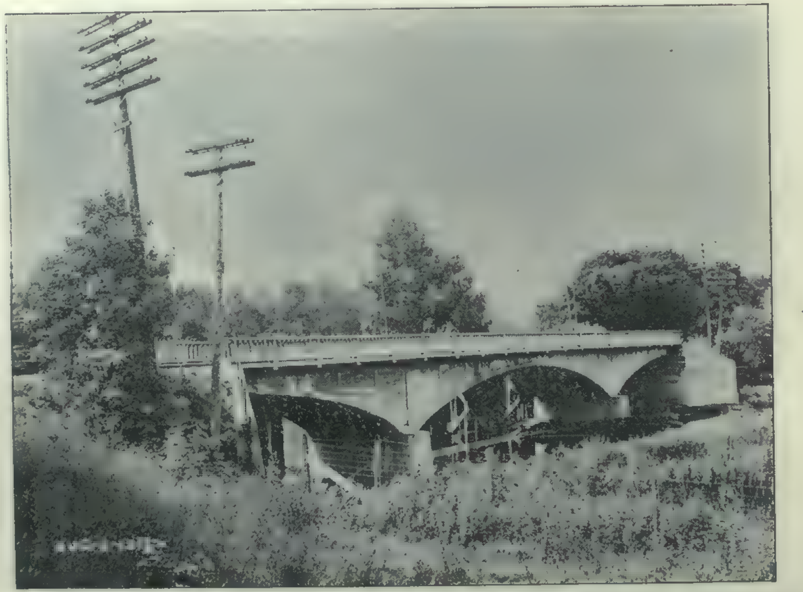


Wayne County highway after improvement.

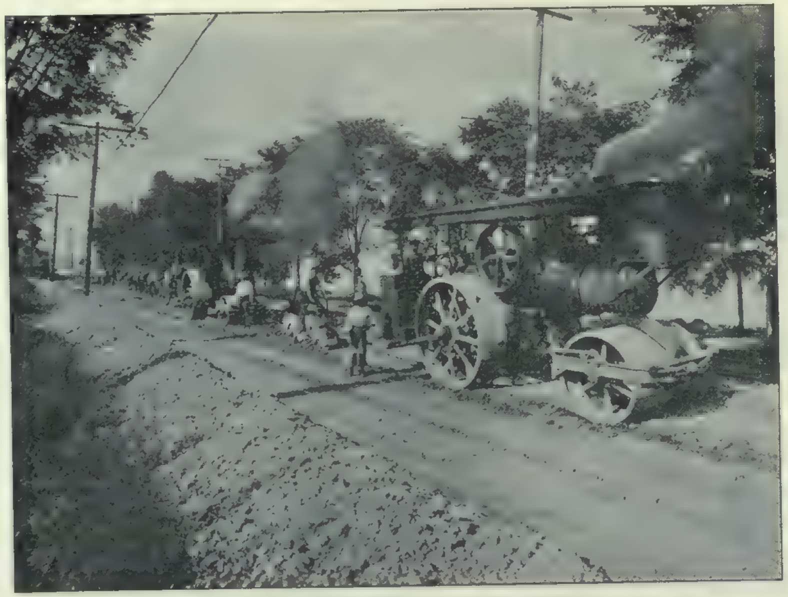
ROAD WORK IN WAYNE COUNTY



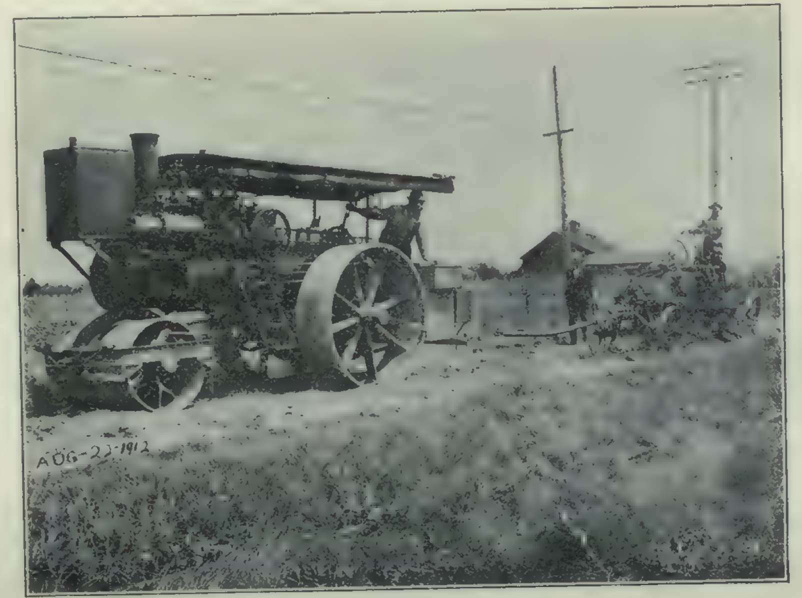
Old tumbledown bridge over Rouge River near Dearborn.



This illustration shows what has replaced the above structure.



Tearing up an old macadam road and preparing grade for concreting. Machinery used to cut down the cost.



Grading behind an engine. An economical plan.

requisite to securing good concrete. Our pebbles are washed and screened so as to be free from loam, clay, and other foreign substances. They range from one-fourth to one and one-half inch and are so graded as to reduce the voids to a minimum. Our sand is bank sand, washed and screened, free from loam, clay, etc., and ranges in size from one-fourth inch to dust with the coarser articles predominating. Wayne County has no stone hard enough for our purposes, and all stone and sand used are shipped from outside points.

"The concrete is brought to grade and shape by the use of a templet. This templet or strike board is made of two-inch plank, preferably in a single piece, the curvature of the under edge being made to exactly conform to the finished surface of the concrete road which is crowned one-fourth of an inch to the foot. On each side of each end is an iron handle for drawing the strike back and forth. The curved edge is shod with one inch angle irons bent to the curvature of the strike, giving it a metal wearing surface. The length of the strike exceeds the width of road metal by one foot. A twelve inch plank is suitable for widths of road metal up to 18 feet. If the road is wider than this, a built up form of strike is necessary, which is trussed to prevent a sag or flattening of the crown. The strikeboard is sawed back and forth on the side rails, and moved slightly forward at each stroke, giving the concrete its initial shape. After this operation no workman is permitted to disturb the concrete in any way either by stepping in it or by throwing anything upon it. This rule is imperative, as a violation of it means a road with waves and depressions by causing the neat cement and finer particles to rise to the top. We aim to have the stone take the wear as it is the hardest part of the aggregate.

"The final finishing up of the road is done by two men whom we term floaters, who work from a bridge which rests on the side rails, having no actual contact with the concrete. A wooden trowel of home manufacture is used for this purpose. The use of a trowel of this nature prevents the road from becoming slippery.

"Joints are placed every 25 feet using a metal plate three-sixteenths of an inch thick and 3 inches wide. These metal plates are intended to protect the edges from spalling and chipping. They are curved to conform to the crown of the road. These thicknesses of asphalted felt (about ¼ of an inch) are inserted between these metal plates cutting the entire depth of the concrete. These plates are provided with shear members which tie them securely to the concrete. We exercise a great deal of care to get these joints flush with the road surface as an unpleasant jolt is experienced by a fast moving vehicle in passing if they are too high or too low. Our whole aim is to provide a level, even surface, and the roads we are building at the present time show a vast improvement on this score over those built three or four years ago.

"When the concrete will stand of its own weight, the side rails are removed, and a three inch bevel is made at about 45 degrees by cutting off the edge with a shovel, and allowing the surplus thus cut off to fall to the side. This prevents a sharp division line between the concrete and the shoulders. Each day's work is finished up to an expansion joint, and no more than twenty minutes is permitted to elapse between batches during the day. The day following the laying of the concrete it is covered with a couple of inches of sand or loose soil such as is available, and is sprinkled during the day for eight continuous days. This prevents the road from drying out and is an important factor in properly curing the concrete so that it will attain its maximum hardness and strength. Plenty of water is vitally essential in producing good concrete.

"Roads are not opened for traffic until from two to five weeks have elapsed after the last batch of concrete is laid; the length of time depends upon the season of the year as concrete sets up much more slowly in cold weather than when it is hot and dry.

"Shoulders of crushed stone or gravel, whichever is the more available, are built three to seven inches thick and three feet wide on each side of the concrete; on many roads additional width of earth shoulders are built. This work is not started until after the road is at least three weeks old.

"All of our work is specialized, one crew doing the grading, another building culverts, another digging ditches, and making shoulders, another unloading and hauling and another at road building proper. These various operations are usually carried on simultaneously at various points along a given road. Machinery is used wherever possible since man and horse labor are scarce and expensive in the country districts during the roadbuilding season. Many labor saving devices have been worked out which increase both the quantity and quality of our work, and a personal inspection of our crews in operation is an interesting and instructive sight.

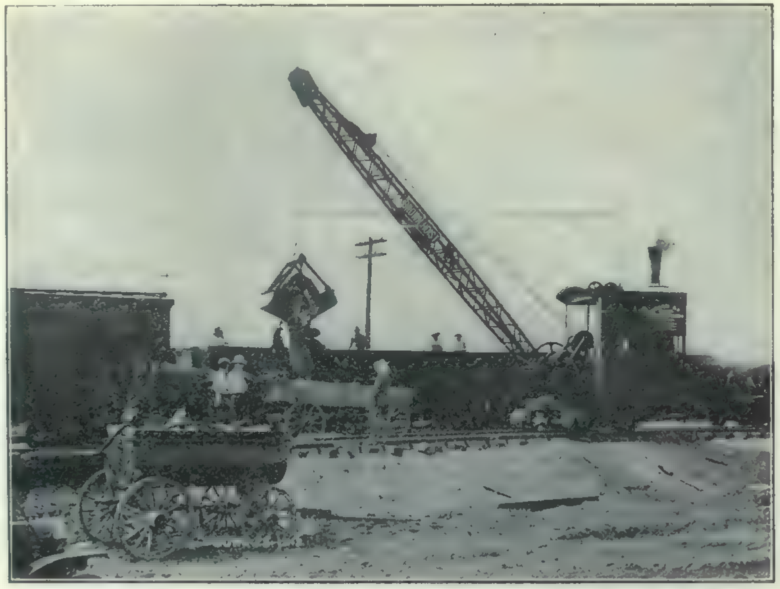
"We have had numerous people question our judgment on the width of metal adopted on various roads, but when we find on the greater proportion of the roads, grass and weeds growing luxuriantly on the gravel and macadam shoulders up to the very edge of the concrete, we feel we are justified in the policy we have adopted. No road is built less than 23 feet in width over all of material upon which traffic can turn out at any season of the year. The accompanying pictures will give a general idea of our methods.

"There are two factors to consider in highway construction: cost and efficiency. Cost is one of the main considerations of the taxpayer. The moment a road is contemplated, his first inquiry is, "How much will it cost?" The second consideration seems to us to be equally vital, "How good will it be?" This question of efficiency is often overlooked entirely.

"Cost must include not only first cost, but maintenance. The prevailing opinion seems to be that once built a road is for all time finished. This is a fallacy; no road is ever completed, because it is at all times subject to the breaking down processes of traffic, freezing and thawing; erosion by heavy storms, and the destructive chemical action tending to reduce everything in nature to its simplest elements. Care and maintenance of a road must be started the day the construction is finished, and must be continued for all time. This becomes a fixed charge, which unless the first construction of the road is of such a character as will suitably withstand the traffic it is called upon to carry, will increase yearly until it becomes an annual burden amounting to a large percentage of the original cost.

"We believe that if it is worth while to spend millions in Wayne County for good roads, it is abject folly not to protect that investment against absolute loss. To permit a road to go to pieces defeats the very object for which it was constructed. There is no special dispensation of Providence for the protection of a road, and unless continuously maintained, the

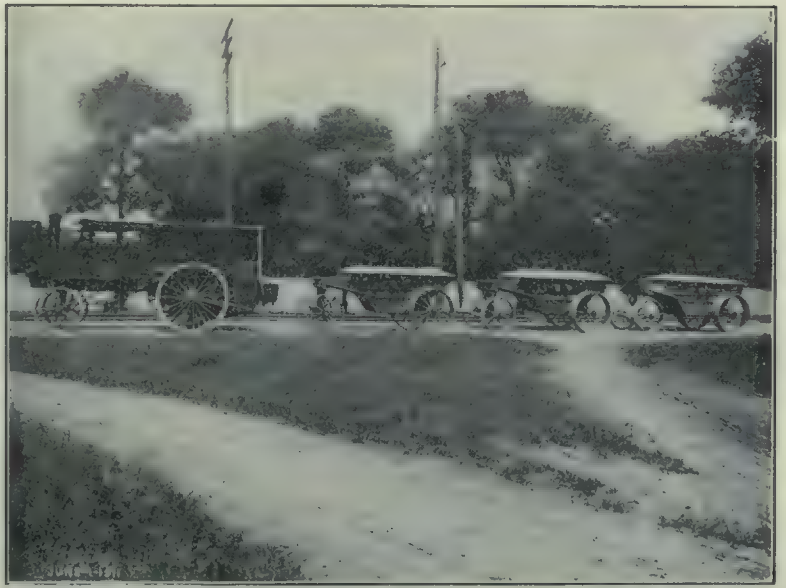
ROAD WORK IN WAYNE COUNTY



Unloading stone with a steam hoist—A practical labor-saving device for loading in wagons or a stock pile.

All ready for placing concrete.

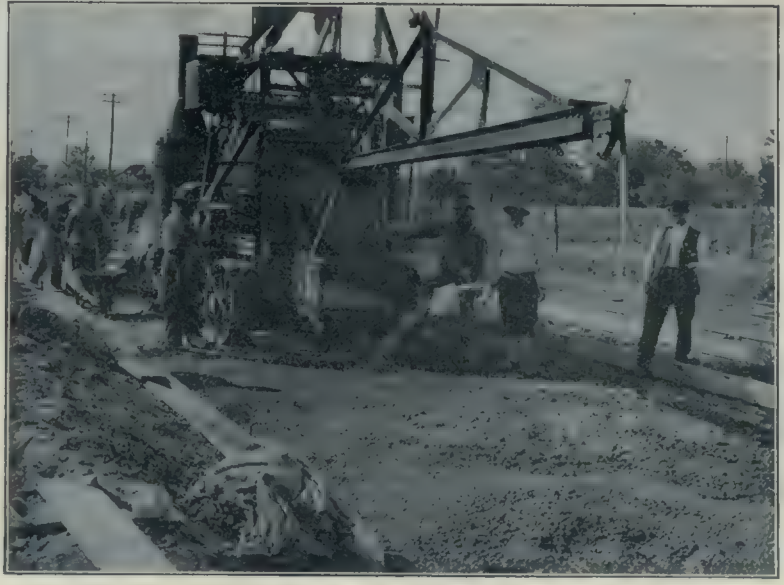
Unloading from cars and stock pile. Road camp in background.



Hauling by steam. Each wagon contains seven tons of stone or sand. These outfits are used in combination with team hauling.

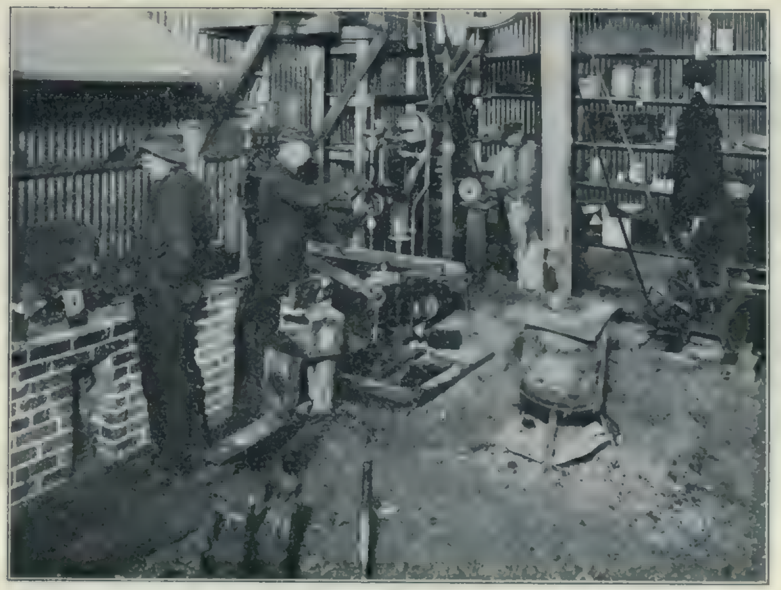
ROAD WORK IN WAYNE COUNTY

How the mixed material is placed on the road.



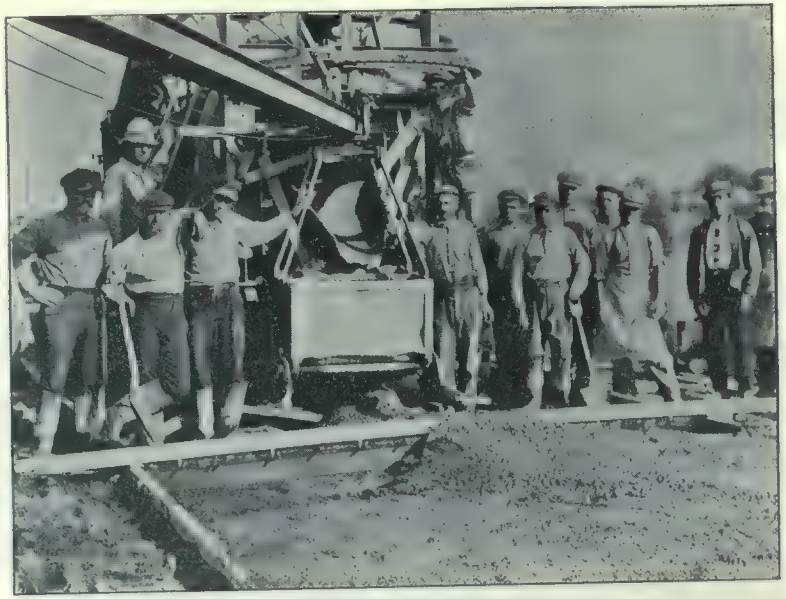
Sprinkling subgrade preparatory to placing concrete.

Setting up protection plates and expansion joints.

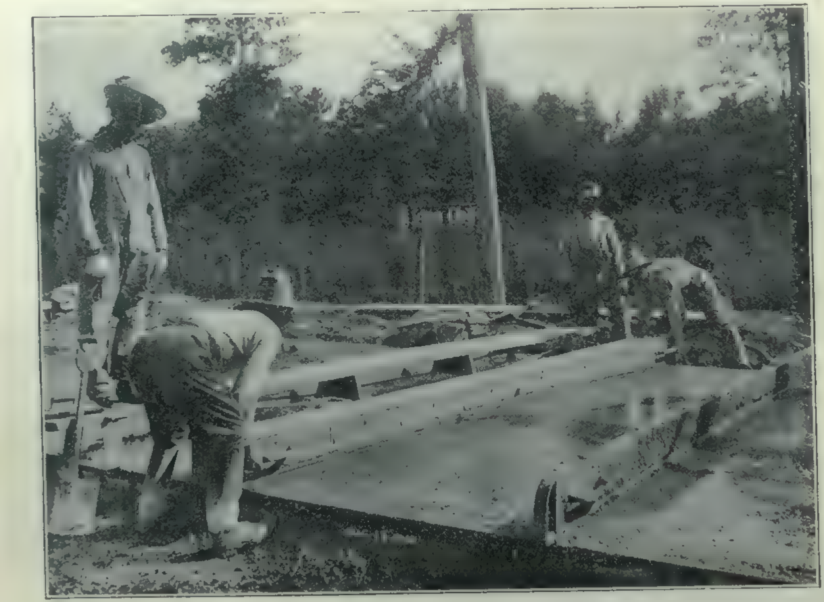


Machine shop where appliances are put in first-class working condition for the next season's road-making.

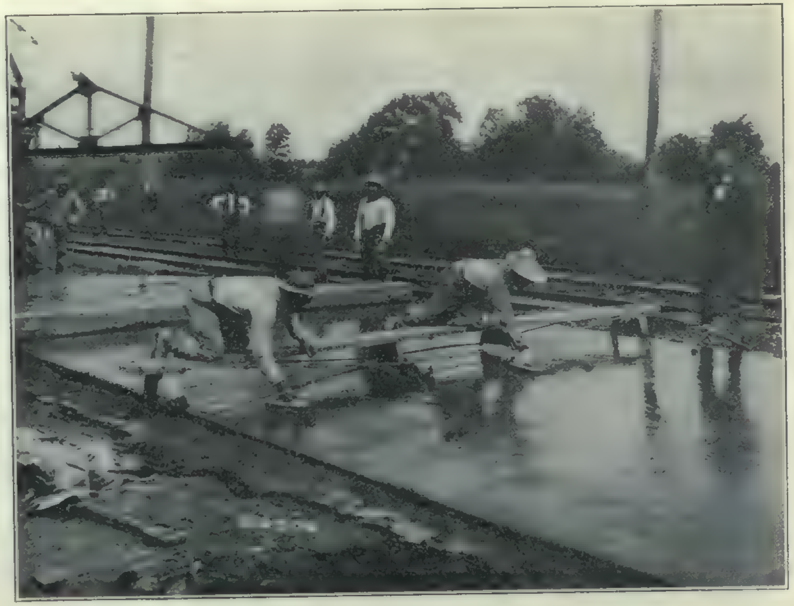
ROAD WORK IN WAYNE COUNTY



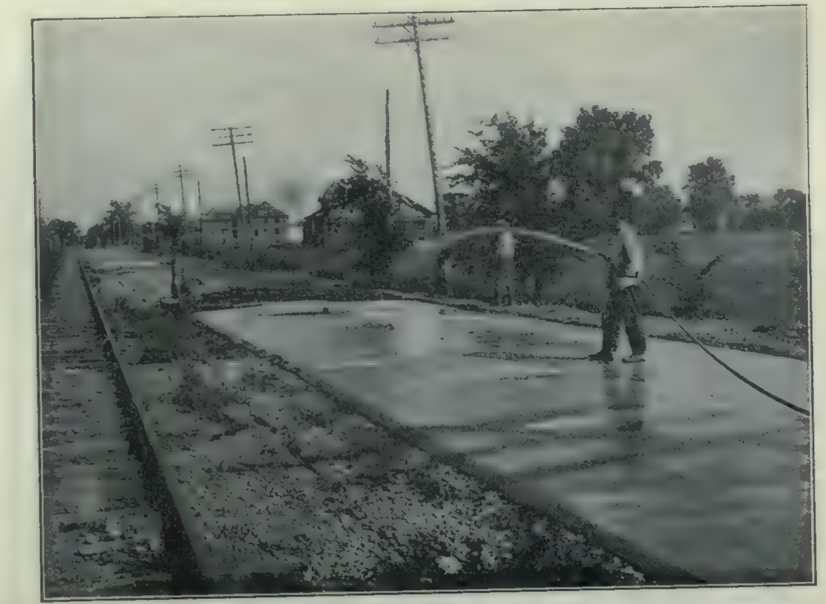
Expansion joint and metal protection plate in position in road.



Method of "striking off" concrete to give it a proper crown.



Putting on the finishing touches with wooden floats.



Finished road sprinkled continuously for 8 days. How to cover road to "cure" it by retaining moisture in concrete.

building of all highways will be a fruitless undertaking.

"The efficiency of a road is dependent upon:

1. Economy of tonnage haul per mile. A greater load can be moved in less time on a concrete road than on a macadam or similar type.
2. Adaptability to commercial and pleasure traffic. The road must be built to sustain heavy trucks, high power autos, auto trucks and horse driven vehicles, and minimize the dust nuisance.
3. General condition for traffic throughout the year. The road that requires least repairs is in best condition for traffic at all times.
4. Degree of safety to travel. The road should be free from ruts and chuck holes, and the surface of such a character that it is not at any time slippery.
5. The probable increase of traffic due to improvement.

"Needless to say no type of road is a panacea for all road ills, but we believe that in the concrete road as developed and built by our crews under our supervision and guidance, we come more nearly obtaining a road that combines the highest economy and efficiency based on the board principle of ultimate cost than is obtained in other types of construction. A comparison of our maintenance costs with those of other localities where roads are maintained in good usable condition, and where $1,000 per mile and upwards per year is being spent on maintenance, will prove illuminating. A special feature of the concrete road as being constructed in Wayne County is its uniformity of wearing surface, a surface that does not give way in any one spot, while it withstands traffic generally over its surface fairly well. This is made possible by a careful selection of material, by our methods of measuring the aggregate, and care in finishing and curing so that uniform wearing surface is obtained, and is a big factor in eliminating maintenance costs."

Oiling State roads in Maryland is accomplished by the state Good Roads Commission with a 40- h.p. auto truck of the worm gear type carrying a tank holding oil sufficient for one mile of road, spreading at the rate of ½ gal. per yard.

The Grunwald Hotel, Calgary, has just been completed at a cost of $200,000. Something of a record in rapid construction was made on this building, it having been completed in less than four months from the time the steel was first started. The contractors were Messrs. McDougall & Forster.

Port Arthur is installing a new waterworks system complete, comprising a duplicate pipe line each of welded steel pipe of 24 inches diameter. This pipe line will be about five miles long, totalling ten miles of pipe, all subjected to a test of 500 lbs. to the square inch. Messrs. Drummond, McCall, of Montreal, are the contractors for the delivery of this pipe and special parts. An up-to-date pumping station is being erected at the shore end of the intake and will be completed by the summer of 1914.

Canadian canal traffic in the season now closing has broken all records. From the opening of the canals the increase in the volume has been steadily sustained. Up to November 1st a total of 46,428,283 tons were handled, this being an increase of 4,845,171 over the corresponding period last year. Of the total increase, the Soo canal contributed 3,384,713 tons; the Welland, 729,477 tons, and the St. Lawrence, 831,369 tons. The difference between the Soo and Welland figures indicates a large volume of Canadian traffic finding an outlet by way of United States ports.

Pile-Driving with Dynamite

A NEW type of concrete pile, which would seem to have little merit except the novel way in which it is planted by explosive force, has been put on the market by the Siegwart Company, of Lucerne, Switzerland, says the Engineering News. The new pile utilizes the bulged bottom principle common to several patented piles, but is novel in that the enlarged base is formed by the use of explosives. The process of making the pile is described as follows:

An iron tube containing a wooden pile with an iron point and a device at the upper end for deadening the blows of the pile driver is driven into the ground. The wooden pile is then removed and the cartridge provided with an electrical detonator is fixed in position at the bottom of the hole, and the tube is filled with wet concrete, a little above the level of the surface of the ground outside the tube. The iron tube is then drawn up some feet to prevent its end from being shattered by the force of explosion. After the detonation the concrete sinks downwards, filling up the space hollowed out by the explosion. Finally the tube is little by little filled with more concrete, and is drawn up gradually at the same rate as the concrete is filled into it.

After the completion of this process, and after sufficient time has been allowed for the hardening of the concrete, there is in position in the ground a pile with a base of greater lateral diameter than it is possible to produce by any other means. Moreover, on account of the action of the gas formed by explosion, these piles will give the best possible results in compressing the earth. In fact, one pile on this system serves the purpose of several piles on any other system, thus insuring a great economy. By using cartridges of greater or less strength the size of the excavation made by the gas is controlled at will; by the use of a cartridge 600 to 700 grams in weight there is, for instance, made a spherical hollow of three to four feet in diameter, according to the quality of the ground material.

Planer shavings and cement are used by the construction forces of the Southern Pacific Company as a plug in tremies for depositing concrete under water. As is well known, in using bottomless tremies in deep water the concrete in the first charge has to be deposited through the tremie full of water, thus defeating the purpose of the tremie, which is to avoid the separation of the concrete as it falls through the water. To get around this difficulty a number of schemes have been used, notably the use of a burlap plug or in extreme cases a flap bottom to the tremie. In the practice of the above named company, however, the tremie is first put down in the water and upon the top surface inside the tube is sprinkled a layer of planer shavings and cement. On top of this plug the concrete is deposited, pushing the plug ahead as the tube is filled, thus allowing the concrete to be placed in a comparatively dry tube. When the plug reaches the bottom the larger part of the stavings and cement goes out of the bottom and floats to the top.

Engineering Topics in the Old Land

London Correspondent of the Contract Record Deplores Misrepresentation of Canadian Conditions—The Part of the English Engineer in Canada—Advisability of Personal Investigation of the Field

London, Nov. 25, 1913

It is somewhat difficult for the English mind to realise the resources of such a country as Canada, and it is more difficult still for it to realise that these marvellous resources remain—despite the progress that has marked recent years—practically untouched. To live in a "right little, tight little" island has its advantages, but one's outlook on the outside world is apt to become constricted, and even now insularity is a much too prevalent attribute of the home-dweller. The vision of the great mass of the population of Great Britain extends no further than the coast line, and as the sea may be reached in two or three hours from almost any part of the country the horizon is a limited one. That Canada has a great future before her none cares to deny, but that that future is imminent, is to a great extent present (if the expression may be used) and is already becoming history is beyond the grasp of the everyday individual one meets. The rapid growth of the population, the development of the cities, the expansion of agricultural and other industries (to quot the Contract Record) are beyond his ken, and Canada is to him a country of wooden houses, earth roads, single railway tracks and 160-acre farms, frost-bound and stagnant the greater part of the year and evoluting slowly towards civilization during the remainder. And it is particularly unfortunate that the over-glowing pictures penned and pencilled by the emigration agents have served largely to strengthen his attitude of ignorant apathy. This form of special (and specious) pleading is responsible for much, and the opinion has become pretty general of late that emigration is a hum and is run by a few interested parties for the sole purpose of overstocking the labour market and bringing down wages. The free farms are regarded as a delusion and a snare, and it is argued that settlers are trapped across the seas, at the instigation of the railway magnates, simply for the purpose of raising produce (mainly at a loss) for freightage purposes. The cheap cinemetagraph show must accept its share of the blame in the wholesale misrepresentation of Canadian life and conditions.

Cosmopolitanism in Engineering

Engineers, happily, form a more enlightened section of the community, their training being of a nature calculated to broaden their outlook. To say that they are in any way cosmopolitan—as are their German brethren—would be to misstate the facts. They do not read foreign articles for the simple reason that their knowledge of languages is confined to their own. They do not even appreciate the importance which, for instance, Spanish holds in the technical world, and hundreds of men yearly try their luck in South America without any preliminary acquaintance with at least the rudiments of that tongue which is a key to the country. Of course, when it comes to the English-speaking colonies, no difficulty of this sort presents itself, and yet there remains the feeling that American practice—as it is loosely termed—is not for Englishmen, and that while the colonial can learn from them, they have nothing to gain by rubbing shoulders with him. It would seem to escape their notice that, as regards Canada anyway, much of the engineering work has been carried out by Englishmen. Many of the schemes now in progress are in English hands, or at least owe their inception to the report of an English engineer. The point is, however, quite an unimportant one, and the broad fact to consider is that schemes of the greatest magnitude and interest are being carried out in all parts of Canada, and that these schemes deserve the careful study of the English engineer. He may derive considerable information from them, and their value is not in the least detracted from because local conditions differ from those obtaining "at home," and in differing require necessarily special forms of treatment.

Opportunities of Engineer, Manufacturer and Investor

In the west of Canada (the Contract Record is taken as authority for the statement) a great amount of engineering work is being carried out, while there is a demand for " new railways, improved roads, waterworks, sewerage, sewage disposal works, steel and reinforced concrete structures, bridges, gas works, electrical works, refuse incinerators" and much else. What an opportunity is here presented for the consultant and civil engineer, scratching painfully for a living on the seventh floor of a Westminster block of offices! Again, what opportunities for the manufacturer and the chemist in those parts of a country where, although there is an abundant supply of clay, "practically all sewer pipes, terra cotta, and other clay products are imported!" And yet, side by side with statements such as these, one reads that money is tight and that "difficulty is encountered" (and will, it is expected, be encountered for some time) "in obtaining large sums of money abroad." The English investor is well-known for the far-reaching nature of his investments, and (to quote a contemporary) "he cheerfully sends his money to the uttermost ends of China and Peru, but he is extremely apt to consider China and Peru as being situated less on the actual terrestrial than on Mercator's Projection in the atlas on the shelf in the study at home, and perhaps also in some mystic way, behind the mahogany counters of the palatial building in the city where his dividends come from. It is a pity that the investor does not travel more. In the absence of figures to refer to, one cannot say off-hand how many millions of British money are invested in Canada, but it is perfectly safe to say, however many millions are invested there would be added to them several millions more if English investors saw Canada for themselves to a greater extent than they do. In seeing Canada, they would not only see fresh opportunities for investments at every turn, but they would inevitably come back with a much greater sense of security in their investments.". That the exercise of care in making investments is important goes without saying, and this especially when dealing in real estate. As Mr. G. T. Somers, late President of the Board of Trade of Toronto has said, no one should buy real estate in

Canada without first making inquiries from others than those interested in the sale; but this does not discount the fact that splendid investments other than those of "the assured sites of new cities" are to be obtained.

It would be useless to attempt a list of the big things going in Canada, and even if space permitted it would have no interest for the Canadian reader. The best advice that can be given the British investor—be he investing his brains or his capital—is to go and see for himself. Business and pleasure could be combined on a trip. Sir Richard McBride, the Premier of British Columbia, was right when he said that if a little more elasticity were displayed by business men in England in the way of playing up to the new conditions in Canada it would lead to a betterment of things all round. "Don't merely send us the things you make," he urged, "but send us what we need, and if you haven't got them make them." Such excellent advice applies equally to the engineer and the manufacturer, and coupled with the admonishment to "go and see" would work wonders. Nothing can beat knowledge acquired at first-hand.

Civic Apathy

According to Mr. Francis Neilson—President of the English League for the Taxation of Land Values—Edmonton, Alberta, is the freest city in the world, "allowing no private pockets to drain away the commercial values of her franchises," and the recent account by the Mayor of Edmonton of this single-tax and municipally-owned city has raised no little interest here. Municipal ownership finds many adherents in England, and its ramifications are extending yearly, but the bulk of the population takes not the remotest interest in municipal matters. Even opposition to enterprise is apathetic, and the daily press reveals in this as in other matters its splendid aptitude for chronicling nothing but items of quite ephemeral importance. The fact that a certain city has paid £100,000 "in relief of rates" from its profits on, say, the gas undertaking is blue-pencilled to make room for a paragraph concerning the knock-out in the seventh round of some third-rate boxer. The doings of such a civic dignitary as the Lord Mayor of London are carefully followed by the Press, it is true, but a remarkable exception was made only a day or two ago. On the occasion in question he honoured with his presence, a conversazione given by the Institution of Municipal Engineers, staying the evening through and speaking at length upon the work of the municipal engineer and the splendid record of the Institution. It is scarcely conceivable that the Press cut out the news paragraph that was sent to them, although, had the Lord Mayor attended a presentation of prizes to the Boy Scouts, columns would have been given up freely to a record of the fact. The civic spirit may be regarded in the main as dead in England, and eyes of envy are not unnaturally turned by the minority to a record such as that held by the city of Edmonton. Happily the apathy of the majority falls an easy prey to the energy and persistence of the enthusiastic few, and each year becomes more definitely progressive. A little of that spirit of enterprise which has been let loose in Edmonton, with such marvellous results, is badly wanted in the old country.

Kindness and co-operation between employer and employee is undoubtedly the best policy, but in this, as in the case of honesty, the man who does it merely for the sake of policy, doesn't get half the good out of the effort that he should.

Dominion of Canada Ore Dressing and Metallurgical Labratory

THE Ore Dressing and Metallurgical Laboratory, which has recently been established at Ottawa by the Mines Branch of the Department of Mines, is now in operation. Experiments for the purpose of determining the best methods of concentration are being conducted on large samples of magnetic iron ore from the Ground Hog mine, which is situated on the Algoma Central Railway.

This testing station has been organized by Dr. Haanel, the Director of the Mines Branch, to aid in solving the problems of ore dressing of the Canadian ores. No charges are made for the investigations, which include the sampling and necessary assays, but the following conditions are imposed:—

(a) Samples must be bagged and delivered to the plant free of all transportation and unloading charges.

(b) For small scale tests, not less than 200 pounds will be accepted, and for large scale tests, not less than five tons.

(c) All testing products are to become the property of the Mines Branch, unless otherwise arranged before commencement of tests.

(d) Reports of tests will be incorporated in the publications of the Mines Branch, but single copies will be given to owners of samples when their tests are completed.

Under ordinary conditions tests will be made by the Mines Branch officials, but arrangements may be made whereby engineers or other competent persons may supervise their own experiments.

The following lists of full scale and laboratory size apparatus will convey some idea of the magnitude and latitude of the plant:

STANDARD SIZE MACHINERY

Crushing and Screening

One Hadfield and Jenks 12 in. x 8 in. Blake crusher; one Allis-Chalmers 24 in. x 14 in. "Style C" rolls; one Hardinge 4 ft. 6 in. conical ball mill; one Ferraris 6 ft. screen for coarse sizing; one Keedy ore sizer, No. 3, for fine sizing; one Duplex Callow screen.

Sampling, Recording, Etc.

Sampling is provided for by two Standard Vezin machines, placed in favourable position to cut out preliminary samples of coarse materials. The fine material is sampled by an eight unit system of the Flood automatic samplers.

Provision has also been made for hand sampling by means of the Jones riffled samplers.

All water lines serving standard apparatus are equipped with Keystone water meters, to enable the keeping of accurate records of water consumption.

Amalgamation and Concentration

One Allis-Chalmers 5-stamp battery, with 1,250 pound stamps, equipped with a 10-ft. tilting amalgamating table, followed by a Pierce amalgamator. The mortar of this mill may be, if so desired, arranged for inside amalgamation.

Six Callow tanks, 8 ft. diam., for de-sliming and settling; two Richards pulsator classifiers, launder type; one Overstrom sand table; one Deister slime table; one Richards pulsator two-compartment jig; one tandem unit Grondal magnetic separator, for wet separation of strongly magnetic minerals; one Grondal magnetic cobber, with dust collector for dry separation of strongly magnetic minerals; one Ullrich four-pole magnetic separator, for either dry or wet separation of weakly magnetic minerals; one Huff electrostatic unit, comprising a standard generator and two laboratory size separators.

Small Scale Apparatus

One Sturtevant 2 in. x 6 in. laboratory crusher; one Sturtevant 8 in. x 5 in. laboratory rolls; one Sturtevant 12 in. x 24 in. laboratory screen; one Braun planitary pulverizer; one Abbe six jar pebble mill; one gyratory screen (Hoover type), for making dry screen analyses with nested screens; one Richards combined laboratory pulsator jig and classifier, with glass side; one Grondal laboratory magnetic separator, for either dry or wet separation of strongly magnetic minerals; one Wilfley table, 24 in., laboratory size; one laboratory cyanide plant of 200 pounds capacity, consisting of a Parrel agitator and air pump, with the necessary solution, zinc, and sump tanks; two laboratory filter presses; one complete set of I. M. M. standard screens; one complete set of Tyler standard screens, after the Rittinger scale.

An experimental roasting and sintering plant, and also floatation apparatus will be installed during the coming spring.

Preparations are under way for the establishment of a Ceramic Testing Laboratory by the Mines Branch, which will be equipped with a full set of modern apparatus for the testing, under working conditions, of clays, feldspars and other materials used in the ceramic arts.

Frost Damage to Montreal Filters

Concrete Piers, Floors, and Ground Arches, Unprotected During Winter, Crack and Spall—Repair Methods and Report by Board of Experts

By Frederick E. Field*

At the end of the summer season for outside construction contractors and engineers should give serious consideration to the proper protection of uncompleted work against frost action during the winter. Neglect in so doing is too frequently followed by serious damage, necessitating delay and costly repairs. During the winter of 1912 the filtration works under construction for the city of Montreal suffered considerable damage. Frost action on the partially completed structures produced many unusual results, which form the main theme of this article, which is an abstract of an interesting feature of The Engineering Record for November 22.

Contracts

The above work is divided into several contracts. Under contract 1 will be furnished the pumping machinery, blower, cranes and other equipment necessary for a complete installation, all of which will be located in a building adjoining the filtered-water reservoir. These pumping units are required to lift the water from the supply conduit to the prefilters, from which it will flow by gravity through the final filters and filtered-water reservoir to the municipal pumping station.

Contract 2 comprises the final filters and appurtenances, which will later be described in detail, as it was upon this contract that the damage by frost occurred.

Contract 3 includes sixteen prefilters, each with a normal capacity of 3,250,000 imp. gals., a filtered-water reservoir with a capacity of 6,000,000 imp. gal., and various supply and discharge conduits.

Contract 4 will include the filtration pumping station, wash-water tower and the superstructures of the prefilter operating gallery and gate houses.

Final Filters and Appurtenances

There are sixteen final filters, each having a net filtering surface of ⅜ acre, arranged in batteries of eight on either side of an operating gallery. The normal capacity of the filters is 50,000,000 imp. gal. per day when operated at a rate of 10,000,000 gal. per acre per day. The equipment is complete, including lighting, heating, and ventilating systems and sand-cleaning machinery.

Some of the more important items included in the work are: Earthwork (excavation and embankment), 100,000 cu. yd.; concrete, 34,000 cu. yd.; steel reinforcement, 1,000,000 lb.; cast-iron pipe and specials, 112 tons; wash-water gutters, 16,300 lin. ft.; filter material (sand and gravel), 35,000 cu. yd.; washing machine track system, 33,700 lin. ft.

Features of Design

The filters are each 55 x 340 ft. in plan, to accom-

Table 1—Meteorological Data for Montreal

Temperature	Dec., 1912	Jan., 1913	Feb., 1913	Mar., 1913	Average	Dec.. (d)	Jan., (e)	Feb., (e)	Mar. (e)	Average
(a) Mean	24.38	22.68	11.81	28.76	21.91	19.03	12.68	14.88	25.18	17.94
(b) Maximum ..., ...	31.05	31.72	20.70	36.18	29.90	25.81	20.92	22.85	32.13	25.40
(c) Minimum	16.87	14.62	3.96	21.07	14.10	12.02	4.73	6.93	17.81	10.40
Total in inches					Totals					Totals
Rainfall	1.83	2.56	0.02	4.54	8.95	1.30	0.87	0.78	1.50	4.45
Snowfall	14.10	22.50	22.40	19.00	78.00	24.90	29.74	25.37	21.40	101.41
Pecipitation ... .../..	2.91	5.08	2.79	6.42	17.20	3.75	3.73	3.29	3.79	14.56

(a) Mean of bi-hourly readings taken from self-recording instruments; (b) and (c) averages of the maximum and minimum temperatures for each day of the month; (d) thirty-eight years' "mean" for and including this month of 1912; (e) thirty-nine years' "mean" for and including this month of 1913.

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*Resident Engineer, Filteration Works, Montreal.

modate Blaisdell sand-washing machines, which will run from the gallery to the extreme end of the filters upon tracks carried by concrete beams between the filter piers. The filters, Fig. 1, are covered by groined arches, supported on piers spaced on 19-ft. centres. The floor is flat and so constructed that the pier and wall loads are carried on reinforced pier and wall bases, entirely independent of the regular unreinforced 5-in. floor.

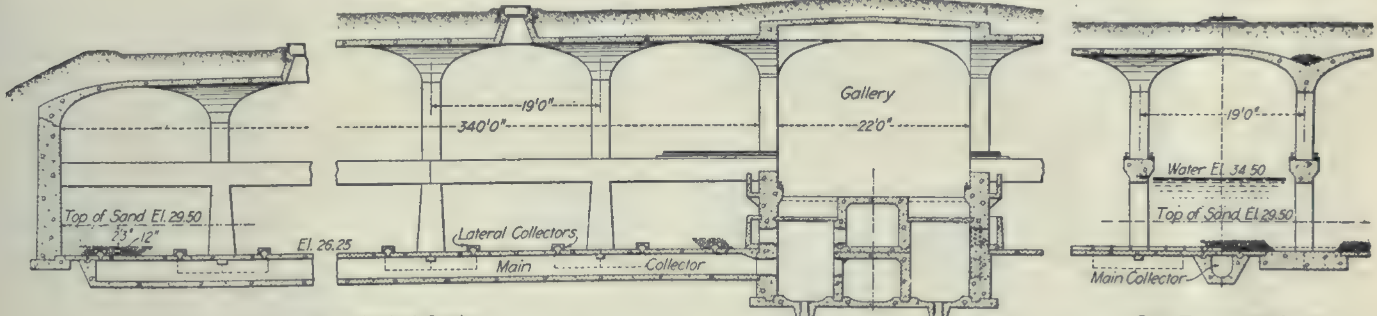
The main collectors run longitudinally the entire length of the filter and below the floor slabs.

In general the walls and wall bases are built in sections 57 ft. long, and the walls are built to their full height at one pouring. The track beams are built in alternate sections, each 38 ft. in length, with expansion joints on the centre line of every second pier.

The gallery is 454 ft. long and 22 ft. wide and contains the prefiltered and filtered water conduits and the necessary piping connections to the filters. The side walls carry tracks upon which a transfer table for conveying the washing machines from one filter to another will be operated.

Foundations

The entire foundation is a secondary deposit of material previously eroded by glacial action, and deposited by running water. The surface layer is yellow, while the underlying material is a grayish blue. An analysis of the soil shows that it consists of fragments of rock and rock powder graded from coarse to very fine particles, all of which under the microscope are found to be sharp and angular.



Part Longitudinal Section

Part Transverse Section

Longtitudinal and transverse sections through filters, showing beam runways for sand-washing machine.

Actual tests of the bearing power of the soil have shown that it will sustain loads of 3 to 5 tons per square foot, with only a slight compression of the soil even when saturated with water. In some of the tests the apparatus was surrounded by water to a depth of 8 ft. for two weeks without any appreciable settlement under the ram. As the maximum load to be carried by the soil does not exceed 2½ tons per square foot, these tests proved the soil to be entirely adequate for the loads to be imposed.

Work Completed Before Winter of 1912

The area covered by the sixteen final filters had been stripped of top soil, the entire area leveled off and brought to the subgrade of the filter floors, and embankment placed to a depth of from 4 to 6 ft. along the completed outside walls. In making the necessary fills to bring the ground up to the subgrade of the filter floors the best clayey material from the excavation of the filtered-water reservoir was used, all such material being placed in 4-in. layers and thoroughly rolled. There were only two comparatively small areas where there was any considerable depth of filling below the pier bases. One of these areas required a maximum fill of about 3 ft. and the other a fill of 4 ft. at the lowest point of the bowl-shaped depressions. Only 8 per cent. of the pier bases is on fills exceeding 6 in. in depth and more than 80 per cent. of the foundations is upon original ground.

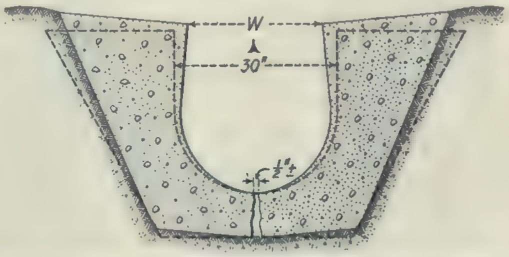
The main collectors and pier and wall bases were completed in all of the sixteen filters. Floor slabs were completed in eleven filters, no slabs having been placed in five filters on the north side of the gallery. All outside walls, practically all dividing walls, and all but a few track beams were competed on the south side of the gallery; but very little work of this character had been done on the north side.

The vaulting had been completed over a little more than two filters.

Protective Measures Neglected

All work was discontinued about the middle of November. The contractor did not make any provision for protecting the foundations from frost action, although he had been officially notified that serious damage might result if the work was not protected. The entire work could have been flooded with water to prevent the freezing of the ground below the foundations. This would have been an easy and cheap method of protection.

As an indication of the probable efficiency of such flooring it is instructive to note that the completed sections of concrete floor in the filtered water reservoir were in a depression which allowed surface drainage to collect to a depth of from 3 to 5 ft. which protected the work so well that there was no freezing of the ground below the floor and no resultant damage or lifting by frost.

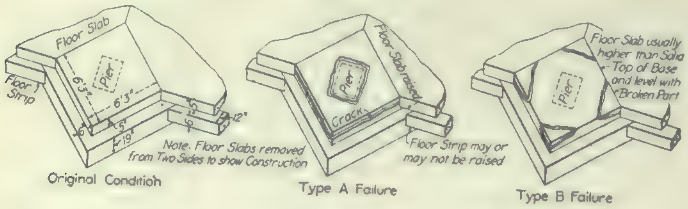


Type of collector failure. W was originally 30 inches.

Range of Temperature

The range of temperatures, together with the amount of rainfall and snowfall, is shown in the table of meteorological data. These statistics are based on reports from the McGill College observatory at Montreal. In comparison with the corresponding months of previous years the weather conditions were unusual in the following particulars: (1) The average temperature was higher by about 4 deg. (2) The total rainfall was in excess by about 100 per cent. (3) The total snowfall was less by about 22 per cent. There were no long continuous periods of low temperatures, and changes from low to moderate temperatures were frequent and sudden, which would tend to increase frost action.

Early in March, 1913, after the snow and ice had largely disappeared from the site, it was found that the disturbance by frost was general and much damage had occurred. The main collectors of floor slabs were raised and many of them badly cracked. The pier bases were raised and tipped and many were also "spalled" where adjacent floor slabs abutted. The wall bases were generally raised and some of them broken completely through by their unequal vertical movements. The track beams were raised and some of them were cracked from the varying movements of their supports. The dividing walls were raised and tipped and the expansion joints between sections were opened considerably more at the top than at the bottom of the walls. The roof groins were unequally raised along the outside barrel arches and some of them were displaced with respect to the adjacent sections of vaulting.


Floor Slab
Floor Strip
Pier
6'3"
6'3"
5"
19"
6"
12"
Note. Floor Slabs removed from Two Sides to show Construction
Original Condition
Pier
Floor Slab raised
Crack
Floor Strip may or may not be raised
Type A Failure
Floor Slab usually higher than Sala
Top of Base and level with Broken Part
Pier
Type B Failure

Type of failure of pier bases. Floor slabs removed from two sides.

As spring advanced and the frost left the ground further changes took place. The floor slabs settled and the widths of the cracks were reduced. The pier bases practically returned to their original position and the "spalling" along edges in contact with floor slabs became more general. The wall bases and walls also returned toward their original elevation, with a resultant closing of the cracks at expansion joints. The track beams followed the downward movement of the pier bases; some of the cracks closed and others developed as the result of unequal movement. The roof groins returned to place with some minor cracking at the springing line, and in some cases the upper piers were slightly tipped.

While the damage sustained by frost action was serious, the fact that this damage was no more extensive is not only conclusive proof of the relatively flexibility of the various structures but also that the work, as designed, was able to suffer great punishment without complete failure. It is interesting to note that the lifting of the foundations by frost was less on those areas where filling had been done than where the footings were on original soil. This may be explained by the fact that the filling was of selected material, placed in thin layers and thoroughly rolled, with the result that it was more compact and contained less voids for the entrance of moisture than the original ground.

A detailed description of some of the damage follows:

Main Collectors.—The general type of failure is indicated in Fig. 2. The pressure of the freezing and expanding ground forced the side inward and produced a longitudinal crack throughout the length of the invert, and also raised the collector from its original elevation. The width of the collector was originally 30 in., but the sides were forced together until in some instances the width at the top was reduced to 23½ in.

.All cracked main collectors have been replaced, while collectors lifted and not cracked in the invert are being repaired by forcing grout into the space below the collectors with sufficient pressure to fill all voids.

Floor Slabs.—The floor slabs, while lifted and frequently badly cracked by the frost, have not returned to their original positions to the same degree as the pier and wall bases. Inspection shows that in many instances the ground has settled to its original elevation, leaving the slabs partially unsupported and with a considerable space between the bottom of the slabs and the earth. Badly cracked slabs will be replaced and others may be repaired by forcing in grout under pressure to fill all voids and cracks.

Pier Bases.—The upward and return movements of the pier bases varied considerably in various parts of the work. Levels were taken on each of the four corners of the pier bases at frequent intervals to determine their movement. The figures in Table 2 show the recorded movement of the pier bases in Filter 16, which may be considered as typical.

It will be noted that the greater return movement took place between April 5 and April 30, during the time the frost most rapidly left the ground, and that on June 5 the pier bases had nearly resumed their original elevations.

Spalling of Pier Bases

Possibly the most peculiar result of frost action was the spalling of the pier bases. This spalling, or horizontal cracking of the pier base above the shoulder upon which the floor slabs rest, was typical of a large number of pier bases against which floor slabs had been placed. In some instances the floor slabs were not so tightly wedged against the pier bases and no spalling of the pier bases was caused by the different relative movements of floor slabs and pier bases.

It was found by investigation that the greater number of pier bases were thus spalled between April 5 and 30, which, as shown in Table 2, was the period during which the frost left the ground most rapidly and the greater movement of the pier bases occurred. There was also a similar spalling of some of the wall bases against which the floor slabs had been placed.

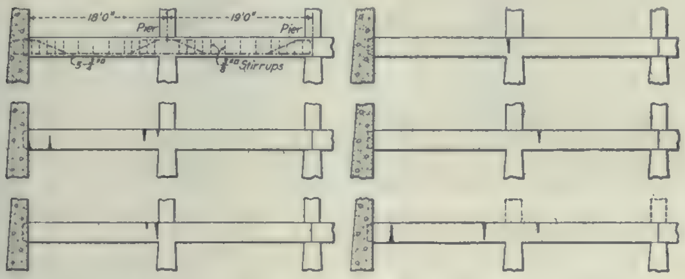
Table 2—Movement of Pier Bases, Filter 16

Date	Average elevation, feet East Row	West Row
Summer, 1912	26.26	26.25
April 5, 1913	26.41	26.37
April 30, 1913	26.31	26.29
June 5, 1913	26.28	26.27

Track Beams.—The track beams opened at the expansion joints, as was to be expected, but the openings were not of equal width, the maximum openings being usually located at the expansion joints nearest the north and south walls of the filter. This was probably due to the fact that the outside walls were not appreciably, if at all, displaced by the frost. Their footings were somewhat protected and the raising of the adjacent piers would make the opening of the expansion joints more pronounced where one end of the beam was rigidly held than in the case of intermediate beams, where all the pier supports were lifted more or less uniformly. The cracks in the beams also occurred in those bays adjacent to the end walls, as indicated in Fig. 10.

In March cracks were seen on the top of the beams near the pier and in the bottom of the beam near the outside wall. Later as the frost went out of the ground and the pier bases settled these cracks closed so as to be almost invisible and other cracks developed in the tops of the beams near the rigid outside wall.

Roof Groins.—As in the case of the track beams, the greatest visible movement of the roof groins was adjacent to the outside walls. The outside wall and barrel arch remained stationary, while the lifting of the adjacent pier bases by the frost raised the upper piers and roof groins above the plane of the barrel arch, and in some cases above the adjacent roof groins. This displacement varied from a very small amount to 1½ in. When the frost left the ground the pier bases settled to their original position and the roof groins also went back to place, with some slight cracking of the arches near the springing line and a slight tipping of the upper piers, all of which became less apparent as the season advanced.



Location of cracks in beams which support runway tracks.

In several cases when the roof groin and adjacent barrel arch were built monolithic cracks developed approximately parallel to and not far distant from the crown of the arch, and these cracks also closed as warm weather approached. The movement of the roof groins is indicated in Fig. 5.

Controversy Over Damaged Work

In the spring of 1913, after it was apparent that the work had been seriously damaged, the contractor advised the city that he had investigated the work with a number of well-known engineers and that they had found "that the disturbance by frost is a minor matter compared with the subsidence of practically the entire outside walls and various parts of the structure where footing loads are appreciable. The subsidence of the walls would indicate that the structural design is inadequate for the bearing power of the soil, which, while having the general appearance of clay, is in reality a finely divided sand, stable enough when dry but unstable when wet, it being in fact a quicksand."

The work was also carefully examined by city and filtration engineers, who found that the soil was adequate for the loads to be imposed, that the design was in accordance with the best modern practice, and that the damage was wholly due to frost action, for which the contractor was responsible, as it was his specified duty to properly protect his work.

The city also appointed, Messrs. J. A. Jamieson, P. W. St. George and F. A. Barbour, who had not in any way been previously connected with the work, and instructed them to report on the adequacy of the soil and design, to determine the cause of the damage, and whether there had been any subsidence of the structures as claimed by the contractor.

The findings of this expert board of engineers are as follows: (1) That the action of frost on the soil under foundations has been the cause, directly or indirectly, of all damage which has occurred.

(2) That settlement has not been a factor in causing damage up to the present time.

(3) That the design has good precedent, is adequate, and, if properly carried out, the resulting structure will be well adapted to the intended purpose.

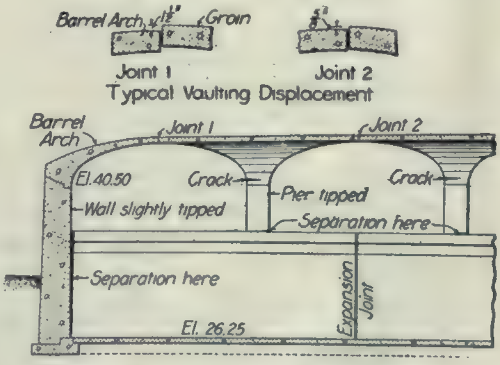
(4) That the soil has and will have under operating conditions sufficient bearing capacity to support the loads to be imposed, and that such minor settlements as will occur, either on soil in natural position or in filled areas, will be, as shown by the tests made, well within the limit to which the structure may be subjected, without detrimental effect.

(5) That the design and method of construction of the arches are in accordance with good practice, and the superstructure is of a type which does not require absolutely equalized foundation loads, this being indicated by the abuse which the superstructure has already withstood without serious final damage.

(6) That the walls, piers and structure which were raised have now practically returned to original position, and, except for some spalling of the masonry and the cracks in the division walls, will be, when the full load is on the roof, in practically as good condition as before the movement.

(7) That in addition to the replacement of the damaged collectors, which has already been undertaken by the contractor, the important work necessary to return the structures to a condition practically equivalent to that which would have obtained if no movement by frost had occurred, includes the replacement or repairs of lifted floors, slabs, and collectors, the repairs of cracks in the division walls, gallery floor and conduit, and the replacement of the retaining wall back of the gallery walls.

(8) That the repairing by forcing cement grout under pressure below structures which have been lifted from a good bearing on the soil should, preferably, not be undertaken until after the full load to be imposed by the filling over the roof is on the supporting members, but that such grouting of space between masonry and the underlying soil should be completed before water is admitted to the filter units for any purpose.



Examples of vaulting displacement.

(9) That since the raising of floors and collectors by frost has introduced abnormal conditions, it is essential that all vacant space be filled completely, or the lifted structures be replaced, and that the success of such filling of voids by grouting as may be attempted can only be proved by a test for leakage of the completed filter unit.

(10) That the fulfilment of such test of leakage

may be accepted as proof that no damage affecting the working capacity of the filters had resulted from the movements occasioned by frost during the past winter.

After the submission of this report the contractor acknowledged the damage to the work had been entirely caused by frost, agreed to repair all damage at his expense and had again resumed the work of construction.

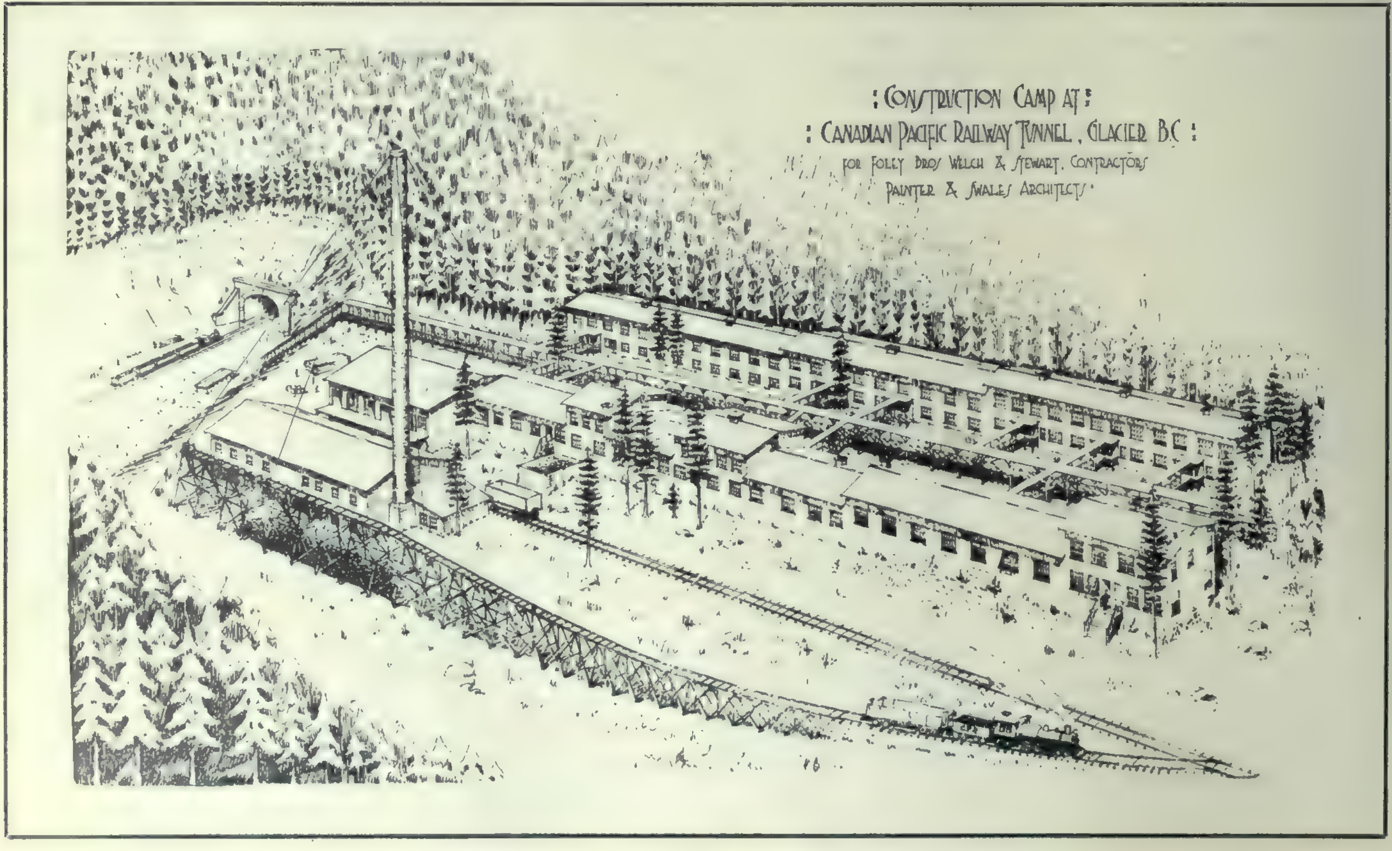
The filtration works form but a part of an extensive programme for the enlargement and improvement of the water supply for the city of Montreal, all of which is under the direction of Mr. George Janin, chief engineer of the city, and Mr. T. W. Lesage, engineer superintendent of waterworks. Hering & Fuller of New York, were the filtration engineers in charge of design. Mr. Norman M. McLeod is the contractor for contracts 2 and 3.

C. P. R. to Tunnel Mount NcDonald

THE Canadian Pacific Railway Company are now making preliminary arrangements for tunnelling Mount McDonald, the largest of the Selkirk range of mountains in the Canadian Rockies. The Selkirk tunnel will measure from east to west five miles through, with an approach of 1,700 feet on the west side and half a mile on the east. It will lower the pressure grade of the road 545 feet, the approaches on either side having a two per cent. grade, while the tunnel itself will have a one per cent. grade sloping west. By means of the scheme the distance will be decreased by nearly four miles, practically doing away with the danger arising from the snow-slides between Canby on the west and Bear Creek on the east.

Some idea of the magnitude of the undertaking may be gathered from the fact that over five hundred men will be given steady employment for nearly four years, and it will take over 20,000 yards of concrete to enclose the tunnel. There are at the present time on the preliminary work about 340 men, these being divided into three groups or camps. Camp 1 is the largest and is the scene of the main operations. another camp is located on the west side, and one at Bear Creek, some six miles east of Camp 1. Camp 1 has at the present time, and will continue to have throughout the construction of the tunnel, three steam shovels; there will be but one other shovel on the east side of the hill. The portal of the tunnel will be 150 feet wide by 40 feet deep, and it will be necessary to go down 50 feet further before reaching tunnel grade. Owing to the fact that somewhere in the neighborhood of 240,000 feet of gravel have yet to be removed before actual work on the tunnel can be commenced, the steam shovels will have plenty of work ahead. It will be necessary before getting at the main tunnel to change the course of the Illesillewaet River, for nearly a mile of its course, as this mountain stream rushes directly over where the big cut for the tunnel will come. The river will be taken some three hundred yards to the left of its present course, and gradually worked back to its original channel.

When the tunnel work is started there will be at Camp 1, seven buildings, including the permanent building of the Canadian Pacific engineers and such as will be located at the west end. The C. P. R. quarters will consist of four buildings, two residences, general offices and mess house. They will be located on


: CONSTRUCTION CAMP AT :
: CANADIAN PACIFIC RAILWAY TUNNEL, GLACIER B.C :
FOR FOLEY BROS WELCH & STEWART. CONTRACTORS
PAINTER & SWALES ARCHITECTS

Vancouver terminal station of the C.P.R. as it will appear upon completion.

the right-hand side of the tunnel, and will be directly over the present course of the Illecillewaet River. The business and living quarters of the contractors will include two immense buildings, a boiler house and an engine house capable of holding four locomotives at one time. The largest of these buildings given over entirely to the housing of the working force, with the exception of the office staff, will be 360 feet long by 50 feet wide, and of two storeys. Steam heat and hot water for washing purposes will be supplied from the boiler house, as well as electric power for lighting both buildings and tunnel. Shower baths for the men and 30 to 36 wash stands are to be located on both the first and second floors. The rooms will be each 12 by 12 feet with large windows swinging out, giving plenty of ventilation to each room.

Messrs. Foley, Welsh, and Stewart, who have charge of the undertaking, state that these heavier buildings are necessary owing to the enormous pressure of the snow in winter. All buildings will be built on stilts and will be raised about 12 feet above the ground, the reason for this being that the snow would block all the light, and in some cases bury the building. Walks are also to be raised from the tunnel directly into all buildings, as it will be practically impossible to keep a cleared track through the heavy snow.

What is probably the highest suspension bridge in the world has just been completed across the Bulkey River at Hagwilgate. The bridge is 600 feet in length and 250 feet above the river, its one span being 450 feet long. The structure is of a special stiffened type and is as rigid as it is possible to make it. The builders were George Cradock & Company, Wakefield, Eng.

That the west is far ahead of the east in the matter of road building and maintenance is the assertion of Mr. E. D. Gray, superintendent of the Kingsway road construction through the South Vancouver municipality. Passing through Toronto on a tour of inspection of the eastern provinces, Mr. Gray said that there was more paving being done in the west than in Ontario, and that the province needed re-vitalizing in road construction.

The C. P. R. Terminals at Vancouver

WORK is now proceeding on the terminal station of the C. P. R. at Vancouver. The eastern wing of the old building was torn down early in the year, and in March the erection of the steel frame for the new six-storied structure was commenced. It is being constructed of red brick, with terra cotta and limestone trimmings.

Work is being rushed day and night on this eastern section and by February 15, 1914, practically a third of the station will be completed. The office staffs and station facilities will then be transferred to the new station, and in the following month the buildings now occupied will be dismantled, and upon the site there will be erected the Granville Street Viaduct, another of the terminal scheme units.

From east to west along the track side, the new station measures 480 feet, practically two blocks. Along the Cordova Street side there are in course of erection ten great Corinthian free-standing columns and ten engaged columns, of limestone.

The big main entrance opens upon Cordova Street, exactly in the centre of the building. From this main street entrance straight through the general waiting room is the main entrance and exit to and from all trains, while from the Granville Street entrance on the west end of the building, by a wide sweep of corridor running the full length of the station, communication is given to the Plaza entrance on the east end. There is also another entrance on Cordova Street and one on the track side for third-class passengers from the wharves and trains, making six entrances in all.

A retaining wall is nearly completed for the purpose of supporting the tracks, which are being raised four feet above the present level. A railing to separate the passenger tracks from the yards and freight lines surmounts this wall, which is 1,200 feet long, and is constructed of reinforced concrete, as will also be several hundred piers for supporting platform shelters and bridges. A covered passenger bridge thirty feet wide leads from the main entrance on the track side, which will be fitted with large swinging doors, to the platforms below, while the stairs, leading down to the platforms, will be six feet wide, and will be biult from both sides of the passenger bridge.

There will be practically two floors below the street level on the track side of the new station. These will be devoted to the baggage and express departments, the lower floor being used mostly for heavy and bonded baggage. The mail room will also be on this floor, as will the telephone exchange, general service rooms, part of the dining car service department, boiler and pump rooms. The boiler room will contain three 150 horse power boilers, which will supply all heat to the station and wharves, using the hot water system of heating. Two large electric transformers will be installed on this floor for lighting the building and running the elevators, of which there will be ten, both freight and passenger.

On the lower mezzanine floor will be located the kitchen, auxiliary store-room, and baggage room. The advertising room of the general passenger agent and the baggage department's unclaimed bundle and valise baggage, will also be on this floor.

The central portion of the main floor is given over to the general waiting room, which will be 60 feet wide by 150 feet long, with massive circular columns at the sides, and the ceiling, which will be of heavy beam and panel effect, is to be 40 feet above the floor. All floors, with the exception of the offices, will be of granolithic, and the entire ground floor basing will be of marble. On the main floor will also be the restaurant and lunch room, railroad and steamship offices, women's waiting room, and smoking room. The ticket offices will consist of eight booths. A large lobby opens off from the general waiting room for first and second class passenger business, separate accommodations being supplied for third-class, third-class having separate waiting room entrance, etc.

The third-class waiting room and ticket office will be on the upper mezzanine floor, between the first and second floors. A stairway leads up to this waiting room from the third class entrance on the main floor. The general freight department, local treasurer's general offices, general passenger agent's, baggage agent's, claims agent's, and purchasing agent's general offices will be located here, as will also the Canadian Australasian Steamship Lines, the assistant passenger agents Trans-Pacific lines, and commissary. The public pay office of the paymaster is to be on the extreme eastern end of this floor, with a stairway leading up from the eastern or Plaza entrance.

Dominion Express, sleeping and dining car department, fuel department, solicitor's, and land department's general offices will be placed on the second floor, as will the ship-husband's offices and general staff.

The attic floor will be given over to railway telegraph, draughting room for the engineering department, and the superintendent's general and private offices. All office floors will be of hardwood.

The Canada Building, Saskatoon

In an article relating to the above building published on page 55 of The Contract Record for November 26 we omitted to record the fact that the architects were Messrs. Jas. Chisholm & Son, 310 Enderton Building, Winnipeg, to whom we were indebted for the particulars of design and construction and also for the illustrations.

Owing to the value of the clay deposits found near Strassburg, Sask., there is the probability of a brick-making plant being established there soon. An analysis was recently made of the clay deposits and it has been pronounced a fairly good brick clay, burning to light buff color, hard and fairly porous.

Steel Guyed Derricks for Building Erection

THE erection of the steel work of the 21-storey Commercial and Continental Bank Building, Chicago, was done by means of steel derricks of the guyed type, which the erectors considered preferable to stiff-leg derricks. The steel work can be erected about as rapidly with one type as with the other, but a guyed derrick can be moved up two floors and be ready for operation again within about two hours, while stiff-leg derricks require a considerably longer time to move and make ready for operation. With the latter also, the boom can work only through an angle of about 270 deg., while with the guyed derrick the boom can swing through the entire circle.

The building is 324 x 166 ft. in plan and about 260 ft. high above the street level. There were six steel guyed derricks. Two of these were of 30 tons capacity, with 90-ft. mast and 80-ft. boom. The other four were of 20 tons capacity, with 110-ft. mast and 100-ft. boom. They could erect the columns and framing for two floors before being raised. Each derrick had the mast supported by eight guys of 1⅛-in. steel cable attached to a cap pivoted on the top of the mast. These were anchored at first to 1⅛-in. looped cables embedded in the concrete foundation piers for the columns, but after the derricks were raised the guys were anchored to the steel columns.

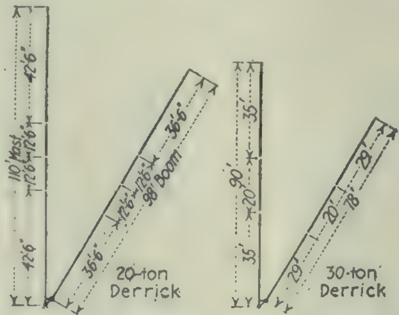


Diagram of 30-ton and 20-ton steel derricks for erecting buildings.

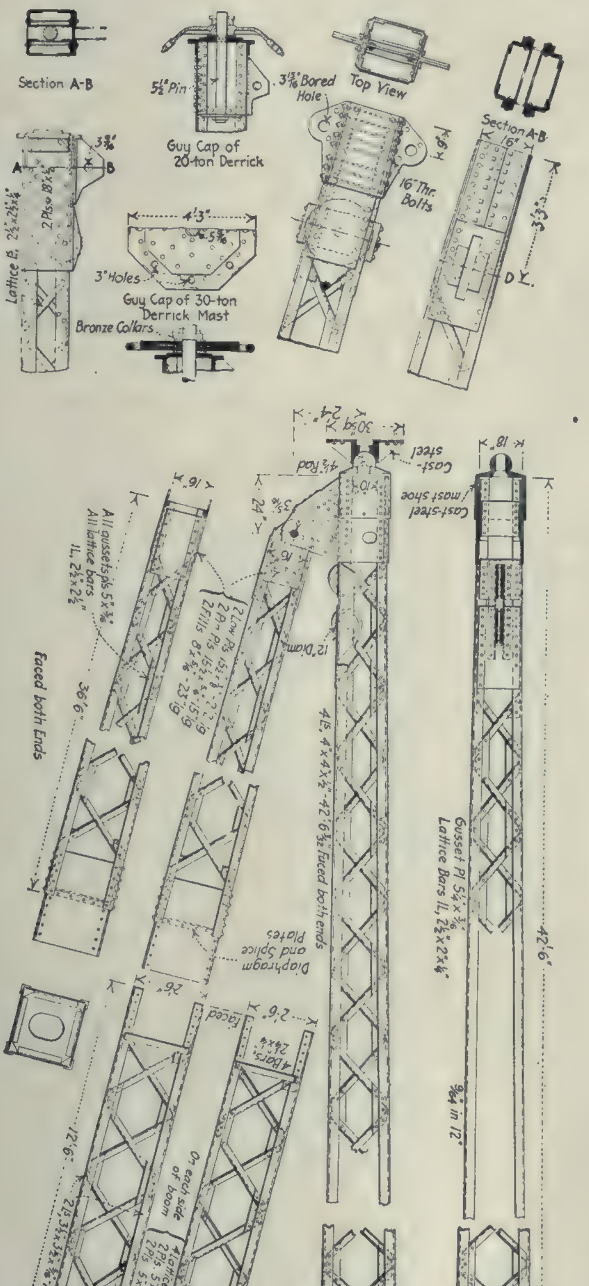
The hoist of each 30-ton derrick was operated by an electric motor of 100 h.p., while each of the lighter derricks had a 50 h.p. motor. The hoists were first located in the basement, but were later moved to the first floor for the benefit of the enginemen. Signals governing the movements were given by bell cords operated by a man at each derrick, the bell being located near the hoist operator. The hoisting and topping lines consisted of ⅝-in. wire cables, with four-part tackle for hoisting and three-part tackle for topping the boom. The derricks were swung by hand power, one or more men bearing against an 8-ft. horizontal pole connected to the lower part of the mast. The number of men depended upon the velocity of the wind, and in calm weather one man could swing the derrick easily.

Twenty-Ton Derricks

The maximum reach is 95 ft. from the mast, with a load of 20 tons at that distance, and the boom can be swung to a vertical position.

The mast and boom are box-lattice girders, built up of four angles, with lattice angles on all four sides. Both mast and boom are built in four sections; the two middle sections of each are 12 ft. 6 in. long and enable the length to be varied as required for different work or buildings. The sections are faced at the ends and are put together with bolts in the splice plates; they are stiffened by diaphragm plates at the splices.

The foot of the 110-ft. mast has cover plates on the four sides, with side plates forming the shoe for the boom, which is fitted to a 3½-inch pin, while above these side plates is a heavy plate with 6 x 3½-in. angles in which are journaled two 12-in. rope sheaves. The foot of the mast is stepped into a cast-steel shoe having a spherical bearing formed on the bottom, this bearing resting on a cast-steel base. The chord angles are 4 x 4 x ½ in., with lattice angles 2½ x 2 x ¼ in. riveted to the chord angles and to gussets or connection plates. The head of the mast is also fitted with plates, and has top plates riveted to flange angles. Through these top plates passes a 5½-in. pin 44 in. long, on which rides a cap 4 ft. in diameter, to which the guy cables are attached. The section of the mast is 18 x 18 in. at the shoe and the top, and 30 x 30 in. in the middle.



Details of derricks.
(Most of the details apply to the 20-ton derrick; some 30-ton details are included.)

The 100-ft. boom has four corner angles 3½ x 3½ x 5/16 in., with lacing angles 2½ x 2 x ¼ in., and is spliced in the same way as the mast. The bottom has cover plates on all sides, and pin plates for the 3½-in. shoe pin. The top also has cover plates. In cross-section the boom is 16 in. square at the bottom and top and 28 in. at the intermediate joints and in the removable portions. The top is fitted with a 20-in. sheave for the hoisting line and with lugs for attaching the topping lift and the swinging lines.

The parts are put together with ¾-in. rivets in 13/16-in. punched holes; while the splices have 13/16-in. holes for ¾-in. bolts. Contact surfaces were given a coat of linseed oil, and the work was given a coat of graphite paint when completed.

Thirty-Ton Derricks

These had 90-ft. mast and 80-ft. boom, with a working reach of 75 ft. and a hoisting capacity of 30 tons at that reach. They are of the same design as the 20-ton derricks, but with only one removable section in the mast and boom.

The mast has chord angles 6 x 6 x ⅝ in., with lattice angles 2½ x 2½ x ¼-in., and gussets of ¼-in. plate 5 in. wide. The spherical bearing on the cast-steel shoe rides in a bronze bushing in the base plate, and the head of the mast has an octagonal cap 51 in. diameter for eight 1⅛-in. guy cables. This rides between bronze collars on the 5½-in. pin. The boom has angles 3½ x 3½ x 7/16 in., with lattice angles and gussets the same as in the mast.

Slate Roofs

By a Slate Man

THE prime requisites of any sort of roofing material seem to lie within the following bounds: Architectural adornment, fireproofing qualities, permanence, non-porosity, and comparative low cost. The prospective builder is fairly bewildered by the multitude of various roofings on the market to-day, but when the matter is reduced to its prime factors, it would seem to me that the logical conclusion for the average builder should be slate.

Slate is the only roofing material to-day, excepting wood shingles, which is offered to the consumer unchanged, except in form from its natural state. It is a close grained, tough elastic stone, with a more or less perfect cleavage. It is produced in black, blue, red, green, purple, and variegated and varies in thickness from 3-16 of an inch to 1½ inches to suit the requirements imposed on it. The standard thickness is 3-16 of an inch, making a roof of this material weigh 650 pounds, as against 400 for shingles and 2,000 for tile.

The best slate, both as to texture, grain and lasting color, comes from old, deep quarries. "Top Slate"—that is, slate taken off close to the surface in new quarries, is apt to fade out and to become soft and unserviceable. Slate rock is taken from the ground in large blocks as all stone is quarried, and while fresh is split into sheets of uniform thickness, trimmed to the desired size and marketed without further preparation. It can readily be seen that in all cases where the householder wishes to use his rain water, a slate roof is the cleanest source of supply for his cistern.

Slate is possessed of a very peculiar natural characteristic—while it splits very easily with the grain and works, while newly quarried, almost as easily as wood, it is practically impervious to moisture, taking up less than one-fourth of one per cent. of its gross weight after a protracted immersion in water and an imperceptible amount on ordinary exposure to a heavy rain. The advantages of this characteristic are evident: there is no chance for the rotting of the supporting timbers by seepage or the disintegration of the material by action of the frost in the winter time. In addition to this, while slate is elastic it is unaffected by either heat or cold, having as a co-efficient of expansion .000005, it is evident that there can be no splitting of the individual slates by the strain at the nail holes caused by excessive heat and cold.

As a protection against fire, slate is without a peer—in fact, a very acceptable fire-place might be constructed of slate slabs. The activities of the various fire commissions of late years have produced figures to show that 60 per cent. of the fires of to-day are caused by exterior ignition.

As to architectural adornment, there is no gainsaying the fact that slate makes a handsome roof, easily adaptable to any style of architecture and by its durability retaining its ornamental qualities through a practically unlimited period. Slate split to greater thicknesses than the standard, is becoming universally competitive to the more expensive tile roofing, and approaches tile closely in both weight and cost. The added thickness, while of architectural value at times, does not in any way increase the actual roofing value of the material.

Gases of all kinds, chemical fumes and smoke have no effect upon slate; and it is a material largely in demand in places where various metal and ready roofing are unsuitable, such as chemical laboratories, large factories, and the construction of railroad buildings. In Europe, where slate has been used for centuries, there are a number of roofs which have been on for two or three hundred years, and one old chapel in England, built in the eighth century, has had the same slate roof on it for a thousand years, and it is still performing all the offices of an ideal roof.

The Protection and Upkeep of Road Equipment

By Daniel J. Hauer

NO matter whether roads are built by contractors or by day labor forces under the direction of engineers, the item of plant and equipment is one of the prominent factors of cost. Inadequate plant means material increase in the cost of construction. Only recently the writer stood watching some road building upon which only a few tools were being used, and most of them were ill-adapted to the work. It was difficult to calculate accurately the exact amount of money that was wasted, due to a lack of road equipment, but it was easily estimated that the cost of construction was increased at least 25 per cent. Likewise, too much plant can make an added cost. Even with the proper plant, handled in an efficient manner, the plant item in road construction is a larger percentage of the total cost of the work than in most other classes of construction.

Naturally the life of any machine is dependent upon the use and care given it. The longer the life, the less the annual depreciation, consequently some of the high plant cost can be eliminated from road construction by proper care and upkeep of the equipment, and by selecting the most improved and economical types.

As far as possible the same machines should be used for many different purposes. This can be done in two ways: By trying out machines designed for one particular kind of work, for other kinds, and by adding attachments to machines that thus adapt them to three or four different things.

Keeping Plant Costs Down

To illustrate, a contractor once found by experimenting that a certain kind of road grader would spread crushed stone for macadam at a very much less cost than it could be done by any other known method, at that time. Then a road roller that can be used as a traction engine, with a scarifier attachment, and likewise for operating a stone crusher, or other machines, can be said to be four tools in one; not that it is possible to use it for more than one purpose at a time but in the present method of building roads a roller is used a small portion only of the time, so it is economical to adapt it to as many uses as possible. In this manner the cost of plant, or rather the investment in plant, can be maintained at the minimum.

In like manner, wagons, which are an important factor in road building, should be of the most improved type, and adapted as far as possible to all kinds of hauling. So too, with concrete mixers. Some contracts demand a hot mixer as well as one for mixing ordinary concrete. Money is saved when one mixer will answer for both purposes.

Another item in the cost of plant is in the character of the plant purchased. Cheap and poorly made plant means money lost to the contractor in several ways. Delays occur through breakdowns and these are always expensive. Cheaply made tools mean continual repairs and a short life, and are added expense to any job. Only well made tools should be used. A guarantee as to the construction of a machine can and does mean little. It does not mean payment for delays caused by breakdowns, nor for poor work being done. The ability of a manufacturer in swearing that his product is a good one is not a help to a contractor or engineer in getting his work done, nor in showing that the machine in question is well built. The greatest safety is in buying from a firm of recognized responsibility, one of integrity, and one that is so well advertised that it must stand behind its products by putting into them only the best of materials and workmanship. This is the best guarantee possible. This means work done at a low cost. A firm with such a reputation means that thousands of dollars have been spent by it and its customers in obtaining these results. The new customer profits from these past expenditures.

Road work is done in comparatively short stretches, usually in a single season, which varies in length from about 100 days, to 180 days, according to the climatic conditions. A contractor's plant is moved on to a job, and is used along the line of the work, part or all of the time during the season. Much of a contractor's plant is made up of transportation machinery, and even other items of plant are only working in one place for a few days at a time, so that to protect plant while at work on such jobs is very difficult, and in many cases any kind of a protection is a detriment, and a great hindrance to the free movement of the men and teams.

Giving Care to Equipment

All machinery should be protected when it is not being used, and some when it is in use. Boilers at work use much more fuel when not protected. Some kind of a house, built in sections, should always be used to protect boilers. Such sheds can have one side left out, and a canvas curtain used when necessary. If the sides and tops are built in sections they can be hooked together with hooks and rods and staples so as to be rigid enough to stand up against the wind and weather.

Machinery that cannot be protected while at work can be covered with canvas coverings over night, during rainy spells and at such times as they are not in use. Every traction engine and roller should be thus protected. Steam drills and such tools can be covered with a canvas jacket. The machinery part of a concrete mixer can be so protected, and also pumps and other equipment. Heavy water-proofed canvas will be found to be excellent for this purpose, and not only keep the machinery clean from dust and mud, but will likewise prolong the life of the equipment. As the canvas becomes worn from use, it must be re-treated with water-proofing liquids to preserve it.

At the end of the season, with the job finished, the question always arises: "What shall be done with the plant?" To move it from its present place to some central storage point, will mean an added expense to get it onto a new job. If the work on the same road is to be continued the next season the entire outfit may have to be moved back. The plant can be moved to the next job at the minimum cost from the site upon which it last worked. Then the question comes as to how repairs shall be made, and the protection to be given the plant from the winter weather.

Situated away from machine shops, proper overhauling cannot be given to all the plant, but it will be possible to replace many of the worn and broken parts with new ones, tighten up all loose keys and nuts, true up all bearings, and do all repairing that can be done in the open. Then all iron and wood work can be painted. This is a protection not only against the weather, prolonging the life of the plant, but is also a business proposition that pays well, as every one is impressed with machinery that looks well, and paint covers a multitude of defects.

In some localities it is possible to obtain an empty warehouse or barn in which the various machines can be stored while they are idle, or through the winter season. This keeps them entirely out of the weather, and also allows repairs to be made under cover, which means not only quicker, but also cheaper work.

For winter storage it is also possible to group a number of machines together, and build over and around them a temporary shelter made of cheap boards and single-ply tar paper, which will last a winter season. By using the tar paper, the boards can be spread 6 in. or more apart, both on the sides and roof. Around this temporary shed a ditch should be dug so as to prevent surface water from getting to the machines.

If it is not possible to protect the machines by any of these methods, then the canvas coverings can be resorted to, with fairly good results. These covers should, as far as possible, be shaped to the machine upon which they are to be used. Good and substantial brass eyelets should be fastened in the well bound edges, so that the coverings can be tied tightly to or under the machines, otherwise the wind will flap them loose, soon beating the covering into shreds, as a flag is worn out by the wind, and thus exposing the machine to the weather. Canvas coverings made to fit any machine will always be found useful in protecting machines over night or when not in use for a few days.

Whenever machines are not stored for the winter in buildings, they should be stripped of their brass and glass parts, otherwise these fixtures will be broken or stolen, which means a serious loss. The parts from each machine should be placed in a separate box, nailed up, and properly labelled, the box being stored away for safe keeping. If the machines are stored in a building, it is not necessary to take off parts, as if any one breaks into the building he must go to the trouble of taking off the brass, while if the parts are stored in boxes, the rascals take box and all, giving them much less trouble, and thus assisting them in making a clean sweep of all the brass fixtures.

Spare Parts and Repairs

When a new machine is purchased, there should always be bought at the same time a number of spare parts, which should be kept on hand to be used as needed. No man can build a machine that will not break down in some vital part sooner or later. A breakdown in a construction job means not only a delay, but a waste of money, for even if men can be laid off and not paid, or can be given other work, yet the job, due to the changes made necessary by the breakdown, will not be worked in the most economical manner. It is true that many contractors do keep some spare parts, but they seldom have enough on hand, or the proper ones, due to the fact that as the parts are used to replace broken ones, new ones are not order from the factory. Then one of two things occurs: the job is shut down or some part of it, or the machine is worked with the broken part until a new one can be ordered and put in place. This means that the machine is racked by the work it does, doing permanent injury to it.

Small tools can be repaired promptly in a blacksmith shop. Attention should be given to these as well as to the larger machines. To prevent such tools being lost, they should not only be branded with a die of the contractor's name or initials, but they should likewise be painted with a set of colors, selected by the contractor, to designate his equipment and advertise his business. These colors can be used on the head of some tools, and in most cases on the handles. Tools so marked can be seen at some distance, and thus prevent them being stolen or lost.

Many of these suggestions seem useless, or more or less self-evident, but any one who has much to do with road construction knows that tools and machines are scattered along the entire line of a piece of new road construction, just where they were last used, and there they stay, neglected, until they are needed again. Then they are found out of order, and to repair them, frequently new parts must be ordered, some days intervening before such parts arrive. The tool or machine depreciates greatly in value through such treatment, and thus contractors are compelled to figure a heavy plant expense item against every job. The cost of caring for this equipment is much less than the depreciation figured against it from neglect.

Such extra costs mean higher prices for road work, and as there are many thousand miles of roads that need improving, every dollar wasted means less mileage built each year. Both engineers and contractors are interested in obtaining good roads, and they should do everything possible to save money in the construction of roads.

Tenders Called on Mechanical Filtration Plant for the City of Toronto

IN the municipal field the most interesting piece of work which has cropped up during the past week is the contract for a complete mechanical filtration plant, boilers, steam turbo-generator plant and all appurtenances at Toronto Island for the City of Toronto. Tenders for this installation must reach the chairman of the Board of Control at the City Hall, Toronto, not later than noon on Tuesday, January 20. Each tender must be accompanied by a marked cheque or cash deposit equal to 2½ per cent. of the contract price.

Capacity of filter plant.—The Filtration plant is to be capable of satisfactorily filtering continuously, 60 million Imperial gallons of water every twenty-four hours, with a maximum of not less than 30 million Imperial gallons during any ten hours when discharging effluent into present clear water reservoir at Elevation 45, Toronto datum. When filtering at the aforesaid rates, the filtered water shall be of the standard of purity required under these specifications.

Bacteria removal, and efficiency.—Each tender must be accompanied by a report of some similar plant, municipal or otherwise, of at least one-half million gallons daily capacity, such report having been made by a reputable disinterested bacteriologist, showing:—

(a) The daily bacteriological analyses of the water before and after filtration for a continuous period of at least thirty days, including the percentage of B. Coli organisms removed, as well as the percentage of the total number of bacteria.

(b) The removal of suspended matter, and the nature of the effluent.

The contractor will be required to guarantee that the mechanical filtration plant, which he proposes to furnish, will remove 90 per cent. of all organisms where there are 50 to 500 bacteria per cubic centimetre in the unfiltered water; will remove 95 per cent. of all organisms where there are 500 to 2,000 bacteria per cubic centimetre in the unfiltered water; and 98 per cent. of all organisms where there are 2,000 or more bacteria per cubic centimetre in the unfiltered water.

The contractor must also guarantee removal of 98 per cent. of the B. Coli as determined by the standard methods for the examination of water of the American Public Health Association.

All turbidity must be removed, leaving a bright, colorless water, free from taste. Such results must be guaranteed by the use of not more than one grain of alum per Imperial gallon of water, under average conditions. Where such is required, a sedimentation period of not less than three hours must be provided for after the addition of alum.

Location and examination of site.—The location of the filtration plant will be adjoining the present slow sand filtration plant, on Toronto Island, and all bidders are required to examine the site of the work and adjacent premises, and the various means of approach to the site, and to make all necessary investigation in order to inform themselves thoroughly as to the character and magnitude of the work involved in the contract, also as to the facilities for delivering and handling material and plant at the site, and the conditions and the difficulties that will be encountered in the performance of the work.

Extent of the work.—The work includes the following:—(a) All the necessary foundations required for the entire work including substructures and superstructures for all buildings, coagulating basins, mixing chambers, filters and appurtenances, all pumping and other machinery, all electrical and steam apparatus, including boilers, chimney, etc. (b) The necessary coagulating basins, giving a period of sedimentation of at least three hours, these basins to be constructed entirely of reinforced concrete divided by baffles into the requisite number of bays, and surrounded by a sufficient quantity of earth to render them absolutely frost proof. (c) The necessary mixing tanks. (b) Storage room capable of storing at least six months supply of chemicals. (e) It is the intention to utilize the present clear water reservoir which has an area of 2.2 acres with a depth of 12 ft., but it is probable that some bidders may require a clear water basin. If so, cost of same must be included in tender. (f) The necessary number of mechanical filter units of four million Imperial gallons each, or approved equivalent. These units to be complete with all appurtenances. Filters will be grouped on both sides of the piping gallery, which will be utilized as an operating platform. Filter tanks to be of steel or reinforced concrete. (g) The low lift pumping machinery shall comprise three centrifugal pumping units, each of not less than 36,000,000 Imperial gallons capacity per 24 hours. Units to be capable of pumping from an elevation of 30 (Toronto datum) to whatever height is necessary for delivering the water to the filters. (h) Wash water pumps connected to the tank. (i) Air blowers. (j) All piping and connections from shore end of existing intakes to pumps, including hydraulically-operated valves, together with well and surge overflow. (k) Turbo-generator sett, including exciter and all connections. (l) Switchboard, etc. (m) Boilers, steam piping, flue connections, etc. (n) Chimney, foundation of same, and lightning conductor, etc. (o) Coal storage building capable of storing not less than 1,500 tons of coal.

LETTERS

A Contractor's Viewpoint

Toronto, November 26th, 1913.

Editor Contract Record:

We have read your articles, "The Gratuitous Bid" and "Competitive Tendering," in your issue of November 12 with much interest and heartily endorse the views expressed in each. At the same time we feel that one or two more points might have been made advantageously.

Both articles, as we understand them, presuppose that the contractor has been supplied with a bill of quantities (presumably correct) covering the branch of work for which he is to tender. We will suppose also that he receives a set of plans, showing, in a general way, the style, etc., of the building to be erected or the work to be performed. While an estimate based on such information requires a greater or lesser amount of time, effort and practical knowledge—not to say, in many cases, considerable expense in search of detailed information which is practically useless except to the successful bidder—what shall be said of the conditions which require the contractor to take a set of plans and specifications, which have taken weeks, or often months to prepare, and grasp, in a few hours, the general idea from prints and descriptions too often of a very vague nature, and compile his own bill of quantities, in addition to all the trouble entailed in pricing the same? This, in our experience, is by far the greater task. If a mistake be found after the contract is let, there is no avenue of safety along the line of extras, as is the case where the bill of quantities has formed the basis of contract. While the time required in estimating quantities is often considerable, extending over several days, it must be borne in mind that, except in the larger concerns where an Estimating Department is a separate part of the organization, the contractor is obliged to sandwich this gratuitous work in between his other business duties, and in many cases positively neglect them, to his further loss. And not only so, but such piecemeal estimating is a frequent cause of mistakes by which the proprietor benefits.

Then, too, the necessity of preparing a tender at short notice (on the condition that if late it will not be considered) only to find—after the plans have been returned and one's bid submitted, perhaps—that the time has been extended for several days, is, to say the least, very aggravating and, in our experience, not always productive of the most economical results to the proprietor.

In all fairness the contractor should be given a set of plans and specifications to keep until the latest possible date, so that all available thought and time may be given to the work while the only avenue of reference is open before him. We would go still further and say that he should be allowed to keep them until the contract is awarded, as it is often the case that plans are altered, or annotated, during the reception of bids, which renders someone's position, to say the least, precarious.

Yours very truly,
H. N. Dancy & Son, Limited.

Competition in Public Contracts

Boston, Nov. 25th, 1913.

Editor Contract Record:

Referring to the editorials in your issue of November 12 under the titles, "Gratuitous Bids" and "Competitive Tendering," we enclose herewith as a matter of interest copy of paper by Mr. Geo. C. Warren under subject "Competition in Public Contracts."

Very truly Yours,
Warren Brothers Company.

EXTRACTS FROM MR. WARREN'S PAPER

"I believe more can be accomplished by placing even greater responsibilities upon public officials, holding them to a strict accountability for their proper exercise, and then providing adequate means for the detection, exposure and correction of any abuse of the powers which may be entrusted to them. It is, in my judgment, a serious mistake to attempt to make men honest by the passage of laws which on their face assume that all men are dishonest. I believe our laws at present are generally based too little on the fixing of individual responsibility and too much on suspicion of general dishonesty of public officials and an effort to force honesty by legal safeguards—a result which I believe can never be accomplished. If more responsibility, confidence and discretion were placed in our public officers, we would find more high class citizens ready and glad to take public office for the honor it carries and the good they can accomplish.

"Every contract is made up of three items—labor, materials and profit. Assuming the cost price of the first two to be approximately the same, there is only room for competition as to the profit to be made.

"The above suggestions naturally raise the question as to whether we have not reached the point where the principle of doing business on the competitive basis is not out of date and where we must look for the correction of abuses to publicity and the general elevation of the moral tone of business, and a higher order of integrity and efficiency in all public servants, coupled with the elimination of the political 'Boss' in its generally accepted, and rather uncomplimentary, sense and recognize that every organization, political or otherwise, must have a leader who may in the case of public service be honest and work to the public good.

"Let us proceed on the theory that all men are born honest and that most men would prefer to remain so and generally will remain so if encouraged to give the best that is in them and if given a remuneration for service which is consistent with their effort and responsibility and which will enable them and their families to live as people in their stations should live and, in addition, save a reasonable amount. This applies with equal force to contractors as well as public officials. How many engineers and other executive officials in our small or even large communities who are expected to devote their entire time to the work, are paid salaries which are so small as to be entirely inconsistent with the positions they hold, the results they are expected to accomplish and the expenses of living in a way such men should live to be a credit to themselves and the public? How frequently does it occur that the public is pleased when there is evidence that a contractor has taken a contract at a low price—one which cannot yield a profit and will surely yield a loss if honestly administered?

"Is not the whole system of competitive bidding and award of contracts to the lowest bidder (regardless of responsibility, including previous experience in the line of work undertaken, evidence of honesty of purpose or otherwise and of the profit or loss on the work) based on the wrong principle of grinding the contractor down to a basis on which he cannot live and carry out his contract honestly ruinously excessive competition in other words?

"Do not such conditions as to both officials and contractors breed and encourage, if not almost force dishonesty on the part of both?

"In any reform we undertake let us assume that officials (engineers or otherwise) as well as contractors are honest and place in the officials the responsibility and the confidence which that assumption would carry with it. Then pay the officials fair salaries and you will generally get good service, although at times in public as well as private life there will be an occasional wrong-doer.

"Let the contractors understand that their bids will be as readily rejected if too low as if too high and that experience, responsibility and general reliability in the past will weigh as heavily in determining the award as the amount of the bid in dollars and cents. Would any of us if we were to build an expensive house hire an architect who would work at the cheapest rate and then advertise for bids and say to the contractors—"The man who offers to do the work for the least money and gives a surety company bond will get the work?" What kind of a house would ge get on that plan? In such cases do we not consider price as only one of the many important factors for consideration in awarding the contract? Who has ever heard of satisfactory result through surety bond after the contractor has failed because the contract price is too low?

"The specifications should be clear and distinct and as brief as practicable. They should avoid all trick clauses and at the end of every paragraph should state under what item of the contract and bid the work embraced in that paragraph is to be paid for. 'Discretion of the engineer' should be eliminated and yet some things must be left to the 'best judgment' which is another way of stating 'discretion' of the engineer, but its exercise should always be fair. Too often the engineer considers his duty is to get all he can for his employer, however unfair to the contractor. In such cases it is only to be expected that the contractor will do his best to 'recoup' and the engineer who is so narrow as to take advantage of the contractor is generally sufficiently dense so that the contractor can find a way to 'put one over' on him.

The Unbalanced Bid

"This is the most potent means of exercising dishonesty. It is only made possible through unbalanced quantities of the engineer's estimate, whether the error in estimate is due to dishonest design, to incompetence, or to undue haste or lack of care in making the estimate. Even contractors with an honest purpose are pretty apt to avail themselves of an opportunity to 'unbalance' their bids if the estimate offers the opportunity, knowing that even if they do not 'unbalance' some one or more of their competitors are pretty certain to see the opportunity and avail themselves of it.

"Let contracts provide that if any item of a contract exceeds 20 per cent. of the estimated quantity the excess shall be done at cost of labor and materials plus fifteen per cent. regardless of the contract price for such item, and let the engineer understand that when any item exceeds the estimated quantity by more than 20 per cent. the fact will be regarded as prima facie evidence of incompetence and be followed by rigid investigation and probable discharge, if the investigation proves the error to be due to either incompetence or dishonesty. Then, at least intentional unbalancing of bids and estimates will be promptly stopped and engineers will exercise more care than they often do at present.

"In some cases the quantities cannot be accurately estimated in advance and in such cases the 'cost plus fifteen per cent.' basis of payment for the excess will check dishonesty. Never put in a contract a clause that if certain unanticipated contingencies arise the work 'will be done by the contractor without extra allowance.' Nothing could be more unfair, for instance, than a clause in specifications for a pavement that if 'soft or springy places develop in the subgrade they shall be dug out by the contractor and refilled with sound material (earth, stone, cinders or concrete) as the engineer may direct without extra charge.' Yet this is a common clause in pavement specifications, and equally unreasonable and similar clauses are found in specifications for other classes of work.

"If the contractor, in the construction, is faced with such a condition, he is sure to know he has been 'robbed,' and if he doesn't retaliate by 'stealing' some cement out of the concrete or otherwise it will be because he doesn't know how—not because he is dishonest, for he will be pretty certain to figure out in his own mind that, under the circumstances, such retaliation is honest. In every construction unforeseen contingencies are liable to occur. It is absolutely dishonest to throw the extra expense on the contractor and specifications should always provide for such cases, that such unanticipated or unforeseen work shall be paid for at 'cost of labor and material plus fifteen per cent.' or, as is the custom of the city of Toronto and some other cities, include in the specifications and contracts a long list of unit prices generally accepted as fair and reasonable which will be the measure of pay in case such unanticipated work is required. The cost and percentage basis is the more fair for both parties because a schedule of unit prices cannot be made which will be fair to all cases regardless of quantity or other conditions of the unforeseen work.

Relation of Estimate to Contract

"It has been suggested that no bid should be accepted if the price of any item exceeds the engineer's estimate by more than 10 per cent. Such a system would too much encourage engineers to make unfairly low estimated prices or to force the using of an incompetently prepared estimate as the final basis of contract. I have known cases where such a system was in vogue and on which, from my knowledge of costs, I believe the engineers systematically estimated about 5 per cent. below actual cost in order to entice the unwary contractor and get low bids. In such cases you may be sure the contractor will 'work his wits' to get even and I believe, generally speaking, will succeed in accomplishing the end at the expense of more or less poor work and still consider himself honest. So long as contracts are based on such lack of confidence and fairness between the contractor and engineer, so long will there be dishonesty in carrying out of contracts. Employ only competent engineers; pay them fair salaries; treat the contractors fairly, and I believe 90 per cent. of the rascality in public work will be removed."

Contract Awards on Satisfactory Basis

Winnipeg, November 26, 1913.

Editor Contract Record:

We have given considerable thought to your discussion of "The Gratuitous Bid," but we fail to see any means whereby a system of reimbursing the contractor for making up his tender could be arranged. The contractor is in practically the same position as a firm employing salesmen; he must add cost of maintaining his sales force to his price. In our office we endeavor to estimate the percentage it costs us to secure the year's business, and that is an item to be added in figuring future work. We cannot see how it can be worked otherwise, as the men who are making estimates and securing information in regard to tenders have to be paid out of one's profits and it is only right that their expenses should become one of the items which make up the estimate.

In one of two cities that we know the local Builders' Exchange has endeavored to effect an arrangement whereby a certain amount is added to each tender to be divided among the unsuccessful bidders by the successful contractor. It is said that this keeps certain small firms in business. They live on putting in tenders, frequently merely cubing the work and making little effort to arrive at a close bid. They make sure that they are high enough and get paid for their tender.

To our mind there is practically nothing wrong with the present system. It simply means that the contractor must add a certain percentage to his estimate in making up his figures.

As to deposits with tenders, this is a system devised for the express purpose of eliminating unreliable contractors, and, as you are aware, we have lots of them.

We do not approve of the system of putting up marked cheques and leaving them as a guarantee for the faithful fulfilment of the contract. A marked cheque or a bid bond attached to the tender is all right so long as the owner will accept security bonds for the performance of the work. This is no expense to the contractor, as he knows what his guarantee bond will cost—the figure being based upon the amount of his contract—and a proportionate amount should be added to his estimate. Without a system of this kind contracts will be obtained by irresponsible contractors who have not adequate facilities for carrying out work, and this only brings misfortune on the material men and sub-contractors concerned. We believe that architects and owners should require a marked cheque of five per cent. of the tender to accompany the bid. The purpose of such a cheque being only an indication of the stability of the tenderer, it should be returned as soon as it is received and the successful bidder should be asked to put up a Security Company's bond. These conditions should be set forth in the specifications so that the contractor could make the necessary preparation and add the cost to his estimate.

A contractor is entitled to withdraw his tender any time until it has been accepted in writing by the owner; further, should the owner fail to let the work within a reasonable length of time the contractor should withdraw his tender You might look into this point, but we are informed that this is the law in Manitoba and we know of cases where action has been taken accordingly. There is no reason why the contractor should suffer loss from the change of conditions during the time the owner holds his bid, as he can anticipate these conditions a few days and withdrew his bid.

As to the employer putting up a sum equal to the amount of the contract, this is only a case of the contractor satisfying himself that the owner is in a financial condition to carry out his undertaking; if he is not, the contractor has the alternative. Had we figured upon all the work we have been asked to figure on and taken all the contracts we have been offered we should have been "broken" long ago. But there are plenty of facilities for ascertaining the financial standing of owners and these we generally use. If there is any doubt in our mind as to the ability of the owner to carry out his part of the undertaking we generally let the contract go to somebody else. Occasionally, as in a number of cases this year, conditions change radically, but, as a rule, where the owner has made proper arrangements to pay for his building he can finance the work.

Summing up, we feel that the whole question of gratuitous bidding and deposits with tenders can be solved by contractors themselves. We are of the opinion that the Contract Record can do good work along the line of educating contractors to make ample provision for the expense of their estimating department or the equivalent thereof. The system of marked cheques or bid bonds with tenders eliminates a great deal of irresponsible bidding and is in the best interests of the contracting community. Finally, the anxiety to secure work manifested by some contractors might well be replaced by care in satisfying themselves as to the ability of the owner to fulfil his responsibilities.

Yours very truly,
Carter-Halls-Aldinger Company, Limited.

Foundation Work at Regina

Montreal, Nov. 27, 1913.

Editor Contract Record:

We note in your issue of October 29th, 1913, a short article, entitled, "Foundation Difficulties at Regina." This article stated that considerable difficulty was experienced and that as piles were found to be useless a reinforced concrete mattress, five feet thick, was placed over the entire area, thus adding materially to the cost. None of these statements is in accordance with the facts. No serious difficulties have been encountered and the foundations are at the present time in place, concrete piles of the Raymond type having been used with very satisfactory results. During the driving of the piles the earth in the trenches kicked up to some extent, but otherwise nothing unusual took place.

We might say that the method which you mention of using a continuous reinforced mattress for the entire site was considered, but was rejected as not being feasible and as being prohibitive as regards cost.

Yours truly,
Ross & Macdonald.

Report on Refuse Disposal at Montreal

By Mr. R. S. Lea

TWO projects for the disposal of refuse in Montreal are suggested in a long report submitted by Mr. R. S. Lea. Although the installation of a combined destructor and reduction plant is considered to be the ultimate choice, recommendation is made to the controllers that the final selection of the scheme be deferred another six months or a year to permit the collection of data with respect to the quantity and character of the various classes of refuse collected in Montreal.

The two schemes suggested by Mr. R. S. Lea, who has inspected the different plants in operation in large European and American cities, are the following:

The installation of a destructor plant of the British type for the incineration of the total refuse, garbage, ashes and rubbish. The gross revenue from this proposition would be represented chiefly by the value of the net power available from the operation of the plant.

The installation of a combined destructor and reduction plant for the incineration of ashes and rubbish in the destruction plant and the treatment of garbage in the reduction plant for the recovery of grease and fertilizer. The steam for the operation of the reduction plant would be obtained from the destruction plant. The gross revenue from this proposition would be represented by the proceeds from the sale of grease and fertilizer and by the value of such surplus power from the destruction plant as might be available over and above what is required for the operation of the reduction plant. Additional revenue might materialize in the case of both propositions from the sale of clinker or its utilization by the city and, moreover, if it should appear profitable the so-called refuse utilization plant could be established in connection with either proposition for the recovery of the marketable portions of the rubbish.

A Distinguished British Engineer

SIR Alexander Binnie, the eminent English expert, has been identified with many important engineering undertakings in his time, but none of these has won for him in Canada the fame that attaches to the solution of the Ottawa water supply problem. Sir Alexander has submitted to the Ottawa City Council a report, which they have adopted, for bringing water from Thirty-One Mile Lake at a cost of $7,985,000. The seal of approval has been given to the report by Dr. A. C. Houston, chemist and water examiner of the Metropolitan Water Board of London. Details were given in our issue of October 29.

The adoption of Sir Alexander's report followed the rejection by popular vote of two successive plans recommended by Sir Allan Hazen of New York City.

Much criticism of the Ottawa council has been forthcoming in connection with their vacillation in engineering matters—vacillation which has cost the city hundreds of lives and many thousands of dollars. In an editorial on the situation at Ottawa published last August, a New York contemporary described half the Ottawa electorate as "self-appointed experts" and scored the city roundly for a muddled charter and poor municipal government—government responsible for typhoid epidemics, law-suits and other tragic occurrences.

Whatever professional jealousies may have arisen on either side of the border among the many experts of whom few were called and none was chosen, the man whose recommendations establish peace among the warring factions at Ottawa is entitled to more than passing consideration. We have pleasure therefore in giving the following biographical facts concerning Sir Alexander Binnie:

Sir Alexander Richardson Binnie was born in London in 1839. Educated privately, he was articled in 1858 to the late J. W. Flanagan, M.Inst.C.E., and on his death to the late J. F. la Trobe Bateman, F.R.S., Past President of the Institution of Civil Engineers, who carried out the great works of water supply for Manchester, Glasgow and other towns.

On the completion of his pupilage he remained with Mr. Bateman as an assistant, resigning his position in 1862 in order to take up an appointment in connection with the construction of new railways in Mid Wales. There he remained until 1865, returning to London to enter into private practice. In 1867 after examination, he secured a position as Executive Engineer in the Public Works Department of India. Delegated to the Central Provinces he was posted to Nagpur and during the time he remained there he carried out the works for the supply of that city with water, from Ambajhari, about four miles distant. It is interesting to note that after forty years these works still form the supply to that city.

During his period of service in conjunction with the late Major Lucey Smith he made discoveries of coal in the Chanda District which led to the construction of a railway and the opening up of the coalfield, for which he received the commendation of the Government of India.

In March, 1875, he was appointed Chief Engineer for waterworks purposes to the city of Bradford. During the fifteen years he held that position he repaired and reconstructed the Stubden, Leeshaw and Leeming Reservoirs and designed and constructed the reservoirs at Barden and Thornton Moor with their necessary conduits.

One of the last acts he performed before leaving Bradford was the preparation of the plans and sections for the Nidd Valley water scheme, which, after long and protracted controversy, was adopted by the Corporation and carried through Parliament in the Session of 1890. The works then authorized have since, with modifications, been carried out by his successor, Mr. James Watson.

In March, 1890, Sir Alexander took leave of Bradford having been appointed Chief Engineer to the London County Council. This position he occupied for nearly twelve years, during which time there were constructed under his directions among other things, the Blackwall and Greenwich tunnels under the River Thames, and the Barking Road Bridge over the River Lea, and he commenced the new Vauxhall Bridge which was completed by his successor.

In conjunction with the late Sir Benjamin Baker, K.C.B., K.C.M.G., he reported on the re-construction of and additions to the main drainage of London involving an estimated expenditure of about £2,500,000. These works he commenced and they have since been completed by his successor, Sir Maurice FitzMaurice, C.M.G.

He also projected and carried through Parliament the necessary works for the widening of the Strand and the important thoroughfares of Aldwych and Kingsway, connecting it with Holborn.

Sir Alexander further assisted the London County Council in Parliament in the many controversies which arose in connection with the various proposals to carry the tramways from South London over Westminster Bridge and along the Victoria Embankment, works which have since been carried out with great benefit to the public. He also conducted the engineering case of the London County Council before the Royal Commissions on Metropolitan Water Supply in 1891-3 and 1897-1900, and in the Session of 1900 he deposited plans on behalf of that Council in connection with the supply of London from the mountains of Wales.

On the completion of his engagement with the London County Council, Sir Alexander commenced private practice in Westminster, in which he was joined by his eldest son and later by Mr. Deacon. When the question of the transfer of the Metropolitan Water Companies to the Water Board occurred, he acted as principal engineering adviser to the Board and subsequently as Arbitrator in connection with the subdivision of some of the areas of the Companies.

In 1906 he reported to the Government of Ireland on the Bann and Lough Neagh Drainage and from 1905 to 1907 he acted as Chairman of the Vice-Regal Commission on the Arterial Drainage of Ireland.

At the present time he is senior partner in the firm of Sir Alex. Binnie, Son & Deacon, civil engineers of Westminster, and is engaged in the carrying out of several large water schemes, including the new Birkenhead supply from the River Alwen in Denbighshire, and the supply of Merthyr Tydvil from the River Taf Fechan. He visited St. Petersburg in 1910 and 1911 at the request of the Russian Government to report on the water supply and drainage of that city.

On the completion of the Blackwall Tunnel he received the honour of Knighthood at the hand of the late Queen Victoria and in 1905 his professional brethren conferred upon him the highest honour in their power by electing him President of the Institution of Civil Engineers.

Canadian Municipal Engineers

H. A. McLean, Town Engineer, Sarnia, Ont.

Mr. H. A. McLean, Town Engineer of Sarnia, Ont., was born in Middlesex county and received his high school education at Glencoe and the Strathroy Collegiate Institute. After a six years' course he graduated from the State University of Michigan at Ann Arbor with the degree of Bachelor of Science in mechanical and electrical engineering. For a year he was assistant superintendent for the F. Bissell Company, of Toledo, a local electrical supply and manufacturing company; then he became chief engineer for the South-Western Traction Company, operating from London to Port Stanley, and had charge of the construction of the first section of the line. He was with the traction company for two years, after which he served for a similar period in the capacity of Master Mechanic for M. A. Piggot & Company, building the Goderich branch of the C. P. R.

Mr. H. A. McLean, Town Engineer, Sarnia.

Mr. McLean has been Town Engineer of Sarnia for the last seven years and for two years has been consulting engineer on the new water-works which the town of Sarnia is now constructing at Point Edward at a cost of $250,000. The work at Point Edward is being carried out in accordance with Mr. McLean's recommendations, which were approved by the provincial authorities.

In addition to his work for the town of Sarnia, Mr. McLean is also consulting engineer for the town of Forest, where a new electric light plant is now being built and where it is proposed to install water-works—in both cases according to plans and specifications prepared by Mr. McLean. Quite recently Mr. McLean reported on water-works for the village of Point Edward whose electors will vote on a by-law in the new year.

Mr. H. E. Matthews has been elected president of the Manitoba Association of Architects for the ensuing year.

Mr. John Flanigan, a retired contractor and a resident of Brockville for nearly sixty years, died last week at the age of 77.

Mr. John William Stewart, partner in a firm of Vancouver railroad contractors, has bought a large area of the Duke of Sutherland's land.

Sir William Henry Preece, past president of the Institution of Civil Engineers and a famous British electrical engineer, died in London, Eng., recently in his eightieth year. He was an authority on telegraphy and telephony and the author of text-books on these subjects. In 1870 he was appointed division engineer of the Post Office Department. Seven years later he was advanced to the office of Electrician and in 1892 to that of Engineer-in-Chief. He was also a past-president of the Institute of Electrical Engineers and a member of the Institute of Mechanical Engineers.

Mr. Peter A. Peterson, formerly chief engineer of the C. P. R., died in Montreal on November 21st. He had a very wide experience in railway engineering, and in the early days of the C. P. R. did much in replacing the temporary bridge structures with steel bridges in the West. Before joining the C. P. R. he was connected with the I. C. R. Mr. Peterson retired ten years ago, but retained the position of consulting engineer to the C. P. R. He was responsible for designing the bridge across the St. Lawrence of which the late Sir George Reid was contractor. In 1894 he was appointed president of the Canadian Society of Civil Engineers. Mr. Peterson was born at Niagara Falls in 1839 and was educated at Toronto University, where he graduated with the degree of B.Sc.

Coming Events

The annual convention of the Canadian Clay Products Association will be held at the King Edward Hotel, Toronto, January 27-30 next. This was decided at a meeting of the executive of the Association held recently at the King Edward Hotel. The President of the Association is Mr. Chas. H. Millar, of Price's, Limited, Toronto, and the Secretary is Mr. John Walsh, of Mr. Jos. Russell's brick works, Toronto.

The tenth annual convention of the Sand-Lime Brick Association will be held at Harrisburg, Pa., December 9-10. The convention will be called to order on the morning of Tuesday, Dec. 9, by the President, Mr. S. O. Goho. On the opening day the delegates will visit the plant of the Hummelstown Brownstone Company at Waltonville, Pa. A number of interesting papers are scheduled for presentation on Wednesday, December 10. Among these may be mentioned: "Sand-Lime Brick in Canada," by Mr. G. Silvester, of Calgary, Alta.; "Essentials for Success in the Manufacture of Sand-Lime Brick," by Mr. W. H. Crume, of Dayton, Ohio, and "An Analytical Study of Brick Specifications," by Mr. W. E. Emley, U. S. Bureau of Standards, Pittsburgh, Pa.

The Fourth Annual Good Roads Congress and Exhibition will be held in Philadelphia, Pa., December 9-12, in accordance with announcements made in previous issues of The Contract Record. The meeting is the occasion of the Tenth Annual Convention of the American Road Builders' Association of which Mr. E. L. Powers, 150 Nassau Street, New York, is the secretary.

A junior architectural club has been formed at McGill University by the students of the Department of Architecture. At its meetings addresses will be given by men prominent in the profession. Membership is to be extended beyond the university, to all junior draughtsmen in the city. The officers elected for the year are: President, W. C. Hyde; vice-president, J. L. Robertson; secretary, H. G. Henson; treasurer, R. W. Robertson; advisory board, Prof. Ludlow, Prof. Groquair, C. Booth, M. Todd, and W. A. I. Anglin.

Mainly Constructional

The News in Brief—From Coast to Coast

Plans are now being prepared for four large buildings which will be added next year to those already comprising the University of Saskatchewan and upon which over $2,000,000 has already been expended.

The Montreal Council have decided to seek powers from the Quebec Legislature to compulsorily set aside each year for the laying of permanent pavings a sum of not less than $1,500,000, to be taken out of the loan fund.

The Guild of Civic Art has notified the Mayor of Toronto that it will oppose any further violation of the city's building by-laws. It fears that Council will permit the erection of a twenty-storey hotel facing the City Hall on the corner of Queen and Bay streets.

That the Provincial Government of Victoria, B.C., has expended four million dollars on road extension and highway improvement in the past season is the announcement made by the Minister of Public Works, Hon. T. W. Taylor. There is also on hand a sum of 10 per cent. of the amount for maintenance.

Judgment was given at Osgoode Hall in favor of Mr. Alfred Rogers in an action against the National Portland Cement Company, of Durham, for $54,000 damages for breach of contract. It appeared that the contract between the parties had been broken by the defendant company because it desired to reduce its selling expenses.

The Thames Quarry Company, Limited, St. Marys, Ont., are installing a plant for the manufacture of cement stone brick. The machinery is being supplied by Wettlaufer Bros., Toronto. The press has a capacity of 15,000 a day. The company intend putting in a second press in the near future. They will be manufacturing in four or five weeks.

The new wing of the Infants' Home and Infirmary, 21 St. Mary Street, Toronto, has been opened. The new addition, which stands southeast of the old building, cost $60,000. Messrs. Wickson & Gregg designed the structure, which is thoroughly fireproof, having cement floors, fireproof doors and staircases. A feature is the roof nursery covered by sheet metal.

In view of the fact that there is little likelihood of an early sale of school debentures, the Board of School Trustees of Victoria, B.C., at its last monthly meeting determined that no further contracts for the construction of new schools be let. This action of the board means that the work on the new Quadra Street, Hollywood and Beacon Hill schools will not be proceeded with.

The estimated amount to be raised by the County of Essex, Ont., for the good roads scheme is $787,500. Of this amount Windsor is expected to contribute $60,000 and Wakefield $30,000, which will leave $697,500 to be provided by the county. In order to raise this amount the sum of $45,737 will have to be raised each year for thirty years, or $55,969 a year covering a term of twenty years.

Estimates totalling fifty million dollars have been prepared by the Public Works Department at Ottawa. This is about two million in excess of last year. No new works are provided for, but those in progress already are so extensive and require such a large outlay that it is difficult to reduce the amount. Harbor improvements, dredging and the construction of dry docks provide the principal items.

The action of the waves in a recent storm exposed a stratum of earth containing stumps, trees and branches filling in the canal north of Port Huron which connects Lake Huron with Black River and which was just completed a little over a year ago. Geologists claim that the exposing of this strata of earth proves that a forest once flourished hundreds of years ago where now it is but the lake shore.

Messrs. John McKay & Company, the firm of auditors retained by Mayor Hocken, of Toronto, to report on the advisability of purchasing the street railway and the Toronto Electric Light Company, have presented their report, which is practically an endorsement of the proposition, provided the contracts for power can be renewed. The price asked for the two franchises and rolling stock is thirty million dollars.

The rear portion of a seven-storey building nearing completion collapsed recently at Cedar Rapids, carrying with it fourteen men who were working on the roof. The concrete in the seventh floor had been poured two weeks previously and the roof of slab over the remaining portion of the building was just put in place. A portion of it gave way and fell to the sixth floor where the concrete had not hardened, and in a few seconds all the floors beneath were lying in a huge pile in the basement.

The Kamloops, B.C., new power station, opened recently, is another of the many important projects carried through by this progressive city. This station will be a part of the Hydro-Electric System, the total cost of which will reach half-a-million dollars and will give Kamloops all the additional power needed for many years. The new power station is a massive reinforced concrete building, 80 ft. x 90 ft., which, with its 175 ft. stack, makes it an imposing landmark. The machinery installed is the latest and best type.

The new office building of the Quebec Central Railway Company on Wellington and Strathcona Square, Sherbrooke, has been completed by the contractors, Messrs. Loomis-Dakin, Limited. One part of the ground floor will be occupied by the Canadian Pacific Railway as a ticket, telegraph and express office, and two of the upper floors will be utilized for the Quebec Central Railway Company's general offices. The new building is of solid brick with steel frame construction. The floors throughout are of reinforced concrete and all the partitions are fireproof. It has a frontage of 81 feet, width of 62 feet and a height of 80 feet.

About two million dollars will be spent by the Government on the ferry service between Cape Tormentine, N.B., and Carleton Point, Prince Edward Island. Mr. J, O'Brien's contract on the New Brunswick side amounts to half a million, the ferry steamer will cost about the same, and Mr. Roger Miller will construct the ferry terminal at Carleton Point at the cost of nearly a million. Mr. Miller will build out some 2,500 feet, the structure to be of concrete, and the work will require two seasons to finish, and as there is no local labor market most of the large force to be employed there next season will have to be secured outside the island.

According to a statement submitted to the Edmonton Commissioners by Building Inspector McIvor, the number of building permits issued during the year commencing November 1, 1912, and ending October 31, 1913, total in value $10,243,567. Comparing this amount with that of the previous year it is found that 1913 has fallen behind its predecessor to the extent of $2,973,645. Notwithstanding the causes of curtailment of building permits this season, Edmonton's record of over $10,000,000 of building indicates the rate of development of that city. During October last the department inspected 772 buildings, 405 plumbing jobs and 212 sewer connections.

A decrease of $299,850 took place during the last fiscal year in the value of permits issued at Hamilton. Altogether there were 1,351 permits granted, totalling a value of $5,083,050, as compared to $5,382,900 the year before, and $4,073,105 in 1911. In his annual statement Inspector Anderson says:—"The value of brick residences erected this year is $309,700 over that of 1912 which shows that the dwellings erected during 1913 were of a better class than those erected the previous year. The same trouble still exists with the cement foundation contractors as last year. Eighteen concrete foundations were pulled down, causing two police court cases, wherein convictions were secured."

Reports from Winnipeg indicate that despite the lateness of the season there is still considerable activity in building circles. Plans have been drawn for a large apartment block and an extensive wholesale warehouse, while the National Construction Company have made application for a permit to erect a power house for the Provincial Government, which, when completed, will supply power to the new law courts, parliament buildings and land titles office. The foundations of the building are practically completed and a good percentage of the concrete footings are in place. The building, which will cost about $160,000, will be constructed of cut stone to conform with the architecture of the law courts. The permits for the year exceed $18,000,000.

The Link-Belt Company has just published a new booklet entitled "Link-Belt Conveyors for Sand, Stone, Gravel, etc.," an illustration of which is shown herewith. It shows some of the company's rugged installations of continuous bucket elevators, and stone carriers and numerous equipments used by contractors and dealers throughout the country. Probably the most interesting page to sand, stone and gravel dealers, as well as contractors, is that relating to the new Link-Belt Portable Gondola Car Unloader, which it is claimed will unload a railroad car at the rate of 50 tons an hour. It is made either portable or stationary and several equipments have already been installed in Philadelphia. Copies of the new booklet, we understand, will be mailed to interested parties on request to the Link-Belt Company, Philadelphia or Chicago.

M. Beatty & Sons, Limited, of Welland, Ont., have just closed a contract for a steel dipper dredge with hull 100 ft. long, 40 ft. beam and 10 ft. deep, delivery to be made May 1, 1914. The dredge is of the crane type with dipper handle and spuds of sufficient length to make 40 ft. of water. The dipper itself is of five yards capacity. The Beatty firm are building this dredge for the C. S. Boone Dredging & Construction Company, of Toronto, who will use it on one of the large harbor improvement works they secured during the past season. This 5-yard dredge is similar to the dredges previously furnished the Canadian Dredging Company, Midland, Ont., W. E. Phin, Hamilton, Ont., The Dominion Dredging Company, Quebec, and others. It has done admirable work for different firms in a wide variety of material, and has established good records for capacity and low cost of maintenance. Quite recently the firm launched two steel dump scows, 156 ft. x 36 ins. x 14 ft., each of 800 cubic yards capacity. On one of the vacant ways they will at once lay down the 5-yard dredge and on the other will proceed with the construction of the lock gate lifter for the Trent Valley Canal, the contract for which they were awarded by the Department of Railways and Canals.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Camrose, Alta.
Sewer cleaning rods required by Municipal Council. Commissioner and Engineer, Sydney Appleton, Box 327 P. O. Camrose. Tenders received by Commissioner for one set sewer pipe cleaning rods (600 ft. long) suitable for 8-inch vitrified pipe. Diameter of manholes 3 ft. 6 in. f.o.b. Comrose.

Guelph, Ont.
Storm drain is contemplated by City Council. Mayor, Samuel Carter. Clerk, T. J. Moore.

Montreal, Que.
Sidewalks and roads, St. Lambert, cost $26,800, contemplated by Corp. of St. Lambert. Engineer, E. Drinkwater, St. Lambert. Tenders to be called in spring. Concrete walks and tar macadam roads.

Oak Bay, B.C.
Waterworks, cost $35,000, planned by Municipal Council. Clerk, F. W. Clayton. By-law passed.

Ottawa, Ont.
Sewer, cost $1,281.15, is contemplated by City Council. Clerk, Jno. Henderson. 12 in. tile pipe sewer on Gladstone Ave. and Hurdman Rd., from King Edward Ave. to C. N. R. Station.

Asphalt pavement, cost $4,696.56, between Cumberland St. and King Edward Ave., is contemplated by City Council. Clerk, Jno. Henderson. City Engineer, Arch. Currie.

Intercepting sewer, cost $56,827, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie, City Hall. General contractor, Thos. McLaughlin, Sterling Ave. Work has been started.

Concrete sidewalks, cost $1,118.90, walks on east side Leonard Ave. and east side Forest St., is contemplated by City Council. Clerk, Jno. Henderson.

Winnipeg, Man.
Park improvements, cost $110,000. Board of Control. Sec., M. Peterson. City Clerk, C. J. Brown. By-law to be voted on Dec. 12th. Above amount includes cost of erecting a permanent bridge over Assiniboine River into the Assiniboine Park.

Pumping machinery for sewage pumping station, $862. General contractors. Fairbanks-Morse Co., Ltd., 300 Princess Street.

Water mains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Watermains in Cameron street, $102.90; Beach Ave., $230.40; Talbot ave., $568.50.

CONTRACTS AWARDED

Regina, Sask.
Sewage disposal works planned by City of Regina. City Commsr., S. A. Thornton. Engineer, F. McArthur. General contractor, O. W. Smith, 4 Peart Block. Contract for 9,025 concrete blocks awarded to Freeland Bros., St. John St. N.

Metcalfe Twp., Ont.
Tile drain planned by Twp. Council. Twp. Clerk, R. Ward, Strathroy Twp. General contractor, J. B. McMahon, c/o R. Ward. Construction of the O'Neil Drain.

Toronto, Ont.
Sewers planned by Board of Control. General contractors, J. H. McKnight Constr. Co., 88 St. David St. Dufferin St., $14,445, midway drainage system, Gerrard and Hiawatha, $4,445. J. F. Connolly, 606 Avenue Rd., Benlamond Ave., $1,942.

Grading required by Board of Control. General contractors, Britnell Contracting Co., 209 Davenport Rd. Grading on Springmount Ave. and Mount Royal to Rosemount, $10,350.

Pavements planned by York Twp. Clerk, W. A. Clarke, Jarvis St. Engineer, Frank Barber, 57 Adelaide E. General contractors, Rocmac Roads Ltd., 74 King E. Rocmac on Spadina Rd.

Pavements planned by Board of Control. Mayor, H. C. Hocken. General contractors, Constructing & Paving Co., Confed. Life Bldg., asphalt on Grange and Theodore Ave., $10,385, asphaltic concrete on Argyle, $7,003. General contractors, Grant Contracting Co., 50 Front E., brick block on Derby Lane, $2,595.

Asphalt pavements planned by Board of Control. General contractors, Godson Contracting Co., Manning Chambrs., Arlington Ave., $8,400. General contractors, Constructing & Paving Co., Confed. Life Bldg., Carns Ave., $1,822. General contractor, Commr. of Works, by day labor, on Alma, Johnsons Lane, Rushton Rd. and Wells Hill Ave., also bitulithic on Arlington Ave.

Sewer, cost $7,230, planned by York Twp. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide St. General contractor, J. F. Connolly, 606 Avenue Rd.

North Vancouver, B.C.
Passenger subway, cost $30,105, planned by Municipal Council. Dist. Engineer, J. R. Cosgrave. General contractors, M. P. Cotton Co., Ltd.

Winnipeg, Man.
Watermains planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction, City Yards. Watermains on Dunfra Ave., $273.30.; McGregor St., $126,50; Armetta Ave., $148.50.

Railroads, Bridges and Wharves

Balsam Lake, Ont.
The C. P. R. has been authorized to construct spur for J. L. Abbott, Toronto, in W. ½ Lot 16, Con. 7, Twp. Eldon, Co. Victoria, at mileage 35.07, Ont. Div., Port McNicoll Sub.-Div.

Barrie, Ont.
The G. T. R. has been authorized to construct siding into premises of Messrs. Whiteside & Arnold, on lots 2 and 3, South Tiffin St., Allandale.

Province of B.C.
The G. T. R. has been authorized to construct bridge across Kitssumkaylum River at mileage 91, Prince Rupert East B.C.

Gravelbourg, Sask.
Plans showing location and details of special station to be constructed by C. N. R. have been approved.

Grands Mechins, Que.
Wharf extension planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until 4 p.m. Dec. 22nd. Plans, etc., at offices of Dist. Engineers, Rimouski, Post Office Bldg., Quebec, Postmaster, Grands Mechins, and at Dept., Ottawa.

Gravel, Ont.
The location of station at Gravel, for C. P. R., mileage 32.50 Lake Superior Div., Nipigon Sub. Div., Ont., has been approved.

Maidstone, Ont.
Location of Windsor, Essex and Lake Shore Rapid Rly. Co. station, Twp. Sandwich South, has been approved.

Montreal, Que.
Roofing shed planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Tenders received by Sec. until 12 o'clock noon Dec. 11th for roofing of St. Gabriel Shed No. 1, Ottawa St., Lachine Canal. Plans, specifications, at office of Chief Engineer of Dept., Ottawa, Suptg. Engineer of Quebec Canals, New Birks Bldg., Montreal.

The C. P. R. has been authorized to construct spur for Joseph Elie.

New Westminster, B.C.
Sub-station is contemplated by Vancouver Power Co., 16 Hastings E., Vancouver. Work to start shortly. Two storeys, concrete construction.

Ottawa, Ont.
Temporary bridge contemplated by City Council. Mayor, J. A. Ellis. The above bridge will not now be built.

Bridge, cost $50,000, planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie, City Hall. Steel bridge 60 ft. wide, concrete abutments and piers, approximately 2,500 cu. yds. cement and 500 tons steel. Tenders for concrete work to be called in about 3 weeks, and steel about 1 week later. Plans in progress.

Province of Ontario.
Plan showing two new abutments for replacing piers at C. P. R. bridge at mileage 35.4 on Chalk River Sub-div. has been approved.

Pritchard, B.C.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until 4 p.m. Dec. 15th. Plans, etc., at office of the Dist. Engineers, Chase, B.C., New Westminster, Postmaster, Pritchard, and at Dept., Ottawa.

Renfrew, Ont.
The C. N. O. Rly. has been authorized to construct bridge to carry its line over Indian River, Twp. Richards, Co. Renfrew, at mileage 107.85 from Ottawa.

Rosseau, Ont.
Humphrey Twp. Council contemplate building a new steel bridge over Broad River. Clerk, A. A. Young.

St. Anne Des Monts, Que.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. No action to be taken.

Saskatoon, Sask.
The C. P. R. has been authorized to construct spur for Quaker Oats Co.

Toronto, Ont.
Bloor E. Viaduct planned by Board of Control. Mayor, H. C. Hocken. Plans nearly completed. Tenders to be called after Jan. 1st.

Plans have been approved for the new steel trestle for C. P. R. Don Viaduct. To be constructed to allow thoroughfare under same.

The C. P. R. has been authorized to construct siding for Cowan Co., Ltd., at Parkdale.

St. Cesaire, Que.
Montreal & Southern Counties Railway has been authorized to construct bridge to carry its line across Yamaska River.

Victoria, B.C.
New plans for Johnson St. Bridge are being prepared by City Council. Clerk, W. J. Dowler.

Vancouver, B.C.
Four viaducts, cost $540,000, planned by City Council & Great Northern Rly. Co. City engineer, F. L. Fellowes. Engineer has completed plans for viaducts at intersection of Hastings, Pender, Keefer and Harris Sts.

Weyburn, Sask.
G. T. P. Rly. freight shed, cost $15,000. One storey, 40 x 244, platform, 200 x 40, frame construction, cement foundation, floors, felt and gravel roofing. Tenders to close as soon as possible.

Whitehall, Ont.
The G. T. R. has been authorized to construct siding for Arthur Sherk into premises of Northern Veneer Co., Ltd., on lot 28, Con. 11, Twp. McMurrich.

CONTRACTS AWARDED

Shelter Point, B.C.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Hodgson, King & McPhalen Bros., 319 Pender St., W. Vancouver.

Victoria, B.C.
Concrete conduit, cost $329,750, planned by City Council., Water Commr., C. H. Rust. General contractors, Pacific Lock Joint Pipe Co., Victoria. 27½ miles reinforced concrete pipe and apparatus on the line of the Sooke Water Supply Conduit.

Public Buildings, Churches, Schools, etc.

Aurora, Ont.
School buildings contemplated by St. John's Industrial School, Kingston Rd., Toronto. Archbishop, N. McNeil, Wellesley Place, Toronto, has purchased new site near Aurora, where new building will be erected shortly.

Brussels, Ont.
Church, cost $20,000, for Melville Presbyterian Congregation. Pastor, Rev. A. J. Mann. Architect, J. S. Russel, 21 Downie St., Stratford. Plans in progress.

Cobalt, Ont.
Post office fittings required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until Dec. 9th for interior fittings. Specifications at P. O. Cobalt, Office of Sec., Station "F," Toronto.

Cochrane, Ont.
School, cost $25,000, is contemplated by Public School Board. Sec., J. McD. Douglas. Plans will be received by Board. Work to start in spring. Eight rooms, solid brick construction, concrete foundation, felt and gravel roofing, electric lighting, birch floors, line and sand plastering, slate blackboards, seating.

Edmonton, Alta.
Church for Gaelic Organization. Rev. Dr. MacLean, Bonnie Doone. Sub.-Div., Edmonton S. Work to start in spring. Plans in progress.

Fredericton, N.B.
Normal school annex, cost $45,000, planned by Prov. Govt. Dept. of Public Works. Commr., Hon. Jno. Morrissy. Architect, G. E. Fairweather, Germain St., St. John. General contractor, J. Fred Ryan, Fredericton, N.B. Roofed.

Hamilton, Ont.
Sub-station, cost $15,000, planned by City Council (Hydro-electric Dept.). Mayor, John Allan. Consg. Engineer, E. I. Sifton, City Hall. Architects, Watt & Blackwell, 125 Lister Chmbrs. Mason, W. H. Yates, 18 Leeming St. Carpenter, T. J. Drake, Earl St. Roofing, J. E. Riddle & Son, Ferguson Ave. N. Plumbing, A. Rogers & Co., 758 King St. T. Iron work, Kingdon Smith Co., King William St. Two storeys, steel and brick construction, concrete foundation, comp. paper roofing, electric lighting, steam heating, concrete floors, metal sash.

Kuper Island, B.C.
School buildings, cost $50,000, planned by Dom. Govt. Dept. of Indian Affairs. Sec., J. D. McLean, Ottawa. Plans prepared. Tenders to be called shortly.

Lachute, Que.
A college is contemplated by R. C. School Commrs.

London, Ont.
Addition to high school, cost $65,000, planned by Board of Education. Chairman, E. R. Dennis. Architects, McBride & Gilbert, Edge Block. Tenders will be called in spring. Stone and concrete foundation, white brick construction, electric lighting, maple and concrete floors, plumbing, lime and sand plaster, seating, slate blackboards. Plans in progress.

Memramcook, N.B.
College extension and power house, cost $70,000, for St. Joseph's College, Memramcook, N.B. Architect, R. A. Frechet, 30 Bonicord St., Moncton, N.B. General contractor, S. R. Gundet, College Bridge. Roofed.

Montreal, Que.
Church for Parish of St. Jean Baptiste. Architect, J. L. D. Lafreniere, 271 St. Denis St. Plans in progress. Tenders to be called in about two months.

Church for St. Lukes Congregation (W. R. Cruikshanks, 115 Drummond St.). Architects, Hutchison, Wood & Miller Royal Ins. Bldg. Architect now ready to receive tenders for General Contractor. To close Dec. 3rd.

Ottawa, Ont.
School, cost $140,000, Rosemount, planned by Ottawa School Board. Sec., Crawford Bros., Elgin St. Architect, W. B. Garvock, Creighton St. School. Roofing, Architectural Sheet Metal Co., Vaughan St. 18 rooms. Walls up.

St. Catharines, Ont.
Addition to school, cost $25,000, contemplated by School Board. Chairman, Jas. A. Hewitt. Four room addition to school in St. Patrick's Ward.

St. Thomas, Ont.
Y. M. C. A., Talbot St. Architect, Jno. T. Findlay. General contractor, A. E. Ponsford, 605 Talbot St. Other contracts not let. Excavating.

Sandwich, Ont.
Addition to registry office, at $20,000, planned by Essex County Council. Chairman, Enos McCausland, Essex. Architect, J. C. Pennington, Windsor. Mason, Thompson Bros., Windsor. Carpenter and roofing, Williamson Construction Co., Walkerville. Iron and steel, Canadian Bridge Co., Walkerville. Painting, C. M. Bennett, Walkerville. Heating and plumbing, R. Paddon, Windsor. Electrical, James Clark, Windsor. One storey, 50 x 50. Foundations in.

Sarnia, Ont.
School, cost $30,000, planned by School Board. Chairman, A. N. Hayes, M.D., 142 Christina. Architect, Robt. W. Fawcett, 152 Essex St. Work to be done by day labor. Ten rooms, steam heating, ventilating system, 48 ft. by about 4 ft. High blackboard required in each room. Work to start.

Toronto, Ont.
Machinery hall, etc., cost $600,000, for Canadian National Exhibition Board. General manager, Dr. J. O. Orr, City Hall. Directors have approved of the following:—New machinery hall, addition to Art Gallery, Live Stock Arena, Sheep Pens, reconstruction of Poultry Bldg., alterations, etc., Grand Stand.

Vancouver, B.C.
Addition planned by General Hospital Board. Managing Secretary, Geo. Had-

don. Architect, A. A. Cox, Cotton Bldg. Tenders received by Sec. until 5 p.m. Dec. 3rd. Plans, etc., at office of Architect. Service wing, estimated cost between $90,000 and $100,000. Three stys., mill and brick construction.

Nurses Home, cost $110,000, for General Hospital Board. Managing Sec., Geo. Haddon. Architect, A. A. Cox, Carter-Cotton Bldg. Tenders received by Sec. until 5 p.m. Dec. 3rd. Plans, etc., at office of Architect. Five stys., mill and brick construction.

Victoria, B.C.
Public swimming baths contemplated by City Council. Clerk, Wellington J. Dowler. The following Committee has been appointed to look into matter:—Messrs. L. F. Leo, P. R. Pomfret, W. J. Keir, C. E. Hopper, W. D. Muir, E. B. Paul, I. St. Clair, Mrs. Pringle, Mrs. Hay, Miss Bradshawe.

Welland, Ont.
Re-building court house, cost $16,000, planned by County of Welland. County Clerk, R. Cooper. General contractors, Clark & Son. About ready for roofing.

Winnipeg, Man.
School, cost $90,000, planned by Rural Municipality of Assinaboia, St. James. Sec.-Treas., Frank Ness, Kirkfield Park P.O. Architect, Alex. Melville, 4th floor, Builders' Exchange. General contractors, Frid Lewis & Co., Somerset Bldg. Three storeys, 135 x 85. Foundations in.

CONTRACTS AWARDED

Fruitlands, B.C.
School planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractor, Chas. B. Austin.

Mission City, B.C.
School, cost $7,500, planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractors, Catherwood & Slack, Mission City. Two rooms, frame construction.

Montreal, Que.
Alterations to church, cost $30,000, for St. Charles Parish, 401 Centre St. Architects, McDuff & Lemieux, University St. General contractor, C. E. Deakin, 41 Mayor. Repairing present basement and covering same in with concrete and steel, concrete floors. Two storeys, 125 x 225, stone and concrete foundation, stone and steel construction.

Alterations to hospital, cost $12,000, for Notre Dame Hospital, Notre Dame St. E. Architect, Alp. Piche, 52 Victoria Sq. General contractor, P. Belair, c/o Architect. Four storeys, 74 x 140, concrete foundation, stone and steel construction, hot water heating.

Port Dover, Ont.
Public school, cost $21,000, planned by Board of Education. Sec., T. W. Smith. Architects, Chapman & M. Giffin, 95 King St. E., Toronto. General contractors, P. H. Secord & Son, 133 Nelson St., Brantford.

Victoria, B.C.
School, cost $44,200, planned by School Board. Sec., W. T. C. Pope, 1127 Catherine St. Architect, C. Elwood Watkins, 1117 Rockland St. General contractors, Stevens Bros., c/o Architect. Heating and ventilating, Andrew Sheret, 1114 Blanchard St.

Business Buildings and Industrial Plants

Brantford, Ont.
Factory contemplated by A. G. Spalding & Bros., Checopec, Mass. Manufacturers of gymnasium equipment, etc. To be built next year. Temporary quarters have been leased at 3 Dalhousie St.

Calgary, Alta.
Stores and offices, cost $500,000, for J. S. Mackie, 1st St. W. Architect, Jas. C. Teague, 310 Dominion Block. General contractors, Jones & Lyttle, Bow River and 6th St. W. Plumbing and heating, Grant Bros., 608 2nd St. E. Electrical, Cunningham Elec. Co., Thomas Block, 2nd St. W. Roof on. Work to be completed in Spring 1914.

Stores and apartments, cost $50,800, for P. O. Sullivan. Architect, J. B. Henderson, 313 Beveridge Block. General contractors and painting, McDougall & Forster, 13-14 Board of Trade Bldg. Heating and plumbing, Alberta Plumbing and Heating Co., 711 3rd Ave. Electrical, Cunningham Elec. Co., 7th Ave. W. Two storeys, 75 x 130. Roofing.

Coquitlam, B.C.
Stores and hotel, cost $50,000, for Coquitlam Terminal Co., 533 Granville St., Vancouver. Architects, Parr, MacKenzie & Day, Vancouver Block, Vancouver. General contractors, Coquitlam Constr. Co., Port Coquitlam. Two stys. and basement, pressed face brick. Excavating.

Cobalt, Ont.
Bank, cost $9,000, for Bank of Ottawa. Manager, Samuel Smythe. Architect, J. P. MacLaren, 104 Sparks Street, Ottawa. General contractors, Hill, Clark & Francis, New Liskeard. Heating, plumbing and electric lighting not let. Walls started.

Edmonton, Alta.
Re-building warehouse, cost $60,000, contemplated by Canadian Consolidated Rubber Co. Concrete foundation of building destroyed by fire will be used. Five storeys, 130 x 50, steel and brick construction, cut stone facings.

Store and offices, cost $40,000, for Capt. A. Palmer, England, c/o Architects. Architects, Magoon & MacDonald, Tegler Block. General contractors, Dunlop Construction Co., 205 Hart Block. Steel, The Manitoba Bridge and Iron Works, Ltd., Logan Ave. W., Winnipeg. Heating and plumbing, McKnight & Frost. Three storeys, 53 x 75. Walls up. To be finished about February, 1914.

Grismby, Ont.
Winery for The Pelee Island Wine & Vineyard Co. Pres., Major J. S. Hamilton, Brantford. By-law passed granting company free site and fixed assessment of $5,000 for 10 years. Contracts to be let shortly. Three storeys, 150 x 60.

Iroquois Falls, Ont.
Pulp and paper mill, cost $1,500,000, for Abitibi Pulp & Paper Co., Ltd. Sec., J. A. McAndrew, 10 Adelaide St. E., Toronto. Engineer, Henry Holgate, 9 Victoria Sq., Montreal. Wood and wet rooms ready for machinery, 175 x 60 and 250 x 130, machine shop, boiler room, also completed, 90 x 55 and 90 x 40. Daily capacity of plant 200 tons. Trimming interior.

Leamington, Ont.
Stores and hall, cost $30,000, contemplated by Leamington Masonic Lodge. Add. Sec., Masonic Lodge, 109½ Talbot St. Three storeys, white brick construction, stone trimmings, concrete and stone foundation, electric lighting, maple and concrete floors, plumbing, plate glass, store fronts and fixtures.

Medicine Hat, Alta.
Store and apartments, cost $10,000. Owner and general contractor, Jno. Gillespie. Two storeys, brick veneer construction. Excavating.

Montreal, Que.
Two stores and flats, cost $8,000. Owner and general contractor, J. A. Joly, 1205 St. Viateur. Architect, Z. Trudel, 238 St. Andre St. General contractor ready to receive tenders for roofing, plastering, painting, heating, plumbing and electrical. To be awarded about December 5th. Four storeys, 40 x 50, brick construction, hot water heating, architectural iron stairs. Foundations in.

Tenders received by Commissioners, Secretary, L. N. Senecal, until Dec. 9th, for the construction of cement floors in Bonsecours Market. Specifications, etc., at office of Superintendent of Buildings, City Hall.

Stores and flats, cost $20,000, at Outremont, for Mr. Bessette, 97 St. James St. Architect, J. A. Ouellette, 250 Amherst St. Roofing, heating and plumbing, Belisle Bros., 808 Papineau. Walls going up.

Ottawa, Ont.
Printing plant, cost $40,000, for Lowe-Martin Co., printers. Architects, Richards & Abra, 218-220 Booth Bldg. Five storeys, reinforced concrete construction.

Addition to warehouse, cost $10,000, for S. .J Major & Co., York St. Architect, C. P. Meredith, 126 Sparks St. General contractor, T. C. James, 104 Flora. Roof on.

Addition to stores, cost $50,000, for Chas. Ogilvy, Ltd., Rideau and Nicholas Sts. Architect, W. E. Noffke, Central Chambers. Three storeys, 66 x 100, concrete foundation, waterproofed, steel and solid brick construction, felt and gravel roofing, electric lighting, steam heating, birch floors, mosaic tiling, plate glass, passenger elevator, cornices, store fronts and fixtures. Plans in progress.

Alterations to bank, cost $15,000, for Bank of Montreal. Architect, C. P. Meredith, 126 Sparks St. Walls up.

Business block, cost $100,000. Owner, F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Tiling, Ottawa Tile & Mosaic Co., 130 Sparks St. Seven storeys, patent roofing, electric lighting, steam heating. Roofing.

Blacksmith shop, etc. Owners and general contractors, Campbell Steel & Iron Works, Ltd., Carling Ave. Architect, Alex. Campbell, c/o General Contractors. Steel construction, concrete foundation, corrugated iron roofing, electric lighting. Excavating.

Business block contemplated by N. D. Porter, Bank and Albert Sts. Brick veneer construction, concrete and stone foundation, felt and gravel roofing, electric lighting.

Port McNicoll, Ont.
Bank for Quebec Bank. General contractor, D. H. McInnis. Supt. of Con-

struction, R. Patterson, Supt. of Branches, H. O., St. James St., Montreal. Interior fittings being supplied by bank. Walls up.

Prince Rupert, B.C.
Fertilizing plant for Scottish-American Oil & Fertilizing Co. Architect, J. S. D. Taylor, Bower Bldg., Vancouver. Plans prepared.

Fertilizing plant contemplated by A. S. King. Site has been purchased. To be built early next year.

Revelstoke, B.C.
Laundry contemplated by West Kootenay Steam Laundry Co., Ltd. To replace building destroyed by fire. 100 x 50, cement construction. Machinery to be installed, estimated cost $9,000.

Sarnia, Ont.
Picture theatre, cost $7,000, for Sarnia Moving Picture Theatre Co., Christina St. General contractor, F. Gutteridge. White brick construction, concrete and stone foundation, electric lighting, maple floors, plumbing, seating. Excavating.

Toronto, Ont.
Water Garth, 34 Gertrude Ave., will erect building suitable for concerts, dances, etc.

Theatre for J. Garbarino, 337 Shaw St. Mason, Elgie & Page, 18 Toronto St. Two storeys, 30 x 150, brick construction, corrugated iron, felt and gravel roofing, electric lighting, hot water heating, maple and concrete floors, lime and sand plastering, marble tiling, seating. Walls going up.

Dance hall, cost $15,000, for Prof. Davis, 215 Dundas St. Architect, E. Packer, 64 Spruce Hill Road. No contracts awarded yet. Three storeys, 35 x 48, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, wood and metal lath, plate glass, mantels, built in fireplaces. Plans drawn.

Stables and addition to bakery, cost $45,000, for Lawrence's Bakery, 31 Carr St. Architect, G. W. Gouinlock, 1108 Temple Bldg. Mason, Wickett Bros., 35 Deer Park Cres. Steel, Reid & Brown, Esplanade St. Tenders in for other trades but not yet awarded. Three stys., 40 x 110, brick and steel construction, felt and gravel roofing, electric lighting, concrete and birch floors, window and wire glass, galvanized iron, skylights, ventilators, metal sash, fireproof doors and shutters. Excavating.

Bank, cost $15,000, Royce and Symington, for Bank of British North America. Architects, Mitchell & White, 55 Isabella St. Plastering, Taylor & Nesbitt, 18 Havelock St. Painting, Hughes & Co., 884 Yonge St. Heating and plumbing, R. Patterson, 907 Keele St. Plastering.

Vancouver, B.C.
Alterations to "Hotel Dunsmuir" for A. Grossman, Shaughnessy Heights. Architects, Russell, Babcock & Rice, Metropolitan Bldg. Three storeys to be added to building later on. Plans being prepared.

Business building. Owner and general contractor, E. Cook, 155 Alexander St. Architect, W. M. Dodd & Co., 924 Hastings St. W. Two storeys and basement, brick construction. Plans drawn.

Re-building loft building, cost $75,000, for Kelly-Douglas & Co., Wholesale Grocers, 367 Water St. To be rebuilt at once.

Windsor, Ont.
Factory contemplated by Parsons Motor Car Co. of Canada, Ltd. Architect not yet chosen.

Stores and flats, cost $35,000, for A. St. Dennis, 155 London St. W. Architects, Atchison & Adams. Two storeys, 70 x 110. Roofing.

Store and flat, cost $10,000, for Nathan Cohn. Architects, Atchison & Adams. Mason and plastering, Shulman & Kaplowitz. Carpenters, Berch & Appleman. Heating and plumbing, Robt. Paddon. Electrical, E. Darrow. Two storeys, 38 x 60. Excavating.

Winnipeg, Man.
Office building for Merchants Bank of Canada. Architects, J. D. Atcheson & Co., Trust & Loan Bldg. General contractors, G. A. Fuller & Co., Union Bank Bldg. Roofed.

Stores and offices for D. S. Curry, care architects, J. D. Atcheson & Co., Trust & Loan Bldg. Five storeys, Plans in progress.

Addition to warehouse, cost $35,000, at St. Boniface, for Western Canada Flour Mills, Winnipeg. Architects and general contractors, G. H. Archibald & Co., 827 Union Bank Bldg. Roof on.

Re-building malt house, cost $18,000. Owners and general contractors, Canadian Malting Co., Lincoln St. One sty., brick construction, felt and gravel roofing, electric lighting, steam heating, pine floors. Plans drawn.

CONTRACTS AWARDED

Calgary, Alta.
Theatre, store and office, cost $85,000, for Dr. T. H. Blow, 210 7th Ave. W. Plastering done by day labor. Heating, Davidson Bros., 1231a 9th Ave. E. Plumbing, Campbell & Hillier, 1007 17th Ave. W. Electrical, Gracey & Crane, Ltd., 129 5th Ave. E.

Grand Forks, B.C.
Cannery, cost $11,000, for Grand Forks Cannery Co. Pres., Daniel McKimmon. Sec.-Treas., J. A. McCallum. General contractor, Angus McDougall. Two stys. and basement, 125 x 50, cement or brick construction, concrete foundation.

Halifax, N.S.
Store and warehouse, cost $20,000. Owners, C. Brister & Son, Ltd., 57 Upper Water St. General contractor and builder, Robert Daw, 536 Gottingen St. Four storeys, 70 x 103, concrete foundation, waterproofed, reinforced concrete construction, felt and gravel roofing, electric lighting.

Hamilton, Ont.
Branch bank, cost $12,000, for Metropolitan Bank. Architects, Watt & Blackwell, 125 Lister Chmbrs. General contractor, R. A. Campbell, 117 Duke St.

Stores and hall, cost $25,000, for Royal Templars of Temperance, Spectator Bldg. Architect, W. A. Edwards, 7 Hughson St. S. Roofing, M. V. Maclean, 314 Hess St. S. Plastering, Hannaford Bros., 232 Robinson St. Gas heating, Canadian Rector Gas Heating Co., Lister Chmbrs. Plumbing, W. J. Walsh, 210 King St. E. Sewer, J. D. Armstrong, 138 Erie Ave. Three storeys, steel and brick construction, gas heating.

London, Ont.
Store, cost $12,000, for S. E. Burridge, 99 King St. General contractors, Hyatt Bros., Egerton St., London. Two stys., 50 x 80, brick construction, concrete foundation.

Montreal, Que.
Addition to store and ice cream parlor, cost $15,000, for Geo. Nicholls & Co., 332 St. Catherine W. Architect, D. J. Crighton, Jacobs Bldg. General contractor, Mr. Clarke, c/o Owners. Heating and plumbing, W. Mackenzie, 87 Mansfield. Three storeys.

Ottawa, Ont.
Business block, cost $15,000, for Blackburn Bros. Architect, W. E. Noffke, Central Chmbrs. Painting, J. Duford-Lea, Rideau St. Heating and plumbing, J. T. Blythe, Bank and James. Eight storeys, electric lighting, steam heating.

Regina, Sask.
Stables, cost $23,900, planned by City Council (Dr. M. R. Bow, M.H.O.). Architect, R. W. Allen, City Engineer's Office. General contractors, Minkley & Traud. Contract for cornices, gutters, tanks and tinware awarded to Hastings and Willoughby, 1719 Cornwall St.

Steveston, B.C.
Cold storage plant for B. C. Packers' Association, 517 Granville St., Vancouver. General contractors, The B. C. Granitoid Co., Exchange Bldg., Vancouver. Sub-structure, Peterson and Archibald, 1905 Quebec St., Vancouver. Sub-contractors are in the market for 1,050 piles. Work to start at once.

Toronto, Ont.
Factory, cost $25,000, for Lever Bros., Eastern Ave. Architect, G. W. Gouinlock, Temple Bldg. Mason, Wickett Bros., 35 Deer Park Cres, Two storeys, 35 x 118, brick and steel construction.

Victoria, B.C.
Building, cost $20,000, for B. C. Pottery Co., Ltd., 626 Pandora. General manager, A. T. Monteith. Architects, Geysbeek Engineering Co. Consulting Architect, T. D. Sedger, 512 Bastion. General contractors, Chas. W. Carkeek & Co., 618 Sayward Bulg. Three stys., mill construction.

Store and residence, cost $8,000, for H. W. Walker, 70 Esquimalt Rd. Architect, T. D. Sedger, 512 Bastion. General contractor, William Martin, 2944 Bridge St.

Residences

Hamilton, Ont.
Five residences, cost $12,500. Owner and general contractor, J. H. Somerville, 28 Prospect St. 2½ storeys, brick construction, concrete and stone foundation, shingle roofing, gas and electric lighting, hot air heating, pine floors, lime and sand plastering, mantels, plumbing. Excavating.

London, Ont.
Apartment house, cost $16,000, is contemplated by Hugh M. Douglas, 206 Central Ave. Architects, Watt & Blackwell, Bank of Toronto Bldg. Two storeys, 40 x 74, tapestry brick construction, concrete foundation, felt and gravel roofing,

gas and electric lighting, oak and maple floors, plumbing, lime and sand plastering, plate glass, cornices, fire escapes, built in fireplaces, mantels, telephone and annunciator system, architectural iron stairs.

Montreal, Que.

Four flats, cost $12,000, for Thos. Hannah, Youville. General contractors, R. E. Edward & Son, 212 Versailles. General Contractors ready to receive tenders for roofing, heating and plumbing. Electrical, Bonet & Thompson, c/o General contractors. Two storeys, 50 x 70, felt and gravel roofing. Foundations in.

Two flats, cost $5,000. Owner and general contractor, Henry Gaffney, 204 St. James. General Contractor ready to receive tenders for plastering and painting. Two storeys, 25 x 52, stone and brick foundation, felt and gravel roofing, hot water heating. Excavating.

Three flats, cost $9,000. Owner and general contractor, Henry Gaffney, 204 St. James. General contractor ready to receive tenders for plastering and painting. One storey, 36 x 36, stone and concrete foundation, felt and gravel roofing, hot water heating. Excavating.

Ten cottages, cost $40,000, at Cote St. Michael. Architect, S. Frappier, 2238 Park Ave. Plans drawn. Architect will call tenders about Dec. 1st. Frame construction.

16 flats, cost $12,000. Owner and general contractor, J. H. Mercure, 1124 Rachel E. Work done by day labor. Four buildings, 3 storeys, 50 x 40 pair, concrete foundation, felt and gravel roofing. Foundations in.

Residence, cost $23,000, at Westmount, for J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Tenders close with Architect for roofing and plastering about Dec. 1st.

12 flats, cost $8,000, Messier. Owner and general contractor, A. Martel, 631 Frontenac. Work done by day labor. Three storeys, 66 x 50, concrete foundation, felt and gravel roofing. Excavating to start.

Residences, cost $7,000, at Outremont. Owner, builder and general contractor, W. Ouimet, 1911 Esplanade. General contractor ready to receive tenders for plastering. Three storeys, 25 x 72, concrete foundation, felt and gravel roofing, electric lighting, hot water heating. Excavating.

Cottages, cost $16,000, at Westmount. Owners and general contractors, White Constr. Co., 306 Coronation Bldg., St. Catherine W. Owners will call tenders on some trades shortly.

Six flats, cost $8,000. Owner, mason and carpenter, A. & D. Boileau, 343 De Lanaudiere. Architect, Jos. Lavigne, Work done by day labor. Three storeys, 44 x 66, concrete foundation, felt and gravel roofing. Excavating.

Three flats, cost $5,000. Owner and general contractor, Jos. Frenette 363 Garnier. Work done by day labor. Three storeys, 25 x 62, concrete foundation, felt and gravel roofing. Foundations in.

Montreal West, Que.

Residence, cost $11,200, for J. R. Colby, c/o Architects, Peden & McLaren, 20 St. Alexis St. General contractor and painting, J. J. Kirkpatrick, Montreal W. Plastering.

Oak Bay, B.C.

Residence, cost $8,000, for Mr. Colgate, c/o Architect, Jesse M. Warren, 503 Central Bldg., Victoria. Eight rooms, hardwood floors, electric lighting, plumbing. Plans being prepared.

Ottawa, Ont.

Residence, cost $6,600, for S. J. Willoughby, 101 James St. Architect, general contractor, mason and carpenter, R. E. McKinstrey, 91 2nd Ave. Plastering, painting, heating, plumbing and electrical not let yet. Brick veneer construction. Foundations in.

Residence, cost $6,000. Owner, J. C. Reynolds, 117 Henderson. General contractor, masonry, brick and roofing, R. W. Hamilton, 81 Echo. Other contracts not let yet. Double brick veneer construction. Foundations in.

Residence, cost $5,500. Owner and carpenter, Geo. Wilson, 341 Gloucester St. Masonry and brick, Mr. Weatherston, at job. Other trades not yet called for. 2½ storeys, 34 x 46. Foundations in.

Residence, cost $7,500. Owner, general contractor, mason and carpenter, A. E. Shaver, 45 Powell Ave. Other contracts not let yet. 2½ storeys, 38 x 32, brick veneer and roughcast construction. Foundations in.

Residence, cost $18,000, for W. F. Powell, 570 Sussex. Architect, W. E. Noffke, Central Chmbrs. Tiling, etc., A. K. Mills & Sons, 191 Sparks. 2½ storeys, electric lighting, hot water heating. Roofed.

Residence, cost $7,000. Owner, architect, general contractor, mason and carpenter, A. E. Shaver, 45 Powell Ave. Other contracts not let yet. Brick veneer and roughcast construction. Foundations in.

Residence, cost $6,000. Owner, general contractor and carpenter, P. W. Joyce, 126 Spadina Ave. Masonry not let. Tenders to be called later for plastering, painting, heating and electrical. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot air heating, birch and spruce floors, water heaters, mantels, built in fireplaces. Excavating completed.

Residence, cost $15,000, for A. E. Blount, 26 Russell. Architect, W. E. Noffke, Central Chmbrs. General contractor, A. E. Spooner, Windsor House. Painting, Geo. Cundell, 58 Hastey. Heating and plumbing, J. T. Blythe, Bank and James. 2½-storeys, shingle roofing, electric lighting, hot water heating, oak, birch and spruce floors, water heaters, plate glass, mantels, built in fireplaces. Walls up.

Regina, Sask.

Thirty residences at Eastview Sub-division are contemplated by J. K. McInnes, care Regina Standard, Rose St. Work to start in spring.

Apartment building, cots $30,000, for A. M. Fields, c/o W. A. Burns, New Dallas Block. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg. Tenders received by Architects until Nov. 31st for excavation. Five storeys.

Toronto, Ont.

Two residences, cost $5,000. Owner, general contractor, mason and carpenter, A. Rotstein, 55 Oxford St. Tenders wanted for plastering, painting and concrete cellars and walks. 2½-storeys, 30 x 36, brick construction and foundation, shingle, felt and gravel roofing, gas lighting, hot air heating, birch and concrete floors, lime and sand plastering, wood lath.

Apartment, cost $8,000. Owner and general contractor, D. Goodheim, 316 Bathurst St. Architect, J. H. Galloway, 23 Toronto St. Three storeys, 44 x 62, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak, birch and pine floors, lime and sand plastering, wood lath. Built-in fireplaces, mantels. Plans drawn.

One detached residence, cost $7,000, for L. A. Docherty, 332 Russell Hill Rd. Work not started yet. 2½ storeys, 24 x 36, brick and steel construction, brick foundation, slate roofing, gas and electric lighting, hot water heating, oak, birch and pine floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built-in fireplaces, mantels.

Two pair residences, cost $8,000. Owner and general contractor, A. E. Cudmore, 111 Ivy Ave. Owner will superintend. Two storeys, 33 x 42, pair, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Three attached residences, cost $8,000. Owner and general contractor, C. Pain, 275 Dupont St. 2½-storeys, 48 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, pine and oak floors, lime and sand plastering, wood lath, mantels, built in fireplaces, hot air heating. Plans drawn.

One pair residences, cost $5,500. Owner and general contractor, W. G. Robinson, 835 Gerrard St. 2½-storeys, 36 x 44, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

One detached residence, cost $5,000. Owner and general contractor, T. Palmer, 44 Briar Hill Ave. Will sublet some trades. 2½-storeys, 24 x 32, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, marble tiling, leaded glass, built in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,500. Owners and general contractors, Agnew Bros., 203 Withrow Ave. Owners will superintend construction. 2½-storeys, 3 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Excavating.

Three pairs residences, cost $12,000, for E. A. Wills, 568 Dovercourt Rd. Owner will superintend construction and will let some trades. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood

(Continued on page 69)

Tenders and For Sale Department

TENDERS
FOR
A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James **Milne, Mechanical and Electrical Engineer**, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913**, for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. 49-50

SALES MANAGER

District Sales Manager wanted by an established Consulting Engineering & Construction Corporation, based on co-operative plan. Offices in Cleveland, Detroit, Buffalo and New York City. The position requires a man with engineering knowledge, one who can take full charge of the Sales Department. Highest references and $1,000 investment required. Contract with salary, commission and expenses guaranteed. Answer Box 919, Contract Record, Toronto. 49

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received at this office until 4 p.m. on **Monday, December 22, 1913**, for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 28,1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47226. 49-50

Contractor with Steam Shovel, Cars, Track, Horses, Scrapers, etc., would like to hear from parties having railroad grading or other work to let. Address "Contractor," c/o Contract Record, Toronto. F

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, December 12th, 1913
for
Heating, Howard School
and
Plumbing, Heating, Electric Wiring, and Heat Control, Regal Road School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, on and after Thursday, December 4th. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. O. McTAGGART,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

49

Wanted Employees

WANTED—Electrical man with knowledge of gasoline engines to sell and erect small isolated electric light installations. Good opportunity for young man. Reply giving age, experience and salary required, to Box 916, Contract Record, Toronto. 49-50

Toronto Harbor

Equipment Wanted

We are in the market for

Tugs, Derrick Boats, Floating Pile Drivers, Barges and Floating Equipment

for use on our work in

PROPOSALS WANTED
from
Experienced Contractors
for
Pile Driving, Capping, Crib Work, Concrete Walls, and Ship Channel for

Toronto Harbor Contracts

Apply to

CANADIAN STEWART COMPANY, LIMITED
C. P. R. Building - Toronto

48-49

WANTED

A 3 to 5 ton double drum Hoisting Engine with swinger and boiler complete.

Also a 3 to 5 ton timber stiff leg derrick.

Sun Brick Co., Limited,
1023 Traders Bank Building,
Toronto, Ontario

48-49

Residences

(Continued from page 67)

lath, mantels, built in fireplaces. Plans drawn.

Two pair residences, cost $8,000. Owner and general contractor, E. Taylor, 162 Delaware Ave. 2½-storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Vancouver, B.C.
Residence, cost $400,000. Owner, B. T. Rogers, c/o B. C. Sugar Refinery Co. Ltd., 997 Powell St. Architects, Somervell & Putman, London Bldg. Fireproof construction. Plans to be prepared.

Westboro, Ont.
Residence, cost $6,000, for J. E. Caldwell, City View. Architect, C. P. Meredith, 126 Sparks St., Ottawa. Plastering.

Windsor, Ont.
Two-family flat, cost $7,500, for Peter Osterhou. Architects, Leybourne & Whitney. Work to be done by Owner. Two storeys, 39 x 44, frame and stucco construction, concrete foundation, shingle roofing, electric lighting, hot air heating, oak floors, water heaters, stucco, lime and sand and hard wall plastering, wood lath, iron stairs and railings, built in fireplaces, laundry tubs. Plans drawn.

Two-family flat, cost $6,000, for Owner, A. A. Little. Architects, Leybourne & Whitney. Work to be done by Owner. Two storeys, 42 x 38, brick and stucco construction, concrete foundation, shingle roofing, electric lighting, hot air heating, oak floors, water heaters, stucco, lime and sand and hard wall plastering, built in fireplaces. Plans drawn.

Winnipeg, Man.
Two residences, cost $8,000. Owner and general contractor, R. Robson, 284 Simcoe. Two storeys, 25 x 28, frame construction, stone foundation, shingle roofing, electric lighting, maple floors. Excavating.

Four residences, cost $10,800. Owner and general contractor, J. W. Phillipson, Suite 44, Aikins Block. Two storeys, 20 x 26, frame construction, stone foundation, shingle roofing, electric lighting, hot air heating, maple floors. Excavating.

CONTRACTS AWARDED

Halifax, N.S.
Residence, cost $5,500, for A. G. Cross, 12 South Hollis St. Builders and general contractors, Maxner & Dunlop, 152 Windsor St. Two storeys, 24 x 31, cement foundation, frame construction, felt and gravel roofing, electric lighting.

Montreal, Que.
Residences, cost $12,000, at Outremont, for Mrs. E. N. Blackburn, 1194 St. Andre. General contractor, E. Charbonneau, 1813 Clarke. Three storeys, 50 x 70, stone foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating.

Six flats, cost $6,500, for Estate Ed. D. Roy, 490 Parc Lafontaine. General contractor, Mag. Ouimet, 20 Christopher Columbus. Three storeys, 43 x 40, concrete foundation, felt and gravel roofing.

Ottawa, Ont.
Residence, cost $5,000. Owner and architect, Ainslee W. Green, Trust Bldg., Sparks Street. General contractor, R. A. Kemp, 149 1st ave. Double brick veneer contsruction, stone foundation, shingle roofing, electric lighting, hot air heating, birch and pine floors, water heating.

Residence, cost $10,000. Owner and general contractor, W. E. Noffke, Central Chambers. Painting, Geo. Cundell, 58 Hastey Ave. Heating and plumbing, J. T. Blythe, Bank and James.

Residence, cost $10,000, for Dr. Quinn, c/o Architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor, T. A. Shore, 41 Chamberlain. Painting, W. J. Carson, 293 Laurier W. Heating and plumbing, Holloway & Son, 373 Somerset. Electrical, Marchand & Donnelly, 128½ Sparks.

Residence and garage, cost $15,000. Owner and architect, W. E. Noffke, Central Chambers. Mason, Holbrook & Sons, 425 Somerset. Carpenter, Smith Bros., 140 Flora St. Steel, Dom. Bridge Co., Sparks St. Plastering, heating, plumbing and electrical not let. 2½-storeys, stone and concrete foundation, brick veneer construction.

Sussex, N.B.
Residence, cost $7,500, for Garfield White, Sussex. Architect, F. Neil Brodie, 42 Princess Street, St. John. Heating and plumbing, Carling & Regan, Princess Street, St. John.

Toronto, Ont.
Apartments, cost $9,000, for B. A. Cumpston, c/o Architects, S. B. Coon & Son, 512 Temple Bldg. Mason, J. W. Hewitt, 56 Roncesvalles Ave. Carpenter, J. M. Davis & Son, 49 Muir Ave. Iron and heating, A. Welch & Son, Queen W. Plastering, W. Haney, 193 Degrassi St. Painting and glazing, C. W. Landon, 569 College St. Electric wire, E. L. Norrish, 82 Clinton St. Two storeys, 36 x 56.

Vancouver, B.C.
Residence, cost $35,000, for H. Bingham, 2063 Grant St. Architect, G. B. Kauffman, Davis Chambers. General contractors, Hodgson, King & McPhalen Bros., 319 Pender St. W. Concrete hollow tile, semi-fireproof and brick construction.

Power Plants, Electricity and Telephones

Beausejour, Man.
Electric light system, cost $3,000, planned by Town Council. Sec.-Treas., M. J. Hoban. By-law passed.

Hamilton, Ont.
Hydro extensions contemplated by Board of Control. Mayor, Jno. Allan. By-law to raise $1,335,000 to be submitted in January.

Point Grey, B.C.
Street lights contemplated by Municipal Council. Clerk, G. G. Heighway, Kerrisdale. 20 additional lights to be installed.

Nelson, B.C.
Street railway improvements, cost $10,000, by-law to be submitted by Town Coun. Clerk, W. E. Wasson.

Walkerville, Ont.
Distributing station, cost $40,000, planned by Hydro-electric Power Commsn., Toronto. General contractors, mason and carpenters, H. G. Christman Co., Hamilton, Ont. Roofing, painting, heating and plumbing not let. Two storeys, 73 x 125, steel, reinforced concrete and brick construction.

CONTRACTS AWARDED

Regina, Sask.
Pawer house equipment planned by City Council (Light and Power Dept.). Supt., E. W. Bull. General contractors, Williams, Robinson & Co., Rugby, Eng., for one 3,000 kw. steam turbine with condenser, and Whitney Foundry & Equipment Co., Harvey, Ill., for one 25 ton capacity, hand power crane for 45 ft. span.

Miscellaneous

Iroquois Falls, Ont.
Contemplated purchase of hotel furnishings by Abitibi Pulp & Paper Co. General contractor, Robt. Chapman, Porcupine. Three storeys, 35 x 70, 50 rooms.

London, Ont.
W. Metcalf, c/o Metcalf Agencies, 252 Dundas St. (manufacturer of rope-making machines), is in the market for special cast iron, malleable iron and general castings.

Montreal, Que.
New system of clocks for Board of Commrs. Sec., L. N. Senecal. Tenders received by Board of Commrs. until noon Dec. 18th for the supply and installation of an Electric Primary Self-Winding Clock System, in the City Hall Annex. Specifications, etc., at office of Purchasing & Sales Agent, City Hall.

Orillia, Ont.
Monument of Champlain to be erected in Couchiching Beach Park in August, 1915, cost $20,000. Competition open to British and French subjects. First prize $500.

Ottawa, Ont.
Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. Tenders received by Alex. Johnston until Jan 8, 1914. Plans, etc., at offices of Purchasing and Contract Agent at Dept., Ottawa, Collectors of Customs, Toronto, Collingwood, Port Arthur, and at agencies of above Dept., at Montreal, St. John, N.B., Halifax, N.S., and Victoria, B.C. Steel twin screw ice breaking steamer, length B.P. 275 ft.; breadth, extreme, 57 ft. 6 in.; draft, mean, 19 ft.; indicated h.p. 8,000. To be delivered at Quebec.

Parry Sound, Ont.
Conger Lumber Co. are open for quo-

tations on about 25,000 red brick, to reline burner at saw mill in March, 1914.

Port Lambton, Ont.
Machinery required by Mr. C. A. Sharp who is in charge of Canadian plant for manufacture of drain heads for owners, American Drainage Co., Dubuque, Iowa.

Stratford, Ont.
Fire apparatus required by City Council. Mayor, C. N. Greenwood. Apparatus will be purchased, some each year, out of general funds.

St. Hyacinthe, Que.
Cedar telegraph posts required by City Council. Clerk, A. Messier. Tenders to be called December 19th for five posts, 40 ft. long, to be at least 9-in. at small end and balance of carload 35 ft. long and 8-in. at small end.

South Vancouver, B.C.
Municipal Council. Clerk, Mr. Springford, Fraser & Wilson Road. Electrical Engineer Rawder has submitted two sets of plans, one for police alarm system of 25 boxes, estimated cost $10,000, the other for 50 box alarm system.

Tillsonburg, Ont.
Messrs. Magee & Jackson, Architects, Rolph St., wish catalogues and samples of building materials.

Toronto, Ont.
Travelling crane required by Board of Control. Mayor, H. C. Hocken. Tenders close Dec. 16th. Plans, etc., at Rm. 12, City Hall. One overhead hand operated traveling crane, working load 40,000 lbs., for Main Pumping Station.

Sun Brick Co. require one 40 h.p. boiler; 1 double drum engine with swinger attachment; one stiff leg, 5-ton derrick with 40 ft. boom, second-hand preferred. Information from Mr. Walker, Don Valley Works.

Complete mechanical filtration plant, boilers, steam turbo-generator plant and appurtenances for Toronto Island. Board of Control. Mayor, H. C. Hocken. Tenders close Jan. 20. Plans, etc., at office of Works Dept.

The Management Committee of Board of Education will recommend that individual lockers be provided for each pupil. Sec., W. C. Wilkinson.

Vancouver, B.C.
Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 3rd, for interior fittings for Customs Examining Warehouse. Plans, etc., at offices of A. J. Chisholm, caretaker, Public Bldg., Vancouver, W. Henderson, Residential Architect, Victoria, and at Dept., Ottawa.

Winnipeg, Man.
Steam locomotive with separate tender and snow plow for use on City's Tramway between Point du Bois and Lac du Bonnet. Specifications at office of Engineer, J. G. Glassco, 54 King St.

Business Notes

Beamsville, Ont.
Residence of Horace Whitton destroyed by fire. Loss $4,000, covered by insurance.

Brighton, Ont.
Hotel stables occupied by A. A. Wode, proprietor of Hotel Central, destroyed by fire. Loss about $5,000.

Cumberland, B.C.
Saw mill of Canadian Collieries (Dunsmuir) Ltd. 2,000,000 ft. lumber destroyed by fire, also valuable machinery. To be rebuilt at once.

Edmonton, Alta.
Warehouse of H. W. McKinney, M.P.P., destroyed by fire. Tenants, L. O. Rose & Co., tobacco, etc.; A. N. Moyer & Co., school furnishings; Otis Fensom Elevator Co.; National Drug Co. Loss about $45,000.

Ganges Harbor, B.C.
Hotel Ganges destroyed by fire. Loss $15,000, covered by insurance. To be rebuilt at once.

Montreal, Que.
Store of M. Wolfe, 462 St. Catherine W., destroyed by fire. Loss $7,000.

Electrical store of F. Nichols & Co., 119 Bleury St., destroyed by fire. Loss $8,000.

Pincher Creek, Alta.
Stores, etc., destroyed by fire. Hudson's Bay Co., Loss, buildings, $9,000, stock $3,000, insurance $30,000; Dr. Hewitson, residence, $3,500, insurance $2,000; F. S. Blake, building $2,000, insurance $1,500; Langton's livery and barn, loss $5,000, insurance $3,000; I. X. L. Blacksmith Co., building $4,000, insurance $2,000.

Yarker, Ont.
General store of D. B. Bowman destroyed by fire. Some insurance.

Trinidad Liquid Asphalt

For road preservation. Applied hot or cold, it forms a protective coating for road surfaces. Having the stability of the lake asphalt, it should not be confused with ephemeral dust preventives. Trinidad Liquid Asphalt is a permanent constructive agent; it *stays in the road*, and builds up a lasting asphaltic surface. Send for Booklets.

The Barber Asphalt Paving Co.
Philadelphia, Pa.

Crushed Stone, Limited

STONE of any Size and in any Quantity on hand for Sidewalks, Roadwork or Concrete Work

Works : Kirkfield, Ont.
Head Office : 47 Yonge St. Arcade, TORONTO
Phone Main 4516
G. W. ESSERY, Manager

Western Lumberman
Representing the Lumbering and Woodworking interests of British Columbia, Alberta, Saskatchewan and Manitoba.
Winnipeg, Man.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	28 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

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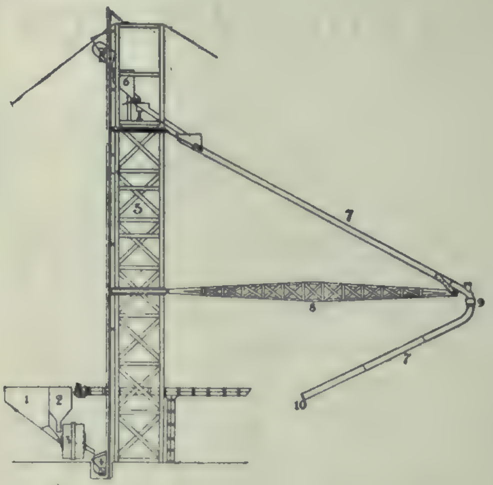

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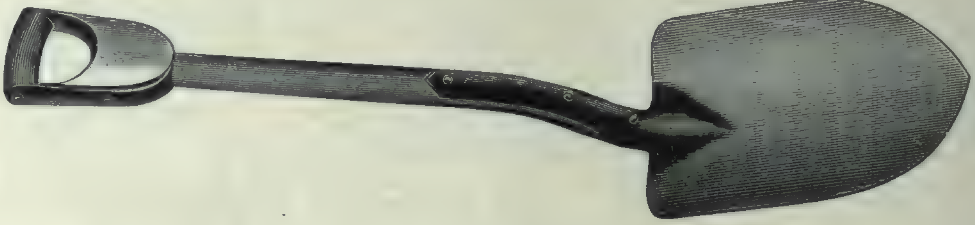

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Alphabetical Index of Advertisers
Page 16

Vol. 27 December 10, 1913 No. 50

Educational Facilities for the Clayworker

NEARLY a year ago one of our British contemporaries got hold of the idea that the Canadian Association of Clay Products Manufacturers were establishing a Chair of Ceramics at the University of Toronto. An editorial appeared in which we were complimented highly for the progressive part we were taking, and a line of comparison was even established between this country and Germany, which has long taken a pre-eminent place in the field of technical education. The mother country was represented as being put to shame by "one of her dependencies."

There are those who would immediately resent reference to Canada as a "dependency," but we must pass over this comparatively trivial point to one of the weightiest considerations which the clay-working interests have before them to-day and ask what has actually been achieved since the reports were given out which brought Canadian clay-workers into such unmerited prominence abroad. As a matter of fact nothing has been done since the Board of Governors of the University of Toronto recommended the establishment of a ceramic course, and unless further steps be taken in the near future the matter will end, for it is certain that with the deficit in the University's revenue shown in their recent statements, no funds will be appropriated for new work.

The last few years have been a period of unexampled prosperity for all identified with constructional work in Canada and it may be asserted without fear of contradiction that the clay-working industries have received rather more than a proportionate share of the harvest. If there has been such a strong desire to improve the status of the industry by placing it upon a professional basis through the medium of University courses, why have there been forthcoming no practical suggestions as to ways and means? The wherewithal of the University is not provided by any supernatural agency and the cleverest financier could not make a course of ceramics self-supporting. It is a question, then, of dollars and cents. This is generally recognised, but admitted only in whispers. The University authorities are in favor of starting a course and the laboratories already established at the University could be drawn upon for part of the equipment required. Not only that—one of the leading firms in the industry has offered to furnish whatever machinery and equipment may be required to bring the department right up-to-the-minute. But nobody has followed, and so we find ourselves in a cul-de-sac. One is forced reluctantly to the conclusion that Canadian clay-workers are generous with moral support but extremely parsimonious with financial support.

$ $ $ Must be Found

Having arrived at such a conclusion one cannot but take particular pleasure in declaring that the facilities for professional education can only be supplied at considerable cost and that the establishment of an up-to-date, well-appointed laboratory in charge of a competent lecturer and an assistant can only be effected at the cost of some sacrifice on the part of the trade.

A matter which is of equal if not of greater importance is to ascertain what provisions are being made by the city of Toronto for the clay-working interests in the new technical school. It can hardly be said that such an enquiry is timely, for it is long since overdue, other trades having concluded their arrangements and secured adequate representation.

There are excellent fields for both a University course and a technical school course. The latter is of the greater importance, perhaps, inasmuch as it provides night classes for the men who are actually doing the work and seeking higher attainment in their trade. It is through the technical school, only, that a higher standard of workmanship can be established in the near future. The benefits accruing to the trade from university facilities are further removed.

The technical school is calculated to promote, particularly, the interests of men specially adapted for practical work but lacking perhaps in executive ability. We have all met men of this type and most of us agree that it is in the best interests of clay-working that the ability of such men be used to the best possible advantage. Every clay works needs men who are strong in technical detail—men who can be relied upon to attend to both small and great matters in the operation of the plant with equal ability, care and promptitude. In all large firms there will be found, near to the top, at least one steady worker of this type—a type which is essentially the product of the technical school. The man at the top with the executive ability, or the capital, or the capacity for handling changes of policy, seldom, if ever, has anything to do with the inside of such a clay-working establishment. Nevertheless, the technical school produces the man that is the backbone of the industry.

On the one hand we enable the progressive mechanic to learn everything in connection with his practical work and on the other we provide our sons with a scientific training which will fit them to undertake all work of a theoretical nature—testing, formulation of theories, and so on.

But why dilate further upon the subject? Already too much has been written; too much has been said. What is required now is evidence of practical interest—of the kind that resolves itself into real money. When that is forthcoming it will be time to conjure up a vision of the high position which the clay-working industry in Canada may occupy some day. Meantime, we thank our friends across the water for their good intentions, but we fear we must regretfully decline the bouquets.

The Right Principle Reversed

THE contract for a mechanical filtration plant for the city of Toronto, details concerning which were published in our last issue, appears to be hedged about with specifications which are open to considerable criticism. The financial obligation placed upon the contractor is that his tender shall be accompanied by a marked cheque or cash deposit equal to 2½ per cent. of his contract price. This means no less than $25,000 on an estimate of $1,000,000. It is further stipulated that an amount equal to 80 per cent. of the work done and materials used shall be paid monthly by the city.

Continuing from the specifications:—"One year from the date on which all tests as to efficiency and capacity have been made and the general operation of the filter plant and all its accessories and appurtenances have been found satisfactory to the Commissioner, the Corporation shall, after such final estimate has been made and approved by the Council, pay the entire sum so found to be due hereunder after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provision of the contract."

This means that twenty per cent. of the contract money is retained for from sixteen to eighteen months after the installation is completed—a sum of no less than $200,000 if we revert to our basis of an estimate of $1,000,000!

A bond for the proper performance of the contract is called for in a section of the specifications.

Under such stringent financial obligations tenders are practically limited to large United States companies or to wealthy contracting firms in Canada who are not manufacturers of filters. On the face of it this is a restriction of competition, as all the filters which are well known in the States are manufactured under license from one firm. British firms conduct business from Britain with agents in Canada and they would be foolish to bond themselves to such an extent, seeing that fifty per cent. of the work will be done under contractors in Canada of whom they know little or nothing.

When one million dollars' worth of standard work is done, its market value should be at least $500,000. This amount, added to the $200,000 retained by the city, would give a security of $700,000. Surely if the only object were to secure the city, this sum should be sufficient! Why, then, a limitation which practically means the exclusion of British products?

We cannot but think that these restrictions are unnecessarily severe and accordingly wrong in principle. Here we have practically closed competition with a maximum limitation. What we should have with public money is open competition with the minimum limitation. It is procedure framed on the last-named principle only which will enable us to secure the best in design and construction.

Brick at the Builders' Exchanges

BRICK has long been displayed at builders' exchanges. It was perhaps among the very first articles put on display, and it has always been a familiar product, but has it always been made enough of a live issue, asks The Clayworker.

This question was brought to mind recently in course of a discussion at a builders' exchange in which a member of the exchange said something about concrete and asked some things along the line that led to the remark that we were fighting the battle of brick and clay products. His reply to this was, "You are fighting for a cause already lost." Perhaps he was thinking of some specific instance or work in which concrete has replaced common brick, and perhaps he didn't mean just all he said or think how it would sound, but the fact that this expression could be made by a member of a builders' exchange to-day and a member not directly interested in any rival line of building material, is enough to stir to action the brick manufacturers throughout the country.

It is possible that brick manufacturers have displayed samples of their product in builders' exchanges all along and have taken too much for granted the idea that the good qualities of brick were known and understood and needed no elaboration. It is just such resting on laurels of this kind and permitting things to go along without active exploitation and keeping the subject alive that makes a lot of room for other fellows to come along and spring something new and keep it before the public so continuously that they will forget about other things and go so far as to imagine that brick belongs to the class of has-beens.

In view of all this, it appears to us that it behoves the brick manufacturers in all the cities where there are builders' exchanges to get busy and have a readjustment of matters and a thorough stirring up. Develop some new ideas as to display and see that brick and other clay products are so conspicuously displayed that they will attract attention, and then, above all, see to it that the subject is brought to the minds of the members and visitors in such a manner that there will be no chance for the idea to gain ground that brick is a lost cause in competition with concrete or anything else. We know it is not, but that doesn't keep it from hurting when an expression of this kind is heard on the outside, and it should hurt the average brick manufacturer enough to arouse his energy and stir things up in connection with builders' exchanges. The more the subject of building material is stirred up and agitated the more it will make favor for brick, because the more thoroughly those things are aired and sifted down by analytical study the more certain it is that brick and other burned clay products will stand out conspicuously in home building as well as the erection of big fireproof structures.

A German inventor has taken out an English patent for an enamel substance which is claimed not to require heat to produce the glaze on pottery ware. The ware or articles are submerged in the mixture, and after being in contact with it for a certain time are taken out to dry, and the glazing is done. The substance is made by thoroughly mixing three parts of glowing magnesium oxide of a specific gravity of 3.0 with four parts of saturated cold watery solution of magnesium chloride. To this mixture is added a solution of shelac or sandrac gum in alcohol, in the proportion of 25 to 100.

Production of Clay Products in Canada*

Comparative Statistics Reveal Gratifying Progress and Many New Records—Largely Increased Imports of Brick and Tile

By John McLeish, Chief of the Division of Mineral Resources and Statistics, Ottawa

THE utilization of mineral and material products of the earth, in our present scheme of existence, may be said to be of as great importance almost as the production of food or the actual means of sustaining life itself. Modern civilization tends towards a most complicated interrelationship of all human activities and under these conditions the great harvests of life's necessities could not be secured or kept without the aid of the products of the mine. Whether the price of land goes up, or whether it goes down, wheat must be grown, buildings constructed and means of transportation provided.

Amongst materials of construction, clay is at once the most abundant and one of the most extensively used. Canada is at present absorbing annually from outside sources, a population equivalent to about five per cent. of her population over and above the natural increase. This growth, or development which seems destined to continue as long as we have suitable agricultural lands to settle, must of necessity be accompanied by constructive activity of all kinds—railways, highways, public works, commercial and private building, etc., greatly in excess of the normal. Such a period of intensive development has now been in progress for some years and a rapid increase in the production of structural materials of all kinds is shown in the annual records collected and published by the Department of Mines at Ottawa. Since this record is collected only once a year and the period of time covered is the calendar year, it will be some months yet before a complete record for the year 1913 is available, but from what is known of the activity of the industry during the year, and if the imports during eight months may be taken as a criterion of consumption, it seems safe to assume that the clay industry during 1913 has made similar records of progress to those which it achieved in 1912. During eight months of 1913, the imports of clay products exceeded in value by 13 per cent. the imports during the corresponding period of the previous year.

Although this review is intended to deal primarily with clay products, it may be remarked in passing that the total value of the production during 1912 of materials of construction, such as cement, clay, lime, building and other stone, etc., was $28,794,869, an increase of nearly 27 per cent. over the production in 1911; which was valued at $22,709,612; and comparing with a production valued at $19,627,592 in 1910; $16,533,349 in 1909, and $11,339,955 in 1908. These statistics should be used in a comparative rather than in an absolute sense because of the probable incompleteness of the record of production of sand and gravel, and of stone.

Of the total value of these materials of construction produced in 1912, about 36 per cent. consisted of clay products, valued at $10,575,869. The production in 1911 was valued at $8,359,933, thus showing an increase in 1912 of $2,215,936 or over 26.5 per cent. During the past few years many new plants have been erected both in eastern and western Canada. For the year 1912 about 459 active firms reported, as against 419 firms active in 1911, and 438 firms in 1910. The average number of men employed in 1912 was 10,415, as compared with 9,131 in 1911 and 8,656 in 1910. The total wages paid in 1912 were $4,488,957, as against $3,524,058 in 1911.

Of the several provinces Ontario is by far the largest producer of clay products, being credited in 1912 with 46 per cent. of the total value of the output, as compared with 47 per cent. in 1911. Quebec contributed 16 per cent. of the total output in both years. Alberta about 12.5 per cent.; Manitoba 10 per cent., and British Columbia 8 per cent. in 1911, and 9.4 per cent. in 1912.

Of the total value of the production in 1912, building and paving brick, including fireproofing, contributed $9,163,666, or about 86 2/3 per cent.; sewer pipe and tile production were valued at $1,242,503, or 11.7 per cent. of the total. The total value of the production of pottery was reported as $426,589, of which $43,955 is estimated as attributable to Canadian clays, the balance to imported clays; the value of the production of fireclay and firebrick was $125,585. Compared with the previous year, the production of building, paving and fireproofing brick, shows an increase of about 30 per cent., while the aggregate production of sewer pipe and drain tile, shows a slight falling off.

Exports and Imports

The only export of clay products recorded is that of building brick, of which the exports in 1912 were 694,000, valued at $8,493, and manufactures of clay valued at $256. In 1911 the exports were: building brick 394,000 valued at $3,997, and manufactures of clay valued at $2,071.

The imports of clay products, and of clay, reached a total value during the calendar year 1912 of $6,592,540, equivalent to about 62 per cent. of the domestic production. The total imports in 1911 were valued at $5,156,544, showing an increase in 1912 of $1,435,996, or nearly 28 per cent., as against an increase in 1911 over 1910 of 19 per cent. In both years the imports have increased at a higher rate than the domestic production. Clay imports are classified by the Department of Customs under three main subdivisions, including: brick and tile, earthenware and chinaware, and clays. The imports of clays in 1912 were valued at $288,394 and included chiefly china-clay and fireclay, with a small quantity of pipeclay and other clays not classified. The value of china-clay imports was $127,402, and of fireclay $140,500. In 1911 the total value of the imports of clays was $270,247, and included china-clay valued at $125,768 and fireclay valued at $125,199. The imports of these clays have varied considerably from year to year, and do not show the same general increase as do the imports of manufactured clays. The imports classified under brick and tile, were valued in 1912 at $3,209,190, of which about 28 per cent. was firebrick, other important items being: building brick, sewerpipe, and paving brick. There was also an importation under this class of manufactures of clay not specially designated, valued at $818,467. The value of the imports of brick and tile in 1911 was $2,369,761, of which about 34 per cent. was firebrick. The imports during 1911 of manufactures of clay not specially designated, were valued at $523,998. The imports of these unclassified brick and tile have increased steadily year by year, the value of such imports in 1905 having been only $20,804. The increase in the imports of brick and tile in 1912, as compared with 1911 was a little over 35 per cent. The imports of earthenware and chinaware, of which the most important class is tableware, were valued in 1912 at $3,094,956, as against $2,516,536 in 1911, or an increase of about 23 per cent.

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* Specially contributed by permission of the Director of Mines.

Imported clay products are derived chiefly from Great Britain and the United States, although considerable quantities of earthenware, china, and porcelain ware, white granite or ironstoneware, etc., are brought from Germany, France, Austria-Hungary and Japan. Of the brick and tile imported 82 per cent. was from the United States and 17.9 per cent. from Great Britain; and only $2,045 worth from other countries. Of the earthenware and chinaware, 60 per cent. was imported from Great Britain; 16 per cent. from the United States; 12 per cent. from Germany; 5 per cent. from France, and considerable values also from Japan, Austria-Hungary, and other countries. The crude clays were imported principally from Great Britain and the United States.

In thirteen years Canada has imported clay products to the value of $35,396,706. The increase in imports has been most pronounced in the case of brick and tile, the imports of which in 1900 amounted to $145,914, as compared with $2,462,181 in 1912. The imports of earthenware and chinaware have almost doubled in the same time.

Ratio of Production to Consumption

A comparison of statistics of imports with those of production is instructive. It will be observed that the total value of the imports in 1912 was $6,592,540 (not including certain items probably covering clay products) and after deducting a small export, a total approximate consumption of clay products valued at $17,160,660 is shown, of which about 62 per cent. was of domestic production.

In 1911, the approximate consumption was valued at $13,516,477, of which about 62 per cent. was of domestic production. In 1909 the approximate consumption was valued at $9,172,995, of which about 70 per cent. was of domestic production.

While the imports of building brick continues to increase the total value is still small compared with the home production. In the case of paving brick, however, the imports are about double, and of firebrick nearly eight times the Canadian output. The imports of sewer pipe have also increased much more rapidly than the production during the past year.

Clay Building Brick

In 1912 the total sales were 894,371,954, valued at $8,620,229, made up of 769,191,532 common, valued at $7,010,375, or an average value per thousand of $9.11; and 125,180,422 pressed brick, valued at $1,609,854, or an average value per thousand of $12.86. In addition to the common and pressed brick there was a production of ornamental brick of 371,356, valued at $8,595, and a production of fireproofing brick and architectural terra-cotta, valued at $448,853.

There were 459 active firms reporting in 1912, as compared with 419 firms in 1911, and 397 firms in 1910.

The exports have never been large, averaging for a number of years past about $6,000 per annum. The exports fell off somewhat in 1911 to a value of $3,977, but increased again in 1912 to a value of $8,493. The annual imports for a number of years previous to 1903 averaged only about $20,000 in value, during the past nine years, however, the imports have rapidly increased from $100,000 to nearly $800,000 per annum. During the calendar year 1912, the imports were 81,425,000 brick, valued at $763,470, of which 3,071,000, valued at $32,731, or an average of $10.66 per thousand, were imported from Great Britain and 78,350,000, valued at $730,739, or an average of $9.33 per thousand, from the United States. The imports during the calendar year 1911 were 51,102,000 brick, valued at $475,865, of which 6,404,000, valued at $72,675, or an average of $11.35 per thousand, were imported from Great Britain, and 44,698,000, valued at $403,190, or an average of $9.02 per thousand, from the United States.

Nova Scotia and New Brunswick.—There was a slight falling off in the production of brick in Nova Scotia in 1912 and a small increase in the production in New Brunswick. Comparatively little pressed brick is made. The total value of the output in Nova Scotia was $130,108 and the chief sources of production, Annapolis Royal, Middleton, Pugwash, Mira Gut, River Denys and New Glasgow. A feature of special interest during 1912 was the consolidation of the clay working plants at Annapolis Royal, Bridgetown, Middleport, Pugwash and Elmsdale, under the name of the Nova Scotia Clay Works, Limited.

The total value of the production in New Brunswick was $53,350 and the principal sources of production, Fredericton, St. John, Little River, Chatham and St. Stephen.

Quebec.—The total production of brick in Quebec in 1912 is reported by 74 operating firms as 173,336,557, valued at $1,446,880, comprising 161,836,557 common brick, valued at $1,308,380, or $8.08 per thousand, and 11,500,000 pressed brick valued at $138,500 or $12.04 per thousand.

The production by 60 active firms in 1911 was reported as 122,041,580 brick, valued at $1,033,270.

While brick-making is carried on at many places in the province, the principal plants are located at La Prairie, Sherbrooke and St. Jean des Chaillons.

Ontario.—Over 44 per cent. of the brick production in Canada in 1912 was made in Ontario, the total sales as reported by 271 firms being 423,670,184, valued at $3,807,195, and including 350,461,874 common brick valued at $3,045,840, or an average of $8,69 per thousand, and 73,208,310 pressed brick, valued at $761,355, or an average of $10.40 per thousand. The total sales in 1911 as reported by 262 operating firms were 369,004,371 valued at $3,028,046, and comprised 318,670,621 common brick, valued at $2,513,965, or an average of $7.89 per thousand, and 50,333,750 pressed brick, valued at $514,081, or an average of $10.21 per thousand.

The city of Toronto and vicinity, including the counties of York and Halton, is the principal brick making section and in 1912 produced about 52 per cent. of the Ontario production, or about 23 per cent. of the total Canadian production of brick. The district next in importance, is the county of Wentworth, comprising the city of Hamilton and vicinity, producing nearly 11 per cent. of the Ontario production. The Ottawa district, including the counties of Russell and Carleton, produced over 7 per cent. The greater part of the pressed brick, reported as such, was made in the Toronto and Hamilton districts.

In addition to the ordinary clay building brick, there was produced in this province in 1912 ornamental brick valued at $7,168, and fireproofing and terra cotta valued at $135,087. In 1911 the production of ornamental brick was valued at $7,441, and of fireproofing and terra cotta $51,080.

Manitoba.—The production of clay building brick in the province in 1912 as reported by 21 firms, was 87,178,937, valued at $1,012,801, comprising 83,681,237 common brick, valued at $957,854, or an average of $11.47 per thousand, and 3,497,700 pressed brick, valued at $52,947, or $15.13 per thousand. The production as reported by 18 firms in 1911 was 81,400,000, valued at $826,928, and included 79,600,000 common brick, valued at $805,178, or $10.11 per thousand, and 1,800,000 pressed brick valued at $21,750, or $12.08 per thousand.

The principal brick-making plants are located at Winnipeg, St. Boniface, Morris, Lac du Bonnet, Portage La Prairie, Sidney, Brandon, Gilbert Plains, Virden, Balmoral, Lavenham, Neepawa, and Whitemouth.

Saskatchewan.—Returns from 14 operating firms show a production in 1912 of 30,538,771 brick, valued at $332,943, which includes 25,338,771 common brick, valued at $246,443, or an average of $9.73 per thousand, and 5,200,000 pressed brick valued at $86,500, or an average of $16.63 per thousand. The total production in 1911 by 13 firms was 21,071,660 brick valued at $224,758.

The principal clay plants are located at Estevan, Prince Albert, Saskatoon, Weyburn, Rosthern, Verigin, Arcola and Broadview.

Alberta.—The production of building brick has been increasing very rapidly and in 1912 the production in this province was surpassed only by Ontario and Quebec. During the past year the sales as reported by 33 active firms were 93,759,980 brick, valued at $1,105,912, as compared with sales by 28 firms in 1911 of 71,772,930 brick valued at $779,001. The 1912 output comprised 70,074,568 common brick, valued at $755,986, or an average of $10.69 per thousand, and 23,685,412 pressed brick, valued at $349,926, or an average of $14.77 per thousand. In addition to building brick there was a production in this province during 1912 of fireproofing valued at $248,712.

The principal centres of production are Edmonton, Cochrane, Calgary, Medicine Hat, Redcliff, Lethbridge, Red Deer, Brickburn, Innisfail and Vermilion.

British Columbia.—The brick-making industry has also grown rapidly in British Columbia, the increase of production of 1912 over 1911 being 64 per cent. During 1912 the total sales were 61,284,565, valued at $731,040, and included 53,345,565 common brick, valued at $512.514, or an average of $9.61 per thousand, and 7,939,000 pressed brick, valued at $218,526, or an average of $27.53 per thousand. In 1911 the total sales were 39,680,515 brick, valued at $443,829. There were 28 active firms engaged in brick-making in 1912, as compared with 19 in 1911.

The principal centres of manufacture are Vancouver, New Westminster, Clayburn, Cloverdale, Bazan Bay, Pender Island, Port Haney and vicinity, Anvil Island, Victoria and Sydney.

Paving Brick

The total production of paving brick and paving blocks in Canada in 1912 was reported as 4,579,500, valued at $85,989, or an average value per thousand of $18.78, as compared with a production of 5,220,400, valued at $79,444, or an average value of $15.22 per thousand in 1911.

This paving brick is made chiefly at West Toronto, Ontario, from shale obtained from the banks of the Humber river, although during 1912 there was also a small production reported at Pender Island, near Vancouver, B.C.

The annual production has for a number of years varied from three million to over five million per season, and the output finds a market chiefly in Toronto.

The imports of paving brick during the past four years have considerably exceeded the domestic production. During the calendar year 1912 the imports were 11,793,000, valued at $160,663, or an average value of $13.62 per thousand, and included 6,709,000, valued at $95,610, or $14.25 per thousand from the United States; 5,044,000 valued at $64,375 or $12.76 per thousand from Great Britain; and 40,000 valued at $678 or $16.95 per thousand from other countries.

Fireclay and Fireclay Products

There are a number of clays from different localities in Canada that have been used in the manufacture of refractory brick, or firebrick and for furnace linings, etc., which have been usually termed "fireclays." These include clays found with the coal measures at Westville, Nova Scotia, and at Comox, Vancouver Island, also clays found south of Moose Jaw, Sask., and at Clayburn, near the city of Vancouver, B.C. Stove linings and other refractory clay products are made at several places in Ontario and Quebec from imported clays.

The total value of the sales of fireclay, firebrick, and fireclay products in 1912, was $125,585, as compared with a valuation of $89,130 in 1911, and $50,215, in 1910. There was in addition in 1912 a production of fireclay products valued at $25,000 reported as being made from imported clays.

The production in 1912 included fireclay or refractory clay sold as such to the extent of 6,307 tons, valued at $24,343; firebrick 3,429,594 valued at $67,192, or an average of $19.59 per thousand; and other fireclay products valued at $34,050.

The imports of firebrick during the calendar year 1912 were valued at $953,621, of which $860,587 worth was imported from the United States; $91,236 from Great Britain, and $1,798 from other countries. Fireclay was imported for the calendar year 1912 to the value of $140,500, as compared with a value of $125,199 in 1911, and $124,293 in 1910.

Sewerpipe and Drain Tile

The total value of the sales of sewerpipe in 1912 was $884,641, as compared with a value of $812,716 in 1911, and a value of $774,910 in 1910. About 54 per cent. of the production in 1912 was made in Ontario.

The imports of drain pipe and sewerpipe during 1912 were valued at $507,024, of which $431,600 was imported from the United States; $75,394 from Great Britain, and $30 from other countries.

The total value of sales of drain pipe in Canada in 1912, as reported to this Branch was $357,862, as compared with $339,812 in 1911, and $370.008 in 1910. The greater part of this production is in the province of Ontario, the sales in this province in 1912, as reported to this Branch were valued at $308,050, as against a value of $300,029 in 1911, and $334,402 in 1910.

The Ontario Bureau of Mines reports the total

PRODUCTION OF CLAY PRODUCTS BY PROVINCES, 1912.

Province	No. of active firms reporting	No. of men employed	Wages	Common Brick				Pressed Brick			
				No. manufactured	No. Sold	Value of Sales	Per M	No. Manufactured	No. Sold	Value of Sales	Per M
			$			$	$ c.			$	$ c.
Nova Scotia ...	11	316	98,939	20,095,202	18,722,960	128,508	6.86	220,000	100,000	1,600	16.00
New Brunswick.	7	148	45,536	6,179,000	5,730,000	52,850	9.22	50,000	50,000	500	10.00
Quebec.	74	1,917	645,221	181,219,323	161,836,557	1,308,380	8.08	10,386,454	11,500,000	138,500	12.04
Ontario.	271	4,696	2,060,542	356,964,931	350,461,874	3,045,840	8.69	75,231,791	73,208,310	761,355	10.40
Manitoba	21	1,088	405,926	83,556,437	83,681,237	959,854	11.47	3,450,000	3,497,700	52,947	15.13
Saskatchewan ..	14	383	152,654	24,603,771	25,338,771	246,443	9.73	5,950,000	5,200,000	86,500	16.63
Alberta	33	1,053	587,223	73,394,693	70,074,568	755,986	10.69	25,798,410	23,685,412	349,926	14.77
British Columbia	28	814	492,916	56,569,470	53,345,565	512,514	9.61	8,210,800	7,939,000	218,526	27.53
Totals. ...	459	10,415	4,488,957	802,582,827	769,191,532	7,010,375	9.11	129,297,455	125,180,422	1,609,854	12.86

Province	Paving Brick		Ornamental		Firebrick and fireclay shapes, Value	Fireproofing and terra cotta, etc., Value	Pottery, Value	Sewerpipe, Value	Tiles drain, Value		Total value Clay products
	No. Sold	Value	No. Sold	Value							
		$		$	$	$	$		$	$	$
Nova Scotia	....	......	......	......	15,375	1,270	......	115,000	10,300	......	272,053
New Brunswick. ...	......	......	......	......	....	.. .. ..	......	......	1,560	......	54,910
Quebec.	......	......	......	......	25,000	42,530	500	165,000	390	160	1,680,460
Ontario	4,554,500	85,589	352,816	7,168	......	135,087	43,455	478,156	308,050	......	4,864,700
Manitoba	....	......	......	......	......	......	......	......	5,250	......	1,018,051
Saskatchewan .. .	....	......	......	......	......	......	......	......	......	......	332,943
Alberta	....	......	10,000	1,000	......	248,712	......	......	560	......	1,356,184
British Columbia .	25,000	400	8,540	427	85,210	21,254	......	126,485	31,752	......	996,568
Totals	4,579,500	85,989	371,356	8,595	†125,585	448,853	*43,955	884,641	357,862	160	10,575,869

*There was also a production of 383,154 from imported clays.
†Also a production of $25,000 from imported clays.

PRODUCTION OF CLAY PRODUCTS BY PROVINCES, 1907-1912.

Province	1907	1908	1909	1910	1911	1912
	$	$	$	$	$	$
Nova Scotia ...	125,560	117,833	188,185	204,782	274,249	272,050
New Brunswick ...	57,377	75.513	65,570	56,475	38,000	54,910
Quebec ...	1,214,108	893,717	1,153,832	1,442,842	1,341,467	1,680,300
Ontario ...	3,123,372	2,476,152	3,425,841	3,667,810	3,916,575	4,864,700
Manitoba ...	466,432	265,091	559,008	781,605	834,428	1,018,051
Saskatchewan ...	125,459	87,566	145,516	160,850	226,958	332,943
Alberta ...	353,672	240,384	442,486	753,232	1,052,751	1,356,184
British Columbia ...	306,137	344,446	470,402	562,360	675,505	996.568
	5,772,117	4,500,702	6,450,840	7,629,956	8,359,933	10,575,709

IMPORTS OF CLAY PRODUCTS, 1907 TO 1913.

Imports	9 months ending March, 1907	12 months ending March, 1908	12 months ending March, 1909	Calendar year 1909	Calender year 1910	Calendar year 1911	Calendar year 1912	8 months ending August, 1913
Brick and tile:—	$	$	$	$	$	$	$	$
Bath brick ...	1,076	1,834	4,432	1,495	2,290	2,623	1,927	1,635
Building brick ...	88,144	139,105	108,773	195,360	274,482	475,865	763,470	400,374
Paving brick ...	23,256	61,346	101,187	139,366	124,994	164,292	160,663	110,340
Firebrick, of a class or kind not made in Canada.	*506,801	639,347	350,457	485,994	811,927	814,414	953,621	698,636
Drain tile, not glazed ...	12,106	2,080	2,394	2,785	4,485	5,640	4,018	8,021
Drain pipe, sewerpipe, and earthenware fittings therefor, chimney linings or vents, chimney tops and inverted blocks, glazed or unglazed.	93,458	125,747	106,399	170,280	175,599	382,929	507,024	338,254
Manufactures of clay, N.O.P. ...	45,845	110,097	141,391	254,170	361,996	523,998	818,467	520,829
Total ...	770,686	1,079,556	815,033	1,249,450	1,755,773	2,369,761	3,209,190	2,078,089
Earthenware and chinaware:—								
Brown or colored earthenware and stoneware, and Rockingham ware ...	9,625	22,847	28,273	36,673	53,413	52,100	62,161	44,391
C. C. or cream colored ware, decorated, printed or sponged, and all earthenware, N.O.P. ...	154,879	239,513	197,623	219,936	202,475	184,291	291,804	172,979
Demijohns, churns, or crocks ...	9,342	17,836	10,571	8,888	6,607	4,933	18,404	21,662
Tableware of china, porcelain, white granite or ironstone ware ...	902,798	1,555,517	1,202,537	1,212,365	1,545,538	1,718,582	2,068,362	1,507,610
China and porcelain ware, N.O.P. ...	134,675	109,446	87,798	87,467	95,509	62,025	71,751	30,731
Tiles or blocks of earthenware or stone prepared for mosaic flooring ...	62,547	45,836	43,299	56,974	90,524	123,200	160,082	119,624
Earthenware tiles, N.O.P. ...	67,027	116,480	79,854	81,393	125,772	154,351	239,391	194,332
Manufacture of earthenware, N.O.P ...	81,987	83,309	66,932	78,063	163,278	217,051	183,001	174,676
Total ...	1,422,880	2,190,784	1,716,887	1,781,759	2,283,116	2,516,536	3,094,956	2,266,005
Clays:—								
China-clay, ground or unground ...	78,772	97,236	90,922	100,066	142,125	125,768	127,402	113,409
Fireclay, ground or unground ...	85,044	155,873	77,146	86,161	124,293	125,199	140,500	92,352
Pipeclay, ground or unground ...	307	319	887	310	114	1,786	234	340
Clays, all other, N.O.P. ...	14,117	14,292	21,280	29,793	25,976	17,494	20,258	16,848
Total ...	178,240	267,720	190.235	216,330	292,508	270,247	288,394	222,949
Grand total ...	2,371,806	3,538,060	2,722,155	3,247,539	4,331,397	5,156,544	6,592,540	4,567,043
Baths, bath-tubs, basins, closets, lavatories, urinals, sinks and laundry tubs of any material	62,547	234,505	157.881	211,837	262,667	285,847	382,920	326,439
Chalk, china or cornwall stone, cliff stone and feldspar, fluorspar, magnesite, ground or unground ...	7,376	72,467	81,675	96,747	121,959	147,640	167,990	101.974

*Includes stove linings, N.E.S.

number of drain tile made in that province during 1912 as 16,463,000, valued at $279,579, or an average of $16.98 per thousand, as compared with 21,630,000, valued at $349,545, or an average of $16.16 per thousand in 1911.

The imports of unglazed tile are comparatively small, the value during the calendar year 1912 being $4,018 only, as compared with $5,640 in 1911, and $4,485 in 1910.

Pottery and Earthenware

The pottery made from Canadian clays has been, hitherto, chiefly of the common grades, such as flower-pots, jardinieres, crocks, jars, churns, etc. A number of potters make a higher grade product of stoneware, but the majority of these use imported clays. Sanitaryware is made at St. Johns, Que., and other points; but the raw material, including clays and feldspar, is nearly all imported.

The total value of the production of pottery and clay sanitaryware in 1912, according to returns received, was $427,089, of which it is estimated that the value of $383,134 is attributable to imported clays. The total value of the production in 1911 was reported as $439,264, of which a value of $336,771 is credited to imported clays. The large falling off in Canadian production in 1912 is chiefly due to the destruction by fire of a large pottery works in Quebec.

The imports in 1912 were valued at $3,094,956, as compared with a value of $2,516,536 in 1911, and $2,283,116 in 1910. These imports are subdivided into eight classes, and in 1912 include: brown or coloured earthenware, etc., $62,161; C.C. or cream coloured ware, decorated, printed, or sponged, etc., $291,804; demijohns, churns, or crocks, $18,404; tableware of china, porcelain, white granite, etc., $2,068,362; china and porcelain ware, N.O.P., $71,751; tiles or blocks of earthenware, or stone prepared for mosaic flooring, $160,082; earthenware tiles N.O.P., $239,391; manufactures of earthenware N.O.P., $183,001.

There has been a general increase in almost all classes of earthenware and chinaware imported. Great Britain is the principal source of the imports of this class of products, but quite large supplies are also obtained from the United States, Germany, France, Austria-Hungary, Japan, Belgium and other countries.

Kaolin

A production of kaolin is reported in Canada for the first time in 1912, the total sales being 20 tons, valued at $160. This was obtained from the deposits located on parts of lots Nos. 4, 5, 6, 7 and 8 of range VI. south, township of Amherst, Ottawa county, Que., which were opened up by the Canadian China Clay Company, of Montreal.

The plant for refining the clay is situated two miles from St. Remi d'Amherst, and seven miles from Huberdeau, the terminus of the Canadian Northern Quebec Railway—ninety-four miles northwest of Montreal.

The imports of china-clay, ground and unground, into Canada during the twelve months ending December 31, 1912, were 18,332 tons, valued at $127,402, or $6.95 per ton, as against an importation of 18,819 tons, valued at $125,768, or an average of $6.68 per ton in 1911. These figures indicate to some extent at least the present actual demand for this product. The imports of earthenware and chinaware were, however, valued at $3,094,956 in 1912, and composed chiefly of tableware of china, porcelain, etc., showing the possibilities for the development of industries utilizing china clays.

Kaolin, or china-clay is also in considerable demand in the United States, the imports into that country in 1911 being valued at $1,461,068.

Discovery of a Roman Pottery

A RECENT report of the excavations at Corstopitum shows that a Roman pottery of importance was at one time established there. The remains of a house have been discovered, the northern half of which was clearly devoted to the manufacture of pottery. "In the north-east room," says the report, "two small tanks were found, constructed of flags set on edge and abutting against the north wall; they were filled with clay, apparently unworked, and a considerable heap of the same material was found near them, lying on the latter floor level, which was eight to twelve inches above the original floor, the latter being about 2 feet 9 inches below the present surface. The adjacent chamber to the west showed similar levels, and in each of these rooms, on or above the latter floor, a large quantity of unbroken pottery was found, which had evidently been manufactured on the spot from clay found in the neighbourhood. The ware was coarse, and most of it of a yellowish brick-red colour, but some fragments had been fired in a muffled kiln and showed a dull purple. Several types of vessel were represented, the most noteworthy being flat dishes, some of which had been a large size. The kiln adjoined the west wall of the second of these rooms. It was 9 feet long and 2 feet 2 inches wide, and was floored with flat tiles, 8 inches square and 1¾ inches thick; the sides were of masonry, with two flues, 6½ inches wide, on either side. Apparently the ends had been stopped and the top domed with clay at each firing, as a large quantity of burnt clay was found in the kiln, as well as broken pottery of the same character as that already mentioned; and, in order to gain access to the north end, a portion of the original north wall of the house had been taken down, and rebuilt in the space which had previously divided this house from the building on the northern half of the site. To the south of the brick flooring, and on the same level, was a floor of clay, 2 inches thick, lying on a layer of good opus siginum. The discovery is of particular interest, as confirming the indications found in previous years of the manufacture of pottery at Corstopitum; but the quantity of fragments unearthed was so large that it has been thought advisable to defer a more detailed description, which, it is hoped, will be included in a future report.

In a paper read before the London section of the Society for Chemical Industries, by W. G. Hancock, he described a new method for the testing of various physical properties of clays. He has arrived at the conclusion that the specific weight of clays is between 2.6 and 2.7. The plasticity is determined by the amount of water which it takes to make the body from the dry state to plastic moulding state. The degrees of plasticity is thus determined by the formula $a/b \times 100$, in which a represents the pounds of water used, and b the pounds of clay used. In order to test the porosity, the test pieces are immersed in water, but only in such a way as to leave the surface of the test pieces above the water in order to give the enclosed air in the test pieces a chance to escape. The time of immersion is twenty-four hours.

The Part of Clay Products in the Municipal Engineering Field

By S. Barlow Bennett, City Engineer, Nanaimo, B.C.

THE variety of topics which may be included under the term Municipal Engineering make this subject an extensive and difficult one to deal with in the short space at my disposal.

At the present time the municipal engineering field includes the construction of sidewalks, pavements, sewers, waterworks, bridges and the necessary buildings for carrying on municipal affairs, such as city offices, fire halls, schools and markets. Consequently when the part that clay products takes in these varied and important undertakings is considered, one is apt to exclaim: "Give me a few acres of clay and shale lands, together with a sufficient supply of coal, and I will erect a brick works and a cement factory. Next, supply me with efficient labor in quantity and quality and I will undertake to produce for the benefit of the community the finest city in the Dominion—equipped with good sidewalks, pavements, reservoirs, and all the necessaries required to make a city an ideal place." Strange that all these desirable and beneficial improvements can be achieved from that much neglected and maligned occupation of the clay worker—the manufacturer of clay products!

It is remarkable that clays and shales of exceptionally good quality, and in quantity of an unlimited amount, are found in various parts of Canada, but we are badly in need of records of accurate analysis, together with details of trials of the various bodies obtained by the mixing of different clays. It was through patient investigation, disappointments and stubborn perseverance that such men as Palissy, Wedgwood, Flaxman and, later, Doulton, Twyford and Minton, raised the art of the clay-worker to so high a position in the old country.

At the present moment on Vancouver Island we have several companies producing clay products. One of the most important of these is the Nanaimo Brick and Tile Works. This company is now producing some excellent clay products, as will be seen from the illustration, but the firm is just in its infancy and is frequently handicapped because the operators have not yet gained that experience which can only be obtained by chemical and geological analysis, combined with the patient working of an innumerable amount of tests and trials. Again, these undertakings can only be worked to success when the country has reached that state of development which demands substantial buildings, good roads, sidewalks and sewers, and can provide sufficient railway trackage for successful transportation.

On all sides the use of cement is increasing by leaps and bounds. It becomes the basis on which good municipal development can proceed. On cement depend good roads, good sidewalks, good reservoirs and good permanent buildings. It is estimated that a barrel of Portland cement will consume in its manufacture about 450 pounds of limestone, and 150 pounds of clay or shale. A plant making 1,000 barrels of cement daily will therefore use in the course of an ordinary year about 66,000 tons of limestone and 22,000 tons of clay or shale. Assuming the average density for these materials, a 1,000-barrel plant will use up almost 1,000,000 cubic feet of limestone and 250,000 cubic feet of shale yearly. As the investment in plant is heavy, it would be folly to locate a cement plant, under ordinary circumstances, at a point where less than twenty years' supply of raw material is in sight. A 1,000-barrel plant, therefore, should have 20,000,000 cubic feet of limestone and 5,000,000 cubic feet of clay or shale on its properties. This may appear to be a very considerable

Exhibit awarded special diploma at the Annual Agricultural and Industrial Exhibition, New Westminster, B. C.

amount, but when it is calculated that one acre—that is, a space about 40 yards by 120 yards, and this area 10 yards deep—will give 1,296,000 cubic feet, it will be readily seen that an area of about forty acres will produce all the material required for a twenty years' plant. Now compare this with the thousands of acres of clay and shale which can be found in this vast Dominion and the area required is insignificant.

Portland cement is not considered the best material for finished road construction, but without doubt it is the most useful that can be employed in forming the base of all good roads.

It has been frequently stated that "Portland cement concrete pavements for roadways are wrong in principle and a failure in practice." This may be true enough, but Portland cement concrete as the foundation for pavements for roadways is the material "par excellence." There may be many errors in the proportions used in the mixing of concrete, improper materials may be used, there may be bad foundations and lack of screening—all may lead to bad results, but no one can truly state that this is the fault of the cement.

In the construction of sewers, the clay product that is a proper proportion of clay, shale and rock shale, carefully selected, ground, mixed fired and salt glazed will produce an excellent material for the construction of sewers up to twenty-four inches in diameter, and for the formation of brick sewers of larger dimensions, especially those elliptical in section, is obtained by using an invert, well formed and constructed of vitrified earthenware, that is from the well glazed clay product. And the sewers even of large dimensions are wholly dependent on clay products. Good bricks, good cement and good labor, collectively, will produce the most desirable form of sewer.

In the formation of manholes for sewers, much more care should be exercised than is usually devoted to this detail of municipal construction. The old adage "out of sight and out of mind" is very applicable in this case, but personally I should like to see all manholes constructed of white glazed brickwork, with inverts specially designed and manufactured in white glazed fireclay. These inverts could be made all in one piece and thus any disadvantage from jointing or bad foundation could be entirely eliminated.

In Victoria there is located the B. C. Pottery Company, one of the finest plants for the production of sewer pipes. It is now in process of reconstruction having been lately burnt out and a large quantity of machinery damaged, but by February, 1914, the firm will be producing pipe again. These clay products have many excellent properties which would be hard to equal and practically impossible to excel. The clay is obtained locally, the rock shale from the mainland, while the coal is obtained from Nanaimo. The finished product is despatched to all parts of the province and as far east as Saskatoon. Of late this company have obtained sufficient orders for local developments and improvements to keep them busy for several months.

One of the disadvantages of reinforced concrete buildings is their monotony of construction, but this is now being overcome by the excellent brick frontages which are being built to all important buildings. As improvements in the manufacture of clay products proceed so will the architects take advantage of the same, and additional beauty and artistic taste will be shown by the uses to which ornamental brickwork can be adapted.

The scope of the uses to which clay products can be put is unlimited and I am looking forward with confidence to the time when our streets, sewers, business blocks and homes will not only be fireproof and sanitary in construction, but artistic and pleasing in their design. And this all because of the utility and adaptability of clay products in the municipal field of engineering.

Field Examination and Testing of Clays

By Joseph Keele, of the Geological Survey

THE testing of any clay or shale for commercial purposes begins with an examination of the deposit in the field. A clay deposit should be conveniently situated with regard to transportation, in a body large enough to keep a plant going for a considerable time, free from harmful impurities, and easily worked.

There are many important questions to be considered, however, in the preliminary enquiry. For example: 1. Can drainage be provided as excavation or mining proceeds, as it is necessary to keep the workings dry? 2. Is the water supply for all purposes adequate and of good quality? 3. If sand is required for mixing, or moulding, can it be obtained cheaply? 4. Consideration of the fuel supply. 5, Are conditions in the locality favourable for labour? 6. Can breakages of machinery be repaired quickly? 7. Can the kiln foundations be kept dry? 8. Would further prospecting reveal a more desirable deposit?

Some idea of the extent of a clay deposit may be gathered in a preliminary way from outcroppings either in plowed fields, hillsides or ridges, and along the banks of streams or dry gullies. Springs issuing from hillsides sometimes furnish a clue to the upper level of a bed of clay, as the surface water cannot seep down through it. Wells, and foundations excavated for buildings are useful guides, but railway cuttings often furnish the best information, especially when they are freshly made.

As soft clays in a steep bank are liable to be concealed by slide material which has washed down over them, it is often necessary to cut a deep trench up the slope from top to bottom of the deposit before the true character of the beds are seen. Some banks contain several different grades of clay, some of which may be worthless, and so situated as to render the good clay unworkable.

In addition to the information gained from outcrops, it will be necessary to make several borings, in order to get at the extent of the deposit and its variations. Borings can be made quickly and cheaply in surface clay deposits with a 2-inch augur, coupled to short lengths of pipe, and fitted to a crosshead. The augur is screwed into the clay for about six inches, then withdrawn with a straight pull, and the clay which clings to the augur removed. As the boring proceeds, extra lengths of pipe are added. The clay stripped from the augur is laid out in the proper

Paving brick shales, without too many stone bands, on sea coast opposite Campbelltown, N.B.

Shale beds containing too many stone bands for economic working, Richelieu River, Que.

order on boards or on the grass, from which small samples can be selected at any depth up to 30 feet or more if desired.

The clay deposit may be covered with a varying thickness of either gravel or stoney clay which cannot be used for any purpose. In most cases it will not pay to strip this overburden, if it is very thick, but the higher grades of clay like stoneware and fire clays, can have an overburden of one foot removed for every foot of clay obtained. If the overburden is composed of sand, much of it may be used for mixing with the clay, especially if it should be a fat clay with high shrinkage. An otherwise useless overburden may sometimes be used for filling or levelling up ground on which it is proposed to erect the plant, or it may be removed cheaply by hydraulicing, if a sufficient head of water is available. An overburden which contains pebbles, especially pebbles of limestone, should be removed completely, and kept well back from the face of the bank which is being worked, so that there will be no danger of the pebbles rolling into the material that is being worked for the manufacture of clay products.

Shale deposits are often exposed in fairly steep banks, either in an escarpment or on stream banks or in a railway cutting. From exposures of this kind a good idea of their probable value may often be formed. If the outcrops on the property to be examined are not exposed to any appreciable depth, it will be necessary to sink some shafts, before any sampling can be done or any decision formed regarding its economic value.

Several of the soft shale deposits in the plains region of Western Canada can be examined as easily as surface clays from borings with an augur, but the shales in the East are all too hard for this method of sampling.

The shale formation in Eastern Canada are generally uniform in character over very large areas, but those in the West are often extremely variable so that they require great care in sampling and examination.

Impurities in clay or shale are of two kinds, those which are visible to the naked eye, and those which are not. The field examination detects the first kind, and the laboratory tests should reveal the second kind. Pebbles are probably the most serious visible impurities in surface clays. They may occur sparsely scattered throughout the clay or they may be in the form of gravel streaks, pockets or regular layers. If the pebbles are mostly of limestone, the deposit is practically hopeless. Some manufacturers in search of material will not consider a deposit, if they find it contains even a few scattered pebbles.

Layers or pockets of sand, if not in too large a quantity, are sometimes beneficial in a surface clay, especially if it is of a highly plastic nature. Brickmakers like a clay bank to work itself, meaning one that carries the right proportion of sand for a proper mixture.

An excess of sand layers is undesirable in a clay deposit, because the product made from it is liable to be weak and porous, or lacking in clay bond.

Although a shale deposit may consist largely of beds of true shale, it is possible that it may also contain so many layers of sandstone or limestone as to be of doubtful economic value. If the stone bands are thick enough they may be sold for building stone if a convenient market exists for them.

Ironstone concretions, and lumps of iron pyrite are

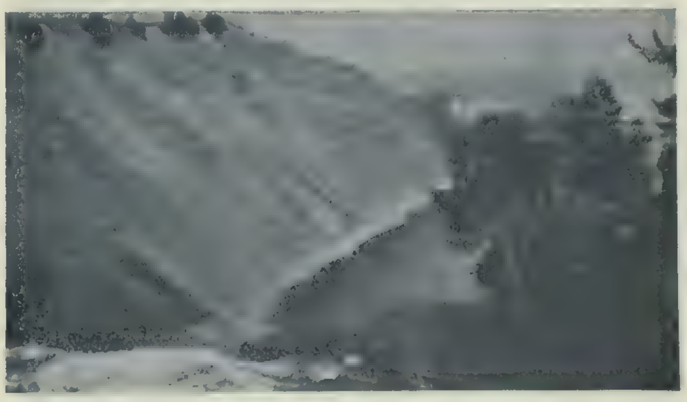
Worthless dark clay overlying white clay in central Alberta.

Soft shales on C.P.R. through Alberta. Well situated for mining and transportation.

among the serious impurities in shales and clays. They sometimes occur of such large size that they may be discarded in mining. Gypsum or lime sulphate is a frequent impurity in the soft shales of Western Canada. It generally occurs in small glistening particles disseminated through the shale, or it may be in large crystals or rosettes. It generally follows in the West that clays carrying gypsum are hard to dry without cracking.

It is generally impossible to foretell much about the value of a clay or shale by simply inspecting the deposit in the field. An experienced clay-worker, however, can gather some information for his guidance in the selection of material. The feel of the moistened clay when kneaded in the hands indicates its degree of plasticity and its probable working qualities. A shale may be distinguished from a slate by grinding a little with a hammer and moistening it. The moistened shale dust will have more or less plasticity, but a slate will have none. Any clay or shale that carries more than about 7 per cent. of lime will probably be useless for the manufacture of vitrified wares, such as paving brick or sewer pipe. If a few drops of diluted hydrochloric acid will produce strong effervescence in a clay it may be discarded as unsuited for this purpose.

Shale cliffs on sea shore, New Brunswick. Example of easily worked shale deposit



Extensive shale deposit at Montmorency Falls. Well situated for mining and transportation.

Many clays will crack in drying, these can be easily detected by kneading up some of it with water to the proper consistency, shaping it into a rough brick or cube, and setting it to dry exposed to the sun and wind. Some clays thus exposed will crack in less than an hour after being set to dry. Others will not show cracking for several hours. If the clay dries intact, then make another brick by hand, and set it over a boiler, or in an oven at a temperature of about 150 deg. F. and observe the results. A clay must be able to stand a certain amount of abuse in drying in order to give a large output of finished products.

Since few clay or shale deposits are uniform in character throughout their entire thickness, the selection of samples for testing purposes is a matter of some importance.

If the deposit appears to be uniform, then the samples should represent an average of the depth of the face it is proposed to work. The average sample should be supplemented by two or three other samples taken from different depths, as appearances are frequently misleading in clay investigations.

Many persons pick a small sample of clay from the surface of a deposit and send it to be tested. The results of tests from this kind of sampling are generally useless, as the body of material when opened up for working may give entirely different results from the thin veneer of weathered clay overlying it. In a locality where industries have been located for a long time, working satisfactorily on a material which occurs widespread and uniform in character, the necessary information may be obtained merely by inspection of a suitable site in the vicinity of the older plants. This proceeding is often, but not always, safe where the manufacture of common bricks only is concerned. Where any of the higher class of clay products were to be made, the cheapest method is to take every possible precaution at the outset of the enterprise.

Laboratory Tests

The invisible impurities in a clay which may produce defects in the process of manufacture or in the appearance of the finished ware can only be detected by working up and burning test pieces made from the clay.

A good deal of time and money has been expended on the chemical analysis of clay, and many chemists have been rash enough to state in reports the kind of wares a clay will make, from the results of their chemical analysis alone. There may be special instances, as in the case of some high grade clays, where the chemical analysis is of value, but it is worthless for the general group of clays or shales used in the manufacture of structural ware.

What the clay-worker desires to know about a clay or shale is: 1, its plasticity and working qualities; 2, the rate of drying; 3, the exact drying and burning shrinkages; 4, the commercial limit of burning; 5, the porosity and absorption of the burned wares; 6, the actual difficulties encountered in burning, such as cracking, warping, or swelling, and scumming or whitewash.

Many of the important clay-working plants in the United States and England, especially those making a variety of wares, have an experimental laboratory, with small kilns for burning trials in charge of a competent ceramist. These firms test a large number of clay samples which are sent to them from outside sources. Three or four of the State Universities give courses in ceramic engineering and have very fully equipped clay testing laboratories. A certain amount of commercial work is done, for which fixed charges are made, according to the scope of the investigation. The tests are conducted by experienced men whose reports are reliable and extremely valuable to the person or company about to start a clay-working industry.

Most of the manufacturers of clayworking machinery have a clay-testing department on their premises.

These people invite prospective customers for machinery to send samples of their clay and have it worked up into specimens of ware. They generally make the tests free of charge. The specimens of burned wares sent back by the machinery companies to their prospective customers are generally perfect in every respect. These samples should be regarded as a standard to be ultimately attained to, however seldom reached, in the everyday world of clayworking.

Tests Under Working Conditions

If a company or individual wishes to establish an important clayworking industry at a certain place to make a certain class of wares, a reasonable way to proceed in the tests of their clay, provided the field examination was satisfactory, is as follows: Take an average sample of say 50 lbs. from top to bottom of the workable depth of the deposit, if it is uniform in appearance, or as many samples as there are different beds. Have a complete set of laboratory tests made from the samples. If the laboratory tests prove satisfactory, then make arrangements with some firm, outside the zone of competition, who are making wares similar to those required, to put a large quantity of clay through their process and to burn it in their kilns. It is important to have an experienced man do the sampling, and accompany the clay to its destination, so that he may observe the behavior of the material in the various stages of manufacture.

Example of shales outcropping at surface. Worked by steam shovel for brickmaking.

The proper location of the deposit, and the assurane of the suitability of the clay for the purpose it is to be used, are absolutely essential to begin with.

The plan of the buildings, the design of the kilns or driers, and the selection of the best types of clay working machinery, should be done by a competent ceramic engineer.

It is impossible to provide against all the troubles which may arise in new localities when dealing with a new material, but the chances for the occurence of trouble can be materially lessened by proper precaution.

The business of manufacturing clay products is a desirable one in many respects. It gives healthy employment, and produces articles of great use to a community.

It is a fairly profitable business when brains and technical skill, as well as capital, are invested in it, varying nowise in this respect from any other complex producing business.

It is just as easy, however, for the unwary novice to lose his money in a homely looking clay-working plant as it frequently is in the more spectacular operations of metal mining.

The Geological Survey has carried on a systematic investigation of the clay and shale deposits of the Dominion since 1909. The reports that are published at intervals contain complete results of laboratory tests, together with descriptions of the field occurrence, of the material collected.

They are intended as guides for manufacturers in search of suitable materials but are of general interest to all clayworkers.

Technical Trade Literature

MANUFACTURERS of materials that enter into building construction, who, as a consequence, are interested in the specification of their goods by architects, will do well to heed the fast growing demand on the part of professional men for a sharp division of trade literature—the elimination of fine writing, endorsements, "puffs" and other favorite lines of the advertising writer, so far as the literature that is designed for architects is concerned, and the amplification of real information, diagrams, technical descriptions and plans for use, the whole subjected to the acid test of "will this be useful to a man who intends to find out all there is about this material?" If trade literature does not shape up to this specification, what right has it to ask that an architect litter his files with it, asks Brick and Clay Record. The picture of a man in a smoking jacket, toasting his slippered feet at a radiator, while frost forms on the window and snow flies without, is all right for the layman, but the architect wants to know how much space the radiator occupies, what its radiating surface is, how connections are made and what pressure of steam is required to bring it up to its full efficiency. Technical booklets, technically correct, that will serve as tabulated and conveniently collected information for the architect, will be preserved and used long after the bills for their distribution are paid and forgotten. Booklets that simply tell how good the material is and who has used it (a mental club that the architect resents) frequently find their way into the wastepaper basket before more than the opening paragraphs are read.

The material of silica brick resembles that of sand-lime brick more closely than does any other material. Silica brick are made quite extensively for use as refractory linings for furnaces. They consist of sand grains, cemented together by true calcium silicate. They are prepared by mixing lime and silica in the proportion of about three to four per cent. of the former, to ninety-six to ninety-seven per cent. of the latter, subjecting to great pressure in moulding, and burning at a rather high temperature. The lime reacts with the silica of the sand forming a kind of glass which cements the sand grains together. The difference between a silica brick and a common sand-lime brick is that in the former, little time is used, and the hardening is done by firing in a kiln, while sand-lime brick contain much more lime, and they are hardened by the action of saturated steam under pressure. In silica brick, the bond consists of a glass containing no water, while in the case of sand-lime brick, the bond is not a glass, but a hydrated silicate, very much akin, no doubt, to some of the constituents of set Portland cement.

The grates in edge-runner mills for fire brick should have holes or slots not more than one-quarter inch in width, and for most purposes, one-eighth inch holes are best.

History of Vitrified Clay Sewer Pipe

Venerable Past of a Product Five Thousand Years Old Found to Embody "Modern" Principles of Manufacture

By Benjamin Brooks

BEFORE the history of Europe really began—say, approximately, five thousand years ago—there were current in the Greek "myths," or fairy tales, numerous persistent rumors of a magnificent and powerful people inhabiting a mysterious island to the south, in the Mediterranean Sea. Was it history or was it just a fairy tale?

Nobody could be quite sure which, until, less than a generation ago, a freak of the desert winds blew the sand off the ruins of Egypt's ancient foreign office and disclosed the little clay tablets whereon were recorded as plainly as in print the letters sent and received by the ancient and honorable Minister of Egypt's Foreign Affairs. Although these letters had been written and filed so many thousand years ago, it was perfectly plain to any archaeologist who glanced at them that about the time Moses was a gallant young man ready to fight any ruffian who crowded a good-looking girl out of her turn at the public well, this magnificent and powerful civilization hinted at in the Greek fairy tales really did exist on the Island of Crete.

There was bountiful trade with other countries; there was much trouble about who handled the customs receipts, and with pirates, and with encroachments of barbarous armies. But there were also huge profits and great wealth, and there was a king who was enough of a sportsman to make a Roman holiday look like a county fair on a rainy day.

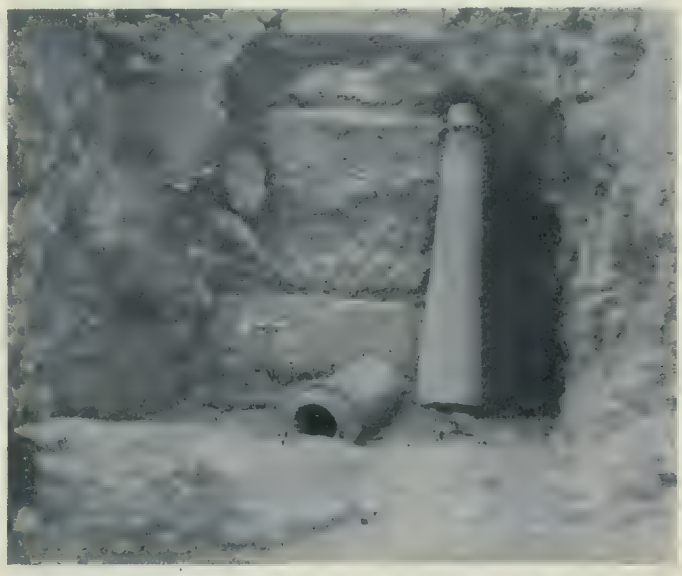
Bull-fighting was the king's special delight—not such tame sport as it is nowadays, but bull-baiting without red flags or horses or weapons of any kind: just a troupe of lithe young men and women, quick as lightning on their feet, who danced before the enraged taurus, grasped his long horns as he charged them and leaped lightly over him through the air to be caught in one another's arms. Some royal sport! But the king had another and a quicker way of spending money if his gold and silver and ebony checker-board, recently discovered, is any indication. And of course he had a magnificent palace, and the best Egpytian architect imported to build it—which brings us to the hero of the story.

Palaces were a common thing with this celebrated architect, no doubt, but this palace for the Cretan king—half pirate and half patron of royal sports—was to be something extra. The ruins of it still proclaim the fact. And one of the little extras that was to make it a famous palace was the idea that it should be drained not merely with open, mosquito-ridden ditches or rough stone waterways, but in a truly up-to-date and sanitary manner with **pipes.** But pipes of what?

It is not difficult to see how he arrived at his choice of materials. The Egyptians had already developed the use of clay bricks. One pyramid had been built of them (and it still stands) and there were the everlasting clay tablets bearing the hieroglyphics, and clay vessels of every sort to contain wine and water. Now if a tall clay vase with a bottom in it would hold water, why wouldn't a succession of tall clay vessels without bottoms, and fitted end to end, convey running water? And this was the invention of vitrified clay sewer pipe, five thousand years ago.

The comparison of the first locomotive, the first steamboat, or the first printing press, with the last, is usually interesting by contrast, but if we take the first clay sewer pipes as they were dug from the ruins of this Cretan king's palace, still in perfect condition, and compare them with the clay pipe of to-day, we are struck by the great similarity of the two. There they are, four inches in diameter, in thirty-inch lengths, with bell-and-spigot joints, without blisters, cracks or any imperfections that would prevent their giving good service in any town of to-day.

How much did this far distant architect know and how much was he guessing? Did he realize that in creating bell-and-spigot clay sewer pipe he was giving something to the world that would be an important feature in its civilization ever afterward? Did he realize that in selecting clay for his material of sanitation he had chosen absolutely the only material that could have carried sewage and resisted its acid-bearing vapors, or carried water and resisted its solvent carbonic acid, and remained to be re-discovered after five thousand years? If an untutored girl like Cleopatra, only a few centuries later, knew that lemon juice would dissolve pearls or any other limey substance, this king's architect may have known more than we think about the destructive chemistry of sewage and the great value of burned clay to resist it. If he knew how to cut 40-ton blocks of stone from quarries without powder, float them across the Nile without tug boats, haul them across the desert without railroads, steam, donkeys or wire cables, pile them up in a temple without derricks or jackscrews, and fit them together without mortar so that not a five-hundredth of an inch



Vitrified clay sewer pipe installed 5,000 years ago by Egyptian engineers to drain the palace of Knossos on the Island of Crete and discovered recently in a perfect state of preservation.

intervened between them, it is difficult to guess how much he knew about sewerage and sanitation. It is fortunate, perhaps, that there was no regular patent office in Egypt, or we might still be paying him royalties as we do to the organized brigands of Gizeh who have come to own the Pyramids.

Now there are two sides to engineering—the Adventurous and the Commonplace. This original inventor, whoever he was, with no building ordinances to bother him, and plenty of the king's money to spend, must have enjoyed the adventure of it exceedingly. But that was five thousand years ago. To-day, the big money is to be found on the Commonplace side. The most successful engineers of to-day hire draughtsmen at $2.00 a day to invent details for them while they deal strictly in standard materials and keep their eyes on standard specifications and their fulfilment. Not being the inventors of the Briggs logarithms, a lot of us must be content to use them faithfully without alteration to the sixth decimal place—for a living. It is the same with vitrified clay sewer pipe. We did not have the fun of inventing it or using it as an experiment, but we must use it as the standard of all first-class sanitation. And, after all, there is great honor in dealing in the most indestructible material ever invented and in carrying forward the world's sanitation as well and as thoroughly as the most wonderful of all builders did for the Kings of Crete.

The True Porosity of Tile

By W. W. H. Day, Professor of Physics, Ontario Agricultural College, Guelph, Ont.

ARE cement tile as porous as the clay tile? Will they let water through them as well as the clay? What is the porosity of clay tile anyway?" So frequent and insistent have been these enquiries since cement tile began to be used for underdrainage purposes in Ontario that we were led last winter to make a general study of the porosity of tile.

The first problem that confronted us was to determine a method of finding correctly the porosity of a tile. We knew that for comparison of porosities a method in rather general use was to determine the per cent. of water by weight that the different tile would absorb when immersed in a trough or other vessel, from which it was an easy matter to determine the volume of water absorbed, and comparing this with the volume of the wall of the tile to arrive at the apparent porosity. But, when we put a tile in water to soak, does the water fill all the pores? If not, i.e., if the air in some of the finer pores does not escape, then the porosity determined by the above method is incorrect.

To test this out we proceeded as follows: 1st. We took three whole tile, Port Dover make, dried them to constant weight and determined the volume of the tile wall, also the volume of water absorbed and from these calculated the apparent porosity by this formula:

$$\text{Per cent. of pore space} = \frac{\text{Volume of water absorbed}}{\text{Volume of tile}} \times 100$$

The average porosity of the three tile by this method was 29.6 per cent.

2nd. We took from each tile, lengthwise, four small samples, about one-half inch square and two inches long. We dried them to constant weight, and weighed them. Then we fitted a beaker with two fine wires hung down inside about an inch from the top. In the bottom of the beaker we placed about an inch of water. The sample of tile was then laid on the wires in as unstable a position as possible, and the beaker, placed under the receiver of a strong air pump and the air exhausted from the receiver. Thus the sample of tile was in almost a perfect vacuum, and hence the air was almost entirely exhausted from the pores. When the vacuum was as complete as the pump would make it, the receiver was jarred sufficiently to dislodge the sample from the wires and allow it to drop down into the water. There being practically no air in the pores the water would fill them completely. The sample was next removed, all adhering water dried from its surface by faint touch of a blotting paper, and the sample again weighed. The difference between this and the original weight gave the weight of water absorbed, from which the volume of water was known.

With the pores of the sample completely full of water it was an easy matter to find the volume of the sample. Being long and narrow it could be slipped down into a narrow graduated tube containing water. By the rise of the water in the tube the volume of the sample could be read directly on the graduated glass. The percentage of pore space was then calculated as before. The average porosity of the three tile by this method was 35.7 per cent., much higher than by the previous method.

3rd. Still another method of finding the pore space was used. Knowing the weight of the dry samples used in method No. 2 and the volume, the apparent specific gravity was determined by dividing, thus:

$$\text{apparent specific gravity} = \frac{\text{weight}}{\text{volume}}.$$

The samples, after being dried again, were ground to a very fine powder, and the real specific gravity of the powder determined, by means of specific gravity bottle. The pore space was then calculated from the two specific gravities by the formula:

$$\text{Pore space (per cent)} = \frac{\text{real} - \text{apparent}}{\text{real}} \times 100.$$

The average porosity of the same three tile by this method was 35.0 per cent., very close to the result by method No. 2.

The various determinations by the three methods resulted as in the following table:

Table showing comparison of results by different methods of determining porosity

	Porosity by absorption in atmosphere	Porosity by absorption in vacuum (four samples)	Porosity by specific gravity method (four samples)
Tile No. 1	30.5	37.8	35.7
Tile No. 2	29.8	33.6	34.2
Tile No. 3	28.6	35.7	35.2
Average	29.6	35.7	35.0

From this it is seen that the vacuum method and the specific gravity method give almost identical results, and both more than one-fifth higher than by absorption in free atmosphere. Hence we concluded that our doubts as to the accuracy of method No. 1 were well founded, and that if we wished to obtain accurate information regarding porosity of tile we must use either method No. 2 or No. 3. As the second is the simpler both in manipulation and calculation it was used exclusively in subsequent work.

It might be urged that method No. 1, while not giving the absolute pore space, would give comparative results, for the amount of air not expelled from the tile would be the same in different kinds of tile. That does not necessarily follow. We should expect that the finer the pores the more air would be imprisoned, the coarser the pores, the less air imprisoned.

Ten other Port Dover clay tile were then taken, and their porosity determined, two samples from each tile, the average of the twenty determinations showing a porosity of 35.66 per cent., a result almost identical with that already reached for the three tile. I must confess that it was a surprise to me to learn that the walls of these Port Dover tile were more than one-third air. They were not what one would term "soft" burned, neither were they hard burned—just medium. All the above tile were 4 inches in diameter.

Three inch tile of the same make showed a porosity of 31.7 per cent.

We happened to have in our laboratory at the time, for testing purposes, some four inch clay tile made at Kingsville. These were just three-quarters as thick as the Port Dover tile of the same diameter, and were burned considerably harder. Their average porosity proved to be 23.8 per cent. as compared with 35.7 for Port Dover. So we see that "porosity of clay tile" has a variable meaning, and the range of variation is considerable. Whether the great difference in porosity just noted resulted from a difference in burning solely, or from difference in clay, or difference in wetness of the clay, or difference in machinery, or difference in thickness, or from some combination of these factors we were unable to determine. Undoubtedly burning had much to do with the difference in porosity, and possibly difference in thickness influenced the burning.

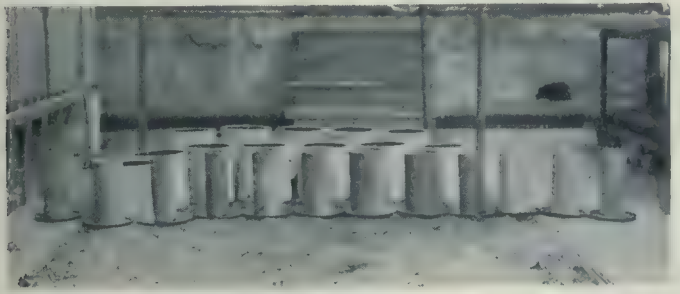


Fig. 1—Tile set in boiling pitch to seal end. Also crocks of water.

Some four-inch cement tile made at Woodstock, on a large power machine, and said to be mixed in the proportion of 1 to 4, proved to have a porosity of 22.5 per cent. Five-inch tile of the same manufacture had a porosity of 16.3 per cent., i.e., the larger tile had the smaller porosity.

With hand made cement tile, proportion 1 to 4, made on The Farmers Cement Tile Machine, the case was just the opposite, the three-inch having a porosity of 22.0 per cent., the four-inch of 27.8 per cent.

A very interesting study in percolation grew out of the study of porosity, by which we were able to answer the question whether tile let the water into the drains through the pores or through the joints. Several tile of the various sizes and different makes were set in plates of boiling pitch, and the pitch allowed to cool. This sealed the bottom ends of the tile air-tight and water-tight. Figure No. 1 shows the tile thus prepared. They were next set in water (See Fig. 2), which stood near the tops of the tile. In this position they were left for a week to see how much water would percolate through the walls. At the end of one week not a clay tile of any of the different makes was full of water! The most in any clay tile was 3½ ins. At this rate it would have taken twenty days for that tile to fill with water up to the same level as the water outside. The next clay tile would have taken 23 days to fill, the others 175 days, 233 days and 234 days respectively. From this we must conclude that practically no water enters clay tile drains through the pores, it all enters through the joints.

With the cement tile we found considerable difference of behaviour even with tile made on the same machine, and of the same materials in the same proportion. Some of the hand-made cement tile shut out the water just as completely as the tightest clay tile, while others filled with water in a short time. The same is true of the power-made cement tile. On examining the specimens that behaved in different ways, we found that the difference arose from a difference in the wetness of the mortar. If it was wet enough that the packer produced a smooth watery surface on the inside, that tile wall would be practically watertight, but if there was not sufficient moisture for this, then the tile wall would let water through readily, and the tile would fill in a short time.

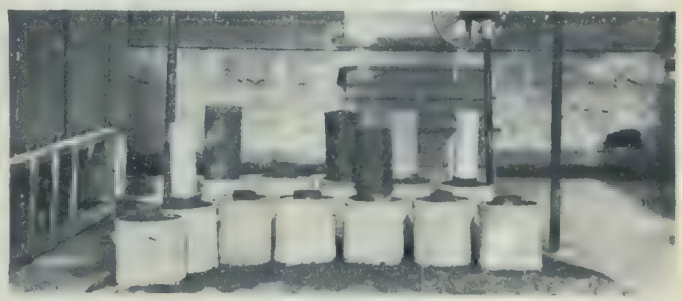
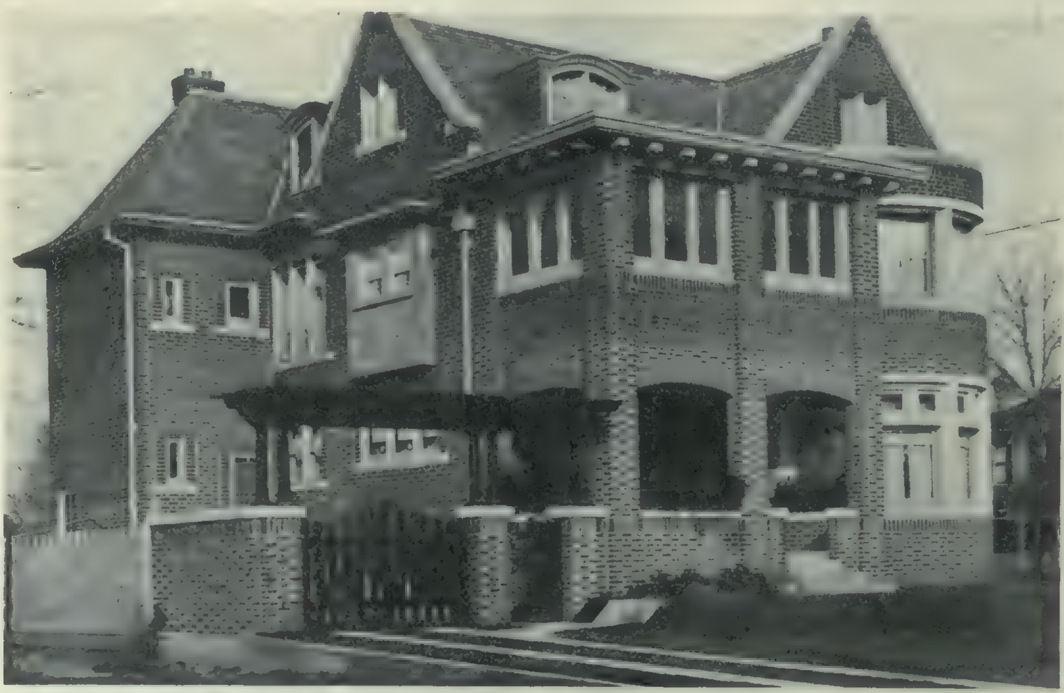


Fig. 2—Sealed tile set in crocks of water to test percolation through walls. In one week only enough water had percolated to cover the bottom of about half the tile. In the others only a few drops came through. The deepest water in any was 3½ ins.

A number of tile problems seem to cluster round the subject of porosity, e.g., strength of tile wall, and effect of frost upon tile. During the present autumn we have ordered a few tile from every yard in Ontario and hope to pursue the subject further during the winter months.

There are two methods in use for piling face brick. Some superintendents insist that brick can be handled much faster in loading them out by piling them on edge, face down, in straw. Others do this without any packing, whatever. Damp and rotting straw, however, is apt to damage the face, or if the packing is omitted, the edges chip. The foreman cannot see how the sorting is done, either—another serious objection. Another method is to pile the brick face out on the flat, two courses high. The loader will handle four brick at a time, in loading these out, two in each hand, which is about as many as if piled on edge. The brick, of course, are not damaged in any way and the foreman can watch the sorting.



Residence of Mr. T. H. Preston, Brantford Ont.

Successful Use of Tapestry Brick and English Bond in Brantford Residences

Architect: Mr. Lloyd D. Barber

It is generally conceded that the materials employed in the construction of a building make up a considerable part of the resultant effect. Architects are constantly employing texture in surfaces for certain results. A good example is shown herewith in the residence of Mr. T. H. Preston, Brantford. The building was designed by and erected under the supervision of Mr. Lloyd D. Barber, architect, Brantford, and is considered one of the finest homes in the city. The style is peculiarly adapted to the tapestry effect, the brickwork being carried out in "Moquette" brick, the color of which is dark brown to deep red. The brick was supplied by The Black Building Supply Company, of Toronto, who were very careful to have the exact shades preferred by the architect.

The grading of brick is particularly well executed and the contractors, Messrs. Schultz Bros., deserve much credit for their efforts, which are most gratifying. The joints are about ¾-in. thick, raked out ⅝-in. deep, the mortar being light gray, gauged with cement to keep the brick setting up in place. A point in laying up this brick is to see that the mortar is rather "dry" and set up well before attempting to rake out the joints, otherwise a very dirty face work will be the result, as it is almost impossible to clean down the brick with acid or rubbing owing to the sharp, rough surface. The brick are very hard and absorb little moisture, hence the necessity of cement in a rather dry mortar. The residence is well built in every particular and is carried out in harmonious colors. The roof is mottled green slate. The stone trimmings are of Cleveland sandstone. Grey "sand-lime" brick are used for backing.

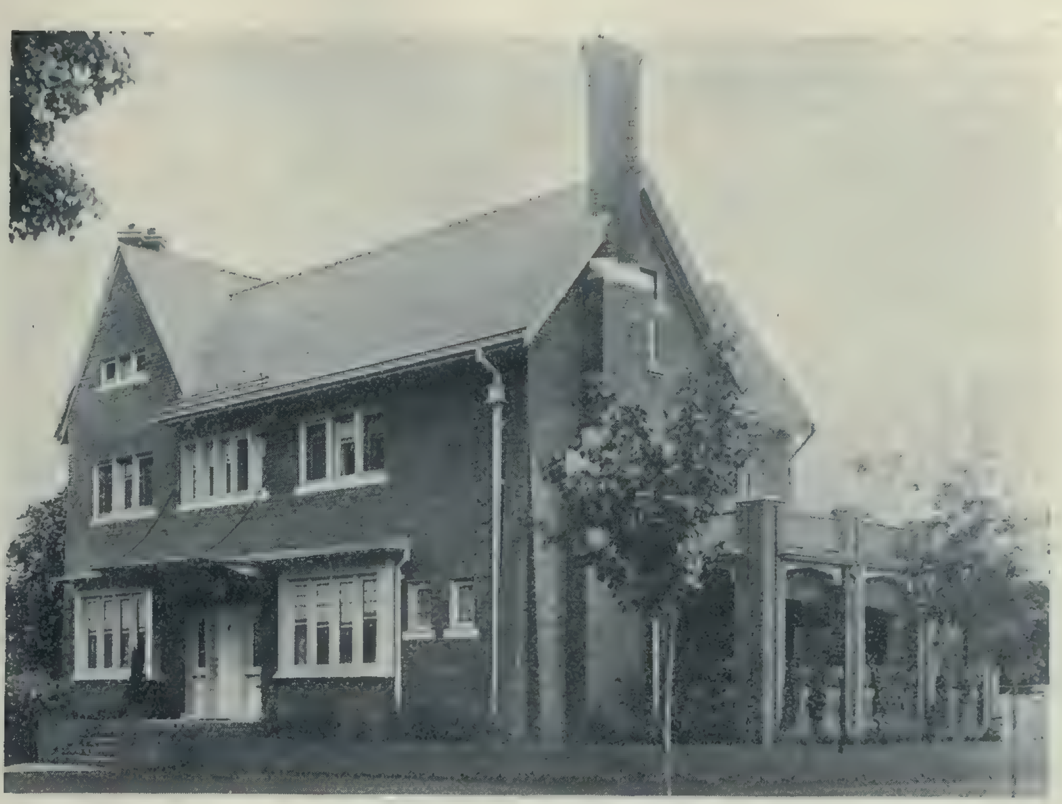
The front entrance is carefully detailed with stone pilasters. The ground floor is finished throughout in white quartered oak and mahogany and the second in whitewood trim finished in a "biscuit" shade. The mahogany doors tend rather to brown than to red tones.

The pergola at the rear entrance is very effective and harmonizes with the general effect. The whole work is hardly completed and the photo shown was taken before any planting was done. A brick and iron fence will enclose the lawn and give the whole an appearance of homeliness.

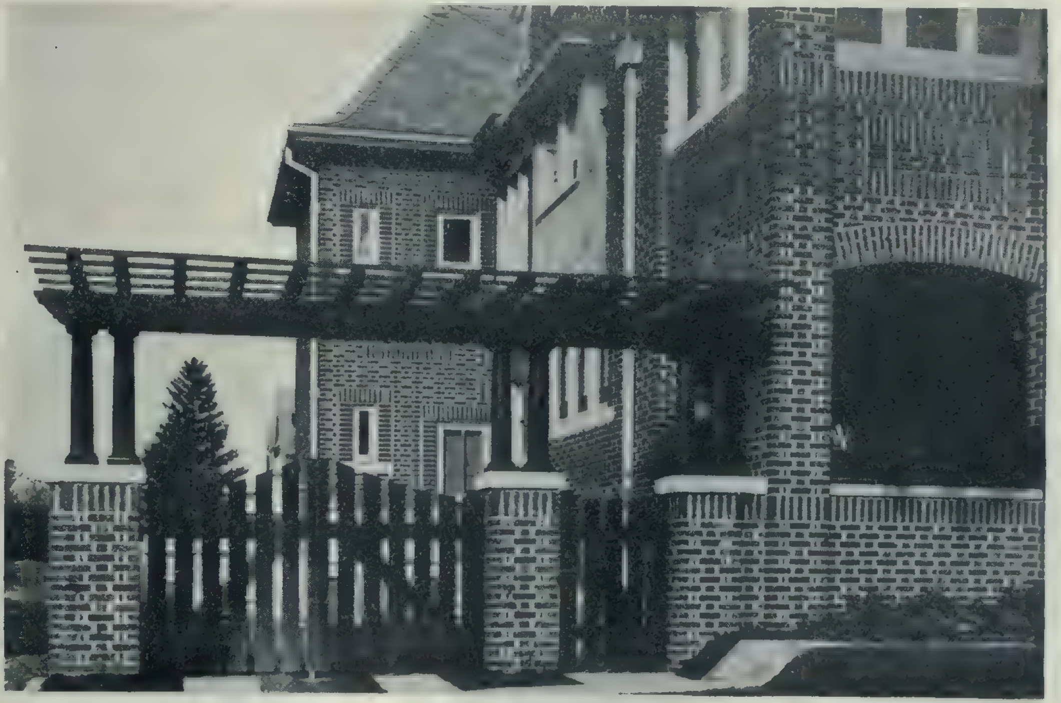
Possibilities of Stock Brick

The residence of Mr. W. B. Preston, of Brantford, is an example of the warmth in effect that can be obtained with stock brick if the design and environment will permit.

The brick employed were furnished by the A. H. Wagstaffe Brick Company, of Toronto, and chosen for their color and quality. They approach in texture the tapestry effects so much sought after by architects. The color ranges from almost green-black to deep red and brown, and as the bond is "English" with one course headers to one course stretchers, the effect in the wall is most pleasing. The desire of the architect was to keep the whole tone dark, consequently the mortar used is black with a raked-out joint. The style is "English Cottage" so familiar to those who have studied domestic work. The work is not in



Residence of Mr. W. B. Preston.



Pergola and veranda details. Residence Mr. T. H. Preston.

Tapestry Brick and English Bond in Brantford Residences

England, but it has not lost any of its charm on that account.

Special care was required in the design to keep the main rooms free from veranda shadings, and the front, which faces the north-east, is carefully detailed to this end. The veranda is on the west and south and is large and roomy, approached by French doors from both living room and dining room, accessible only from the side rear lawn, which is enclosed. The roof is in mottled green slate and is deep enough in color to carry out the color effect of the walls.

The main floor is trimmed in select black ash for the living room and den, while the dining room and hall are in dark mahogany. The second and third floors are in whitewood doors finished French gray, and mahogany trim. Though unusual, this is most effective.

Residence of T. H. Preston, Brantford. Front or Dufferin Avenue view.

The work was designed by Mr. Lloyd D. Barber, of Brantford, and the general contractors were the local firm, Messrs. Secord & Sons.

The Strength of Brickwork

It is only natural that when a brick manufacturer has had the crushing strength of his bricks tested, he should be pleased to show to all likely customers a certificate to indicate the superiority of his bricks in this respect. It is equally right that architects engaged in the design of buildings intended to carry heavy loads, such as factories and some public buildings, should lay considerable stress on the necessity for the bricks showing a certain resistance to crushing. But of what real value are these tests, asks The Brickbuilder.

Most machine-made bricks will have a crushing strength of 2,800 lbs. per square inch, and if reasonable care has been taken in their manufacture, a much higher strength is not uncommon. Engineering bricks may easily double this figure, and in some works the average crushing strength of the bricks is no less than 4,000 lbs. per square inch.

When bricks are built up into masonry, however, the structure will not safely stand a load of more than 100 lbs. per square inch, and only with the best building bricks is a load of 210 lbs. per square inch considered safe. This is due to the fact that the mortar used in laying the bricks is, in itself, far weaker than the bricks, and it only gains strength as it hardens. Yet various investigations of ancient buildings show that lime mortar seldom, if ever, hardens completely in the interior of the joint, so that the weakness of brickwork is not due to the bricks, but to the imperfectly hardened mortar!

This drawback can be overcome by using cement and sand in place of lime and sand for the mortar, and, provided that the joints are kept thin, and the correct proportions of cement are used, this cement mortar will not prove more expensive than ordinary mortar. On the other hand, the strength of the brickwork will be increased many times, and a crushing strength of 3,800 lbs. per square inch—corresponding to a safe load of 380 lbs. per square inch—is not difficult to attain.

The use of cement mortar, therefore, provides the manufacturer of bricks with a means of showing how enormously strong structures may be made at prices to compete with the rivalry of concrete. If the matter is worked out carefully, it will be found that bricks at 27s. per thousand can be reinforced and laid in cement mortar at a cost which is well below that of concrete, provided that the building is one which will really give both materials a fair chance. Moreover, the brick building will have an admittedly better appearance than the concrete structure, and the chances of failure by electrolysis and other adventitious causes are much less. Hitherto most brick manufacturers have been content to accept the statements of other people that concrete is stronger than brickwork. As regards bricks laid in imperfectly hardening lime mortar this is undoubtedly the case, but there is no reason why bricks should be laid in an inferior mortar now that so superior a one as a mixture of sand and cement is available at similar prices.

One fact must be observed in the use of cement: it is very liable to form scum or whitewash unless the mortar is properly made, and this would disfigure the building, though even then it would not be worse in appearance than many of the concrete buildings now in existence. This scum may, however, be avoided by mixing some dust made by crushing soft, red bricks with the mortar, as this brick-dust combines with the lime set free from the cement, and not only increases the strength of the mortar, but also prevents any whitewash being formed. This method was known to the ancient Romans and Greeks, and was used by them in many of their most important buildings. They probably obtained it from the East, as broken tiles are still used in Asia Minor at the present time as a means of strengthening mortar.

There is much to be done in the way of reinforced brickwork. The pity of it is that many brickmakers are content to see trade going into the hands of the concrete makers, whereas if they only took the pains to enlighten their local builders and architects as to the advantages of reinforced brickwork over concrete in most localities, there would soon be an increased demand for bricks. The present dull season is a good time for thinking over this matter, and for getting together the necessary information on the subject.

It is necessary to prepare clay for sewer pipe in wet pans but as the wet pan is intermittent in action, the operation is unsatisfactory when applied to machines which are continuous in their action. In Germany, perforated wet pans are used, as well as perforated rolls, with success. The clay is ground in an ordinary well, then fed into the perforated machine, which forces the wet clay through the narrow slits in the perforated plates, thus giving a continuous stream of clay pugged to the best possible condition.

Face Brick in Distinctive Buildings

Interesting Examples of Successful Application Found in Recent Work at Montreal—Beautiful Work at Baltimore and Elsewhere

By E. F. Dartnell, Montreal

THE use of face brick for high-class buildings is increasing every year by leaps and bounds. Having in mind more especially its larger buildings, Montreal has been regarded in the past as essentially a stone city. In this respect, however, a marked change has come about, and it now possesses a number of costly buildings in which face brick have been largely used for the outside, as well as for interior finish.

Among the striking buildings in which burnt clay in the form of brick has been used, is the new High School, on Upper University Street, near McGill University, now nearing completion. As to its principal faces the brick in this structure is a light grey or white Kittanning brick, of smooth texture, in Norman size. For the interior finish brick were used to a considerable extent, including white enamelled brick, grey Kittanning brick, somewhat similar to those used on the outside but not so light in color and of standard size, together with an ironspot pressed brick. When completed this will be one of the largest buildings in the city and as a school one of the handsomest on the American continent. The architects were Messrs. E. & W. S. Maxwell, and the contractors The Geo. A. Fuller Company, Limited.

On the same street and not far from the High School building, the new Wesleyan college is in course of construction. Messrs. Ross & McDonald are the architects, and Mr. C. E. Deakin is the contractor. This building is faced with rough-textured grey "Caledonian" brick in medium shades, laid up in Flemish bond with raked joints.

The new building for Scroggie, Limited, at the corner of St. Catherine and Bleury Streets, is a large departmental store, one of the largest in Canada. It is of reinforced concrete construction and is faced with a buff Kittanning brick. The architect was Mr. D. J. Spence and the contractors were The P. Lyall & Sons' Construction Company, Limited. This building was erected in record time for a structure of its size.

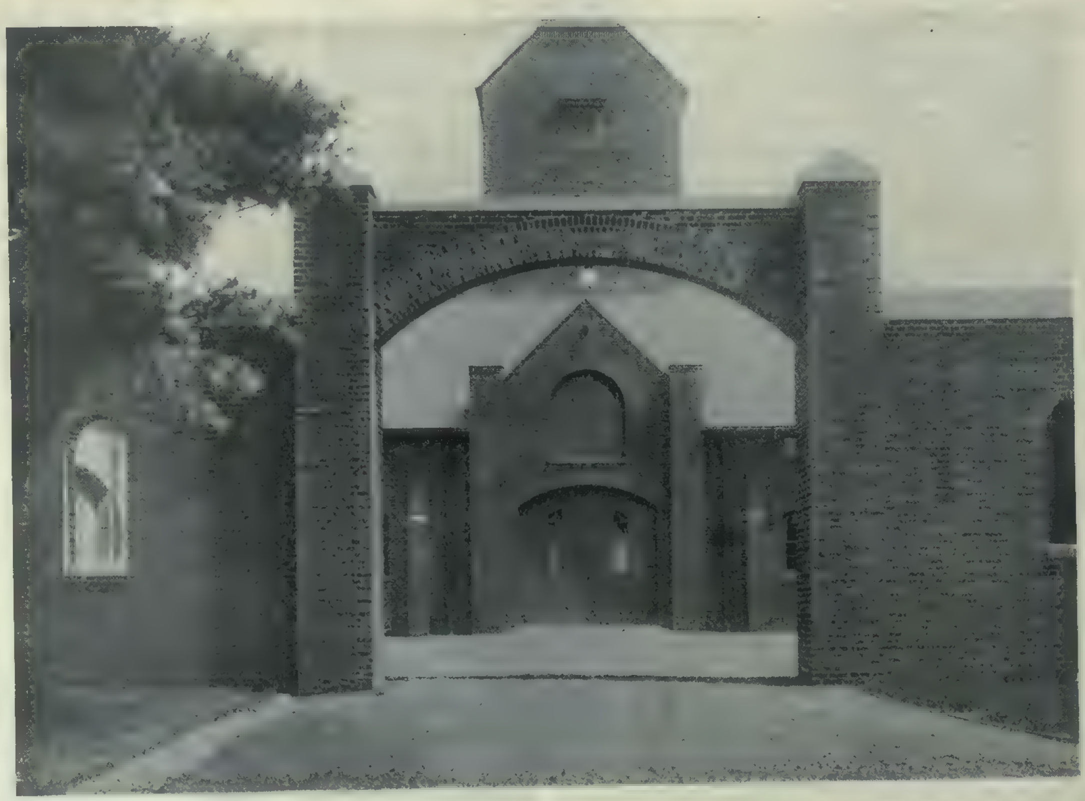
The new Southam building on Bleury Street, now nearing completion, is a large office building faced with grey "Caledonian" rough texture brick in light shades and is a very effective structure. Messrs. D. R. Brown & Hugh Vallance were the architects and the Atlas Construction Company, Limited, the contractors.

A well-designed and neat-looking building finished last year is the gymnasium of the Seminary on Cote des Neiges Hill, shown in the first illustration. The building is of but one storey, faced with a smooth light grey Kittanning brick, with a slightly mottled brick of the same make for trim, the two shades being used so as to give character to the brickwork, while at the same time requiring close observation to distinguish the two colors. The architectural work was entrusted to Mr. A. Lapierre, the contractors being Messrs. Laurent Freres.

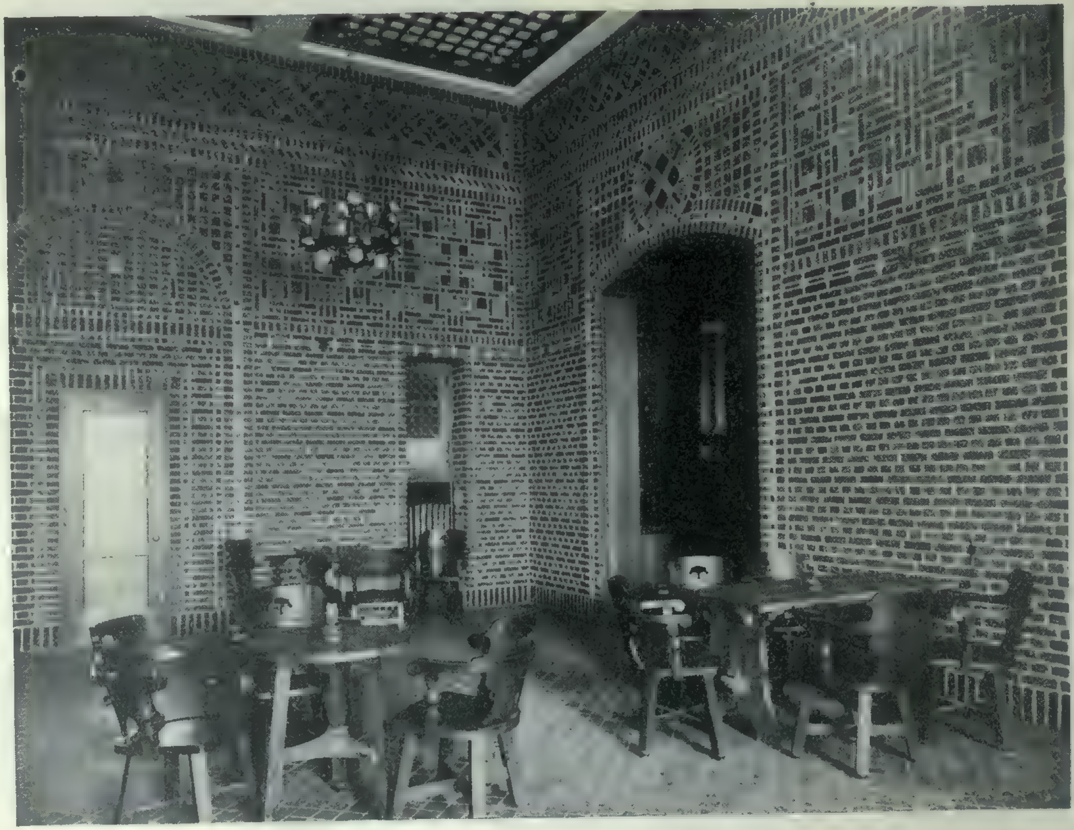
1.—Gymnasium of Montreal Seminary, Cote des Neiges Hill. Faced with a smooth Kittanning brick, light grey and mottled.

Another large building is the Strathearn school on Mance Street. The brick work in this structure is of

2.—Garage at Suffolk, Va., built of red tapestry brick.



3.—Yard entrance and garage at Topsfield, Mass. 'Tapestry' red range, special bond, grey rough cut, flush joints 3/8 ins. thick.



4.—Tap room, Hotel Belvedere, Baltimore, Md. Walls and floor of red range 'Tapestry' brick and tile.

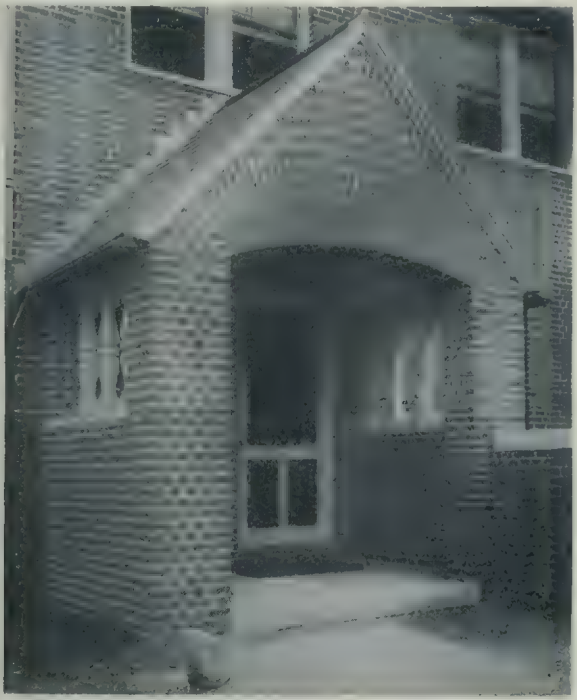
Face Brick in Distinctive Buildings

tapestry grey in the full range of color, giving it a warm, soft tone. Enamelled brick is used for the inside lining of the lavatories. Messrs. Nobbs & Hyde are the architects for this as well as several other school buildings. Messrs. Byers & Anglin, Limited, are the contractors.

A good building of the smaller class is the Montreal Water & Power Company's new pumping station on Clarke Avenue, Westmount. This is faced with golden tapestry brick in the darker shades. Mr. F. G. Robb was the architect and Messrs. A. F. Byers & Company, Limited, were the contractors.

The Read building (offices and lofts) facing on Alexander Street and covering the whole of a block, is of a light grey Shawnee brick of smooth texture. The architects were Messrs. Ross & McDonald and the contractors the Geo. A. Fuller Company, Limited.

For interior work the Montreal Light, Heat & Power Company are using considerable brick for the linings of their new buildings at Ville Emard, in the western part of the city. The lower part of the walls is of white and green enamelled brick and the upper part of light buff, semi-vitreous Shawnee brick. The architect was Mr. E. G. Robb and the contractors were Messrs. D. G. Loomis & Sons.



5.—Porch of residence at Topsfield, Mass. Red tapestry brick with grey mortar joint, rough cut flush, special bond.

For the Ste. Clothilde school, St. Henry, enamelled brick have been largely used for the lower parts of the walls of the corridors, stairways and lavatories. In color this brick is white with a dark blue band course, producing a very pleasing effect. The architects in charge of the work were Messrs. McDuff & Lemieux, the contractor being Mr. O. Archambault.

The second illustration is of a garage at Suffolk, Va., built of red, rough-textured brick. No. 3 shows the garage to the house, the porch of which is illustrated in No. 5. As will be seen from the illustration, the work is simple but very pleasing.

Illustration No. 4 shows the use of rough-textured brick for interior walls in the Hotel Belvedere, Baltimore, Md. This gives a good idea of what is being done with brick in interior decoration. The varieties used in this building were red tapestry brick and tile, the brick being laid up in Dutch bond. The general effect is one of mellowness and warmth, in contrast to the cold appearance of polished marbles. The cost, however, is about the same, or a little less than for the cheapest marbles.

The fifth and last picture illustrates an example of simple brickwork used in a striking manner in the porch of a residence at Topsfield, Mass. Note the effect of the rowlock arch carried up to the top of the porch gable. The brick used in the construction of the arch is red tapestry.

When in Washington, D.C., recently, I saw there a large building erected with a smooth texture, light grey, dry pressed brick in two shades. This was laid up in a modified Flemish bond, using a very light grey brick for the stretchers and brick a shade or two darker for the headers, the whole being laid with raked mortar joints. At a first glance you would fail to notice that two shades had been used. The effect was as though a fine lace veil had been dropped over the face of the building, taking away the harsh appearance that smooth brick generally have when appearing on a large flat surface.

Bonds in Brickwork

SEVERAL of the bonds that are now employed are described in an interesting article by H. D. Eberlien. He says the most common bonds, in fact almost the only one employed during a great part of the nineteenth century, is the running bond, in which all the courses are composed of "stretchers," that is to say, brick laid lengthwise, the only "headers" or endwise brick visible being at the window jambs, at the starting of piers and pilasters and in straight header courses at more or less frequent intervals where their use is made obligatory by the local building laws to tie the face-wall to the backing. Each course breaks joints vertically with the courses immediately above and below. Running bond is perhaps the simplest and certainly the least interesting and artistic way of laying brick and has little to commend it except considerations of economy.

The Flemish bond, in which every course consists of alternate headers and stretchers is, after the running bond, the one we most commonly meet with, having been generally used in our brick buildings of Colonial date, in which the black header and red stretcher effect is so often noticeable. Flemish bond is constructionally honest, artistic and satisfying, and its almost universal employment in modern building of Colonial style cannot be too strongly commended.

The double-stretcher Flemish bond which, as its name denotes, consists of two stretchers together, followed by a single header in all courses, the headers being laid above the joints between the two stretchers in the course next below. It is coming more and more into vogue in America and has been used in some of our largest buildings with signal success.

For the vertical joints between the contiguous stretchers, mortar colored to exactly match the brick is often used, thus making a blind joint and giving the effect of one double-length stretcher. The use of double-stretcher Flemish bond sets a big, broad scale and can be employed to advantage in large wall surfaces, particularly where it is desired to take off somewhat from the appearance of height, as the strongly marked horizontal lines have that effect. This feature can be further emphasized by slightly increasing the thickness of the horizontal mortar joints.

English bond and Dutch cross bond, like both the single-stretcher and double-stretcher Flemish bond are replete with artistic feeling and deserve to be far more widely known and used than they now are in America. Not only are they essentially artistic but they are strong and honest in structure. Both English bond and Dutch cross bond have alternate courses, the one wholly of stretchers and the next wholly of headers; but in the English bond the stretchers of all the courses come directly above each other while in the Dutch cross bond the stretchers of the first and fifth courses break joints with the stretchers of the third and seventh courses respectively and thus throughout, giving a diagonally diapered appearance if the mortar joints and the hue of the brick be judiciously contrasted.

The bonds mentioned are the most usual kinds, but one also meets with special adaptations of recognized types; it is, however, quite sufficient for general purposes to remember the five enumerated. In fact, many people, who are supposed to have some knowledge of such matters, have difficulty in keeping the differences clearly in mind and generally fall down in trying to describe them.

Interesting Examples of Old Brickwork

By George J. Jervis

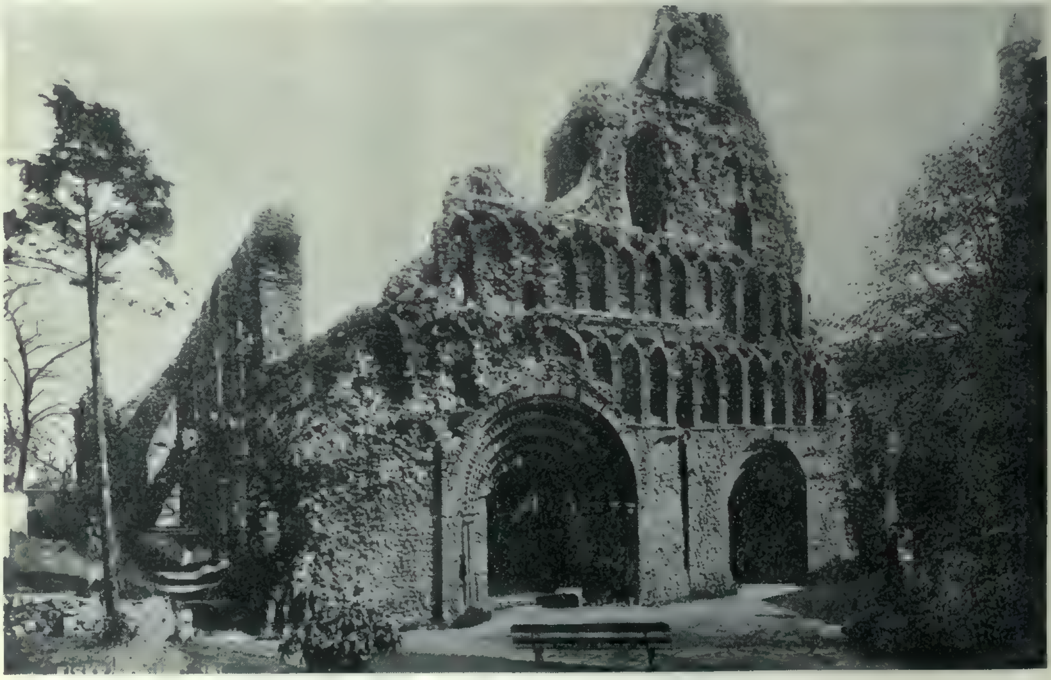
A splendid heritage of brick architecture has been handed down to us through past centuries. In the present day we have better material, increased facilities, and an unlimited field of action, all of which may well augur a bright future for brick architecture. There is a period in its history which is or should be of the greatest interest to us. That period is the introducing of brick architecture into England.

The history of English brickwork is generally supposed to date from the middle of the fifteenth century, for the few isolated examples erected prior to that time either dated from the era of Roman occupation or represented a spasmodic attempt of Saxon builders to imitate the building construction of their late conquerors. Such rare examples as St. Alban's, St. Batolph's Priory (Fig. 1) and possibly half a dozen other brick edifices, are not sufficient to establish a claim for the birth of brickwork in England, for it was not until many centuries later that the seed of brick construction was planted on English soil to blossom so speedily into such artistic creations as Eton College, Great Snoring Parsonage, East Barham and other well-known examples.

It was from the Flemish brick builders that the English received the incentive to erect their private and public buildings of a material so pliable in form and one which offered such amazing possibilities in the way of decorative treatment.

By the middle of the 16th century such examples of brick architecture as Oxborough Hall and Tattershall Castle show that the English people had not only learned the lesson of brick building from their Dutch friends but had evolved an original type as regards outline of design and details of structure.

To those whose interest in brickwork is sufficient to follow its varied historical course and to trace its introduction into England, it would be reasonable to suppose that the Flemish builders demonstrated their art more particularly in those towns on the East coast



St. Botolph's Priory, near Colchester, Eng. Built of Roman brick taken from some old Roman building about 1103.

of England to which they had the earliest access, and it must be in such a locality that we look to find the oldest existing examples of their handiwork.

The inhabitants of the seaport town of Hull, in Yorkshire, from the early part of the fourteenth century traded extensively with the Flemings and it is in this town and its environs that we find today so many interesting remains of old-time brickwork. According to Bishop Leland, the historian, Hull, in the time of Richard the Second, was completely a brick built town. In the quaint English of his day, we read—"And yn this tyme the Towne was wonderfully augmented for building and was enclosed with Diches and the Waul begun, and yn continuance ended and made all of Brike as most part of the Homes of the Towne at the tyme was." Sufficient evidence surely, that by this date the townspeople had appreciated the value of clay products as a building material of sovereign value.

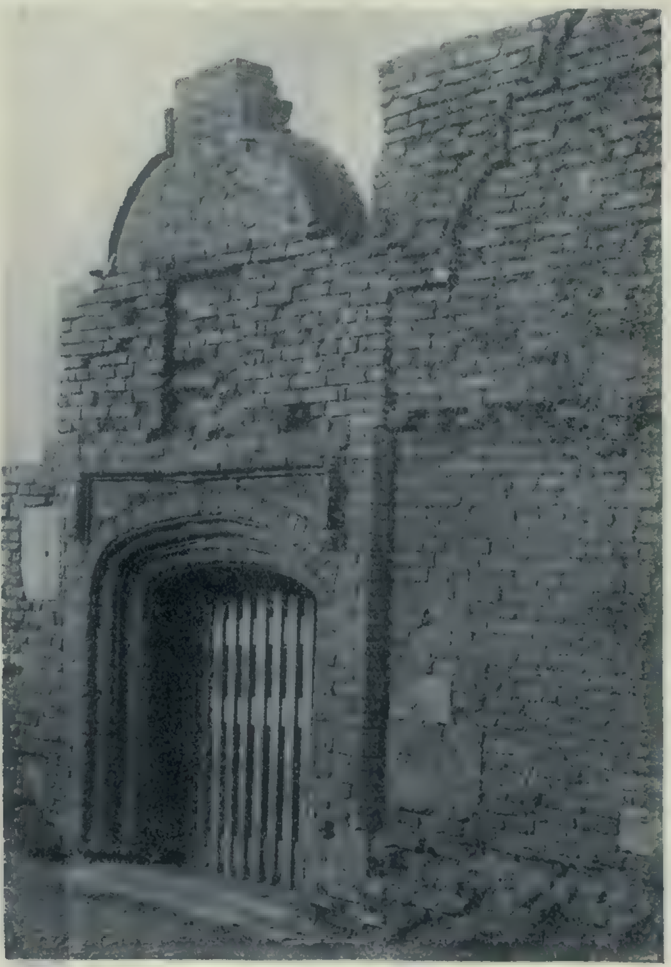
One of the best examples of fourteenth century brickwork is found in Holy Trinity Church. This is one of the largest parish churches in England—its area being 20,040 sq. ft. The building is not entirely of brick, the west end being of stone but that portion of the church which is built of brick is in a wonderful state of preservation. Prominent in this respect is a buttress on the south side, east of the south transept. The sanded face of the old hand-made brick has disappeared and many of the brick show signs of weathering, which, considering the hundreds of years of exposure, is excusable. The size of the bricks in this particular section average nine inches by two and one-quarter inches and are of a dull brownish red color, the mortar joints being of a dark greyish green averaging three-eighths inch to one-quarter inch, the vertical joints being as a rule, slightly narrower than the horizontal ones.

In connection with the above, it is interesting to note that these bricks are longer and thicker than those used in Queens College, Cambridge (1448), the dimensions of the latter being eight inches by one and three-quarter inches by four inches to eight inches by two inches by four and one-quarter inches, laid with wide joints, four courses, averaging eleven and one-half inches from centre to centre. It is possible that the weathering of these particular brick is due not altogether to the chemicals in the atmosphere, but rather to the heat caused in the burning or the dampness of the clay before the brick were put in the kiln.

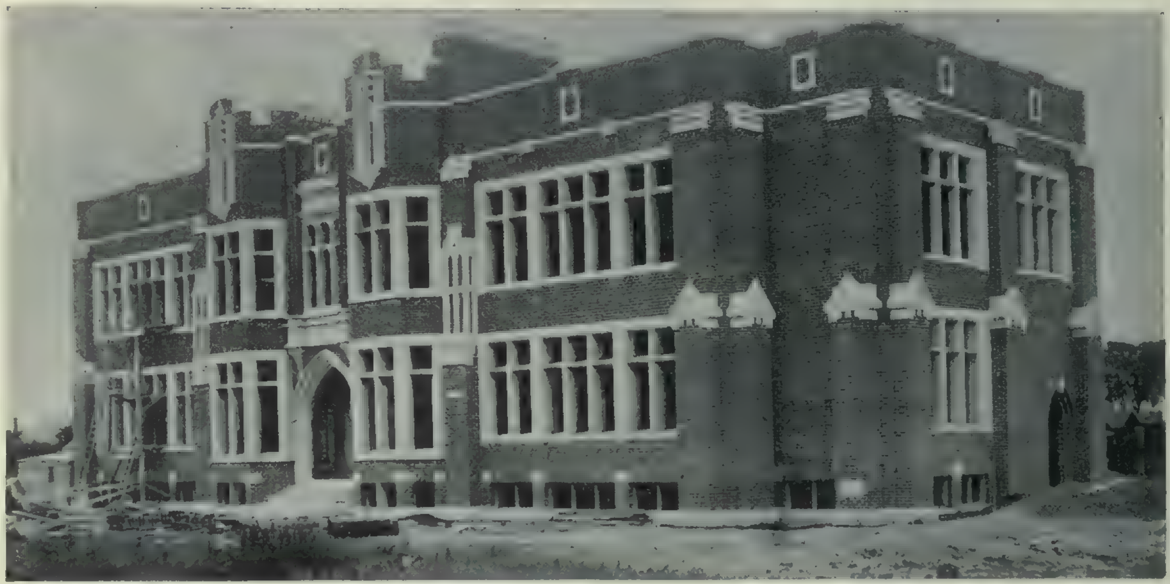
In a part of Hull we come across Little Lane connecting Blackfriars' Gate and Little Humber Street, which up to the seventeenth century was the only entrance to the town from the landing place on the River Humber. It is less than seven feet wide. The bricks average nine and three-quarter inches by two inches by four and one-half inches, with very uneven joints varying from one-half inch to one inch. The bricks also vary in color from a bright red to a dark crimson, some of these having the appearance of being older bricks re-used, while higher up are projecting courses of bricks of all sizes.

A later example of interesting brickwork is to be found in Wilberforce House. In the yard at the back

Great Snoring arsonage, Norfolk, Eng. Erected late in the 5th or early in the 16th century.



Artistic old gateway showing quaint arrangement of moulded brick.



North Toronto High School.—Architects, Messrs. Page & Warrington.

of the mansion is a pavement of old Dutch tile laid in Herringbone pattern.

A short distance outside of Hull lies the ancient town of Beverly, which likewise contains many interesting examples of old brickwork. To the east of the minster are some remains of a Dominican friary, the foundation of which is obscure. But, according to Layland some contribute it as "one Goldsmith's Foundations and so of the tounes but the Lord Darcy of late tyme strove for the patronage of it with the toun." There is also a record of it in connection with some Friars Preachers in a license dated November 11, 1311.

Apropos of the above, a good deal of the history of old time construction seems to be interwoven with the two extremes of peace and war,—for it is to the ecclesiastical temperament of the times that we owe the erection of these ancient churches and monastic buildings—and it is to the military leader to whom we must credit the construction of the walls of defence and castellated buildings.

Portions of the red brick boundary wall of the old Friary, referred to above, still remain with their doorways of moulded brick in East Gate and Chantry Lane—and from the latter street one may visit several cottages constructed out of the Friary building—one with a picturesque old porch and parvise—and some panelling inside; and another with a recumbent effigy propped up against its front wall.

The artistic old gateway as mentioned is particularly interesting with its quaint arrangement of moulded brick. The bricks in this instance average ten and one-half inches by two and one-quarter inches by four and one-quarter inches with three-eighth inch to one-half inch mortar joints. They are of a very dark burnt sienna color and appear to be a loose texture, but in very sound condition. (Fig. 3).

A view of North Bar, Beverly, taken from within, shows the crow-step features of the pediment, pointing unmistakably to its Flemish origin. The date of its erection is known to have been within 1409-1410. The bricks are very similar in size to those in Chantry Lane Gateway and in color much the same as those in Holy Trinity Church, Hull.

The foregoing are a few examples only, but they will possibly suffice to prove that those of us who seek for early traces of the brick-builders' art may well leave the beaten tracks to explore with advantage these by-ways rich in example of early English brickwork, and with the historical examples handed down to us as a guide, the added interest in brick products displayed by architect, client and manufacturer, together with the improved artistic qualities of clay products of the present day, there should be no excuse for the building of brick structures other than those which are a credit to the community in general and worthy of the era in which they were erected.

North Toronto High School

OF the many fine examples of the successful use of clay products in architectural work possessed by Toronto, not the least conspicuous in point of beauty of design and symmetrical construction is the North Toronto High School completed recently. In every respect the building is admirably suited to the educational requirements of North Toronto, due care having been paid to the important details of lighting, heating and ventilation. The building is of grey stock, wire cut and red brick, with artificial stone trimmings and exceptionally fine general effect, a feature of the structure being the uniform color of the brick, which was supplied by the Sun Brick Company, Limited, Toronto. The stone trimmings were furnished by the Toronto Ornamental Stone Company and the steel work by the Dominion Brick Company. The building, an illustration of which is given above involved an outlay of $43,376, the work of construction being apportioned as follows: masonry, Mr. T. Palmer, Toronto; carpentry, Messrs. Smith & McElroy; plastering, Messrs. John Boyce & Son; plumbing, Mr. T. H. Ferguson; electric wiring, The Doyle Allen Electric Company; heating, Messrs. H. G. Waterman & Company; painting, Messrs. Hughes & Company.

Terra-Cotta and Its Proper Use as a Decorative Medium

By Philip J. Turner, F.R.I.B.A., Lecturer in Building Construction and Materials, Department of Agriculture, McGill University, Montreal

THE use of terra-cotta in its many forms is becoming perhaps more popular every day on this continent. It is to be regretted, however, that in many cases where it is used, very little regard is paid to the nature of the material, and the purpose of this article is to endeavour to state what are the possibilities of so valuable a material; also to point out what should be avoided when designing in terra-cotta, especially where it is used to form the ornamental or decorative features of a building.

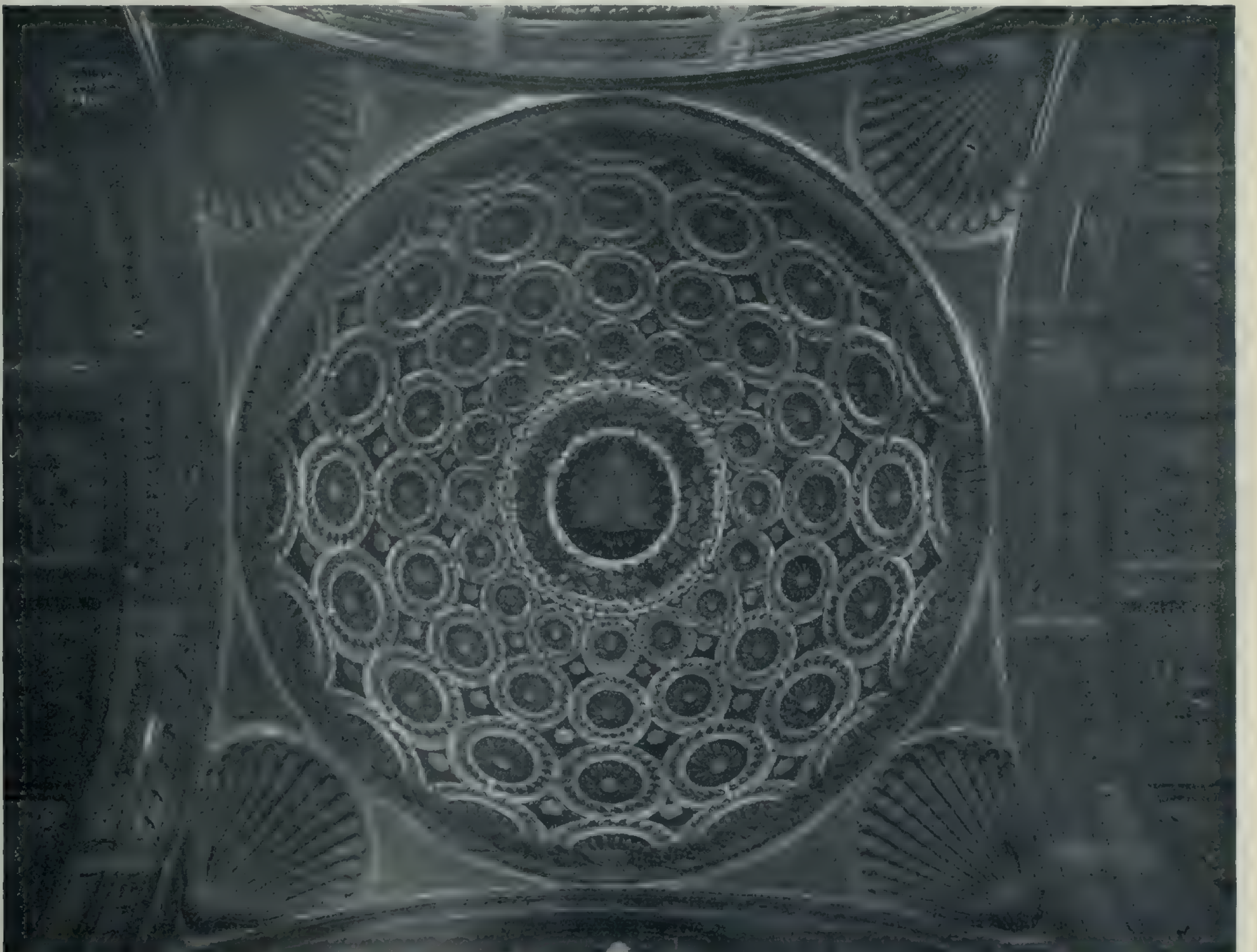
In the design of terra-cotta work, the architect should bear in mind that the material is limited principally to molding and casting. When in the kiln it is liable to warp and twist, both in the lines and surfaces, and therefore the fine delicate lines of Greek moldings cannot be attempted and bolder moldings are found necessary.

Again, the designer should never attempt to treat terra-cotta as if it were stone. Large blocks of stone cannot be imitated in terra-cotta for the more regular and closer the jointing the better the result.

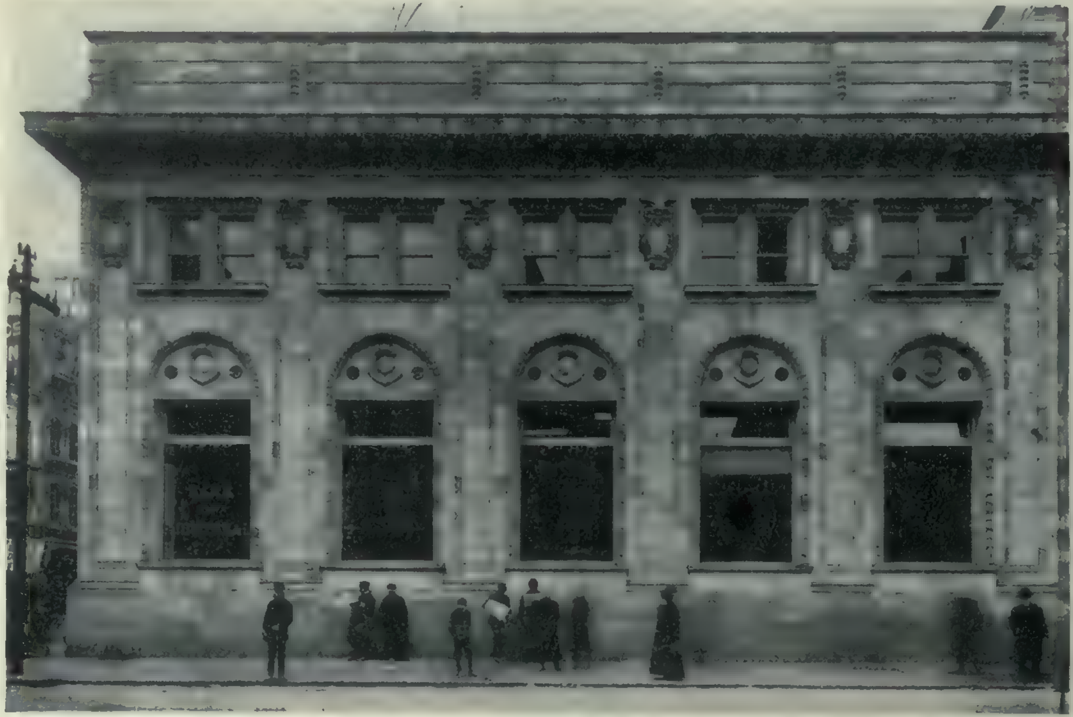
When employing this material as decoration in the form of ornament, perhaps one of the most serious errors made is the use of large projections; for this entails the use of large blocks with the added difficulty of keeping them true.

One of the greatest mistakes to which architects are susceptible is the over-lavish use of ornament in terra-cotta. The objection to extravagant ornament is that it becomes commonplace and cheap, and, as in over dress, the object aimed at is not obtained—namely, richness of effect by contrast with plain surfaces. For example, if we cut up a gable or the front of a building with enriched pilasters, panels and friezes, all repose and breadth is lost and the lines of accentuation are sacrificed.

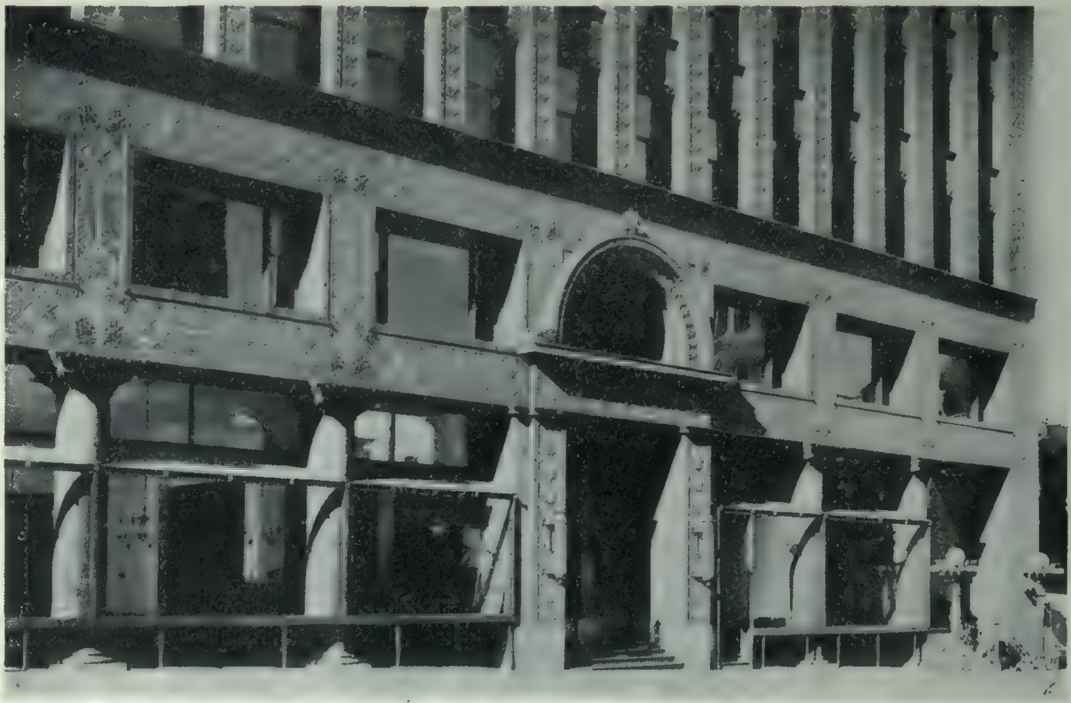
There is a mania among builders and architectural "pot-boilers" to fill in panels and wall-spaces every-



Domed ceiling of Pazzi Chapel, Florence, 1420 a.d. Interesting example of colored terra-cotta or faience. Similar treatment in stone would probably have been considered prohibitive owing to cost.



Bank of Montreal, corner Queen and Yonge streets, Toronto. Messrs Darling and Pearson, architects. The material—unglazed terra cotta—has been properlv understood by the designers and treated accordingly. Note repetition of ornament without overloading. The plain wall surfaces have been relieved by the colored roundels in the semi-circles over the windows. Recognized classic features have not been attempted. Band of main cornice is relieved with flat ornamental band, taking away any unevenness from unequal shrinkage on surfaces of terra cotta. (Illustration by courtesy of Messrs. Doulton, London.)

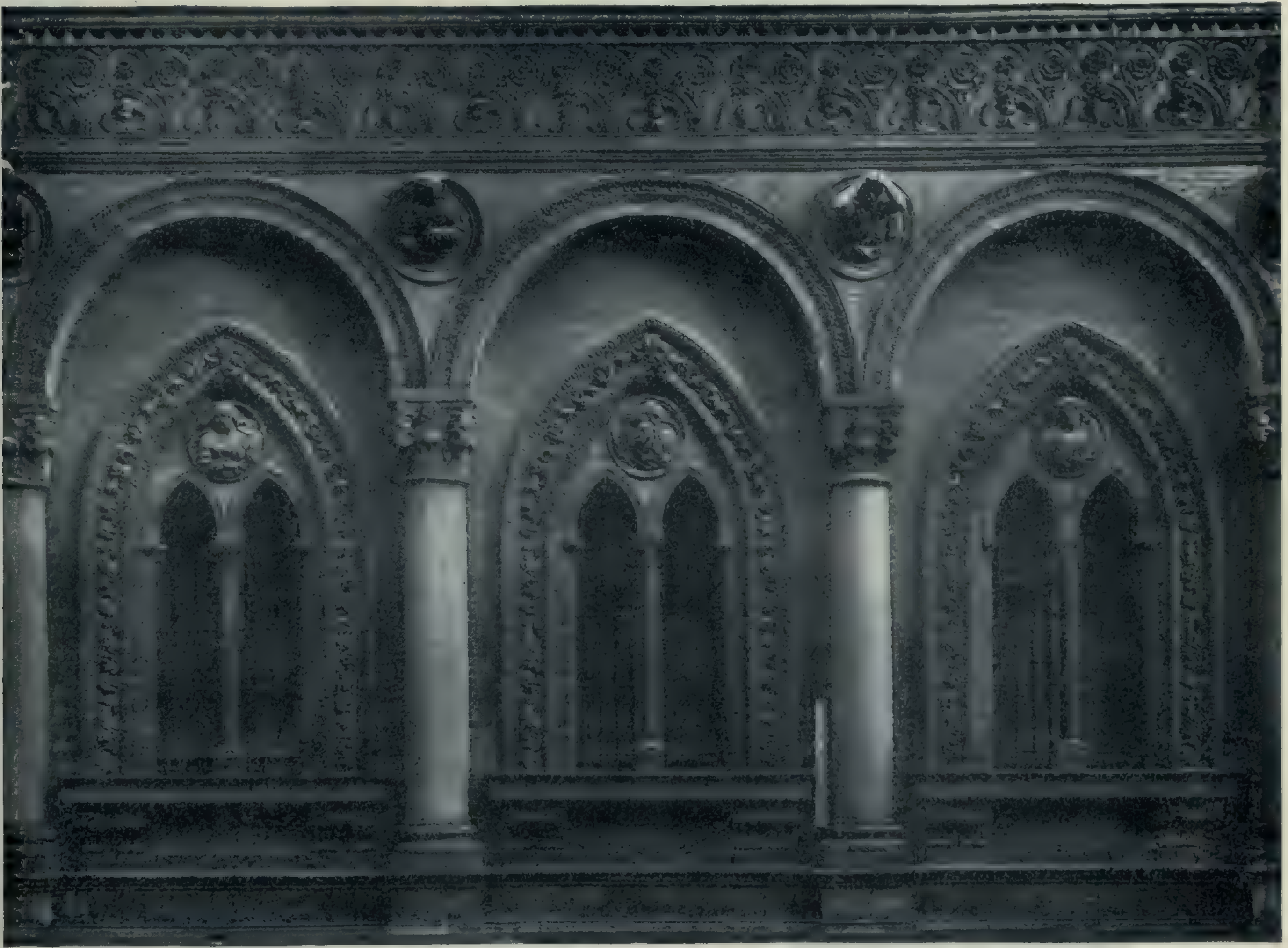


Prudential building, Buffalo, N.Y. Messrs. Adler & Sullivan, architects. All surfaces are decorated with low relief ornament most of which is repeat work. By duplicating constantly the same model can be used over and over again with little additional cost over plain blocks. Elaboration is relieved by plain jambs on the lower storeys. (Illustration by courtesy of the N.-W. Terra-Cotta Company.

where with meaningless decoration—a practice which defeats its purpose by creating confusion rather than effectiveness.

Saloon, picture-house and restaurant builders are adepts at this kind of artistic extravagance. Ornament in terra-cotta should not be cast like stone is carved; undercutting should be avoided, and low relief, which is more adapted to the material, should be the first consideration.

Terra-cotta has been frequently misused in modern times, and in no way more so than when it has been used to imitate stone; and doubtless this is due to the fact that when first introduced into this continent it attempted to win favor by pretensions to cheapness and was used in consequence like a cheap stone. In other times and other places, where it was largely and successfully used, particularly in Assyria and Lombardy, there was practically no competition between it and other materials and consequently no temptation to employ it in a perverted manner.



The great hospital, Milan, Italy, fifteenth century. Fine example of early work. Note smallness of blocks, small projections of caps, irregularity of curved lines, low relief in ornament, and excellent modelling of roundels in spandrels of arcade.

A Rational Use of Terra-Cotta

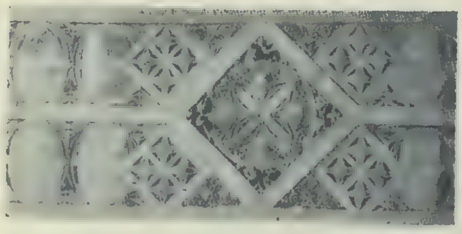
Its lightness in weight and fireproof qualities render terra-cotta a rational and favorite material in these days for the exterior walls of skyscrapers. Such buildings, it is realized by everyone, are in the main self-supporting steel structures and merely require outside walls thick enough to act as protecting curtains from wind and weather, and terra-cotta is the ideal material for this purpose.

The Gothic architects astounded the Middle Ages with the unbounded possibilities of stone, and in this modern world of high buildings, the marvels of the steel structure seem foremost in the building world.

What is the logical reason for hiding this latter achievement—as one so often sees—under traditional masonry, as if the walls were the integral part of the building? Is it not more reasonable to use a material such as terra-cotta? This can be made to express the gradations of the steel framework and repeat its lightness and grace, for "structurability," as has been said, "has its own beauty." This does not mean the mere piling up of terra-cotta in courses as if each course upheld the next, but it does mean an intelligent application of the material to its real supports, in a way that would follow the construction, and not be simply a meaningless panelling that might be applied anywhere.

In utilizing terra-cotta in skyscrapers or other buildings, large unbroken areas should be avoided. This can be done in various ways: by setting back some courses and projecting others, or by ornamenting alternate blocks with a sunken pattern or an almost flat relief. Any such method would tend agreeably to break up an area which if left plain would magnify the unevenness of the material.

When terra-cotta is used in a decorative matter for



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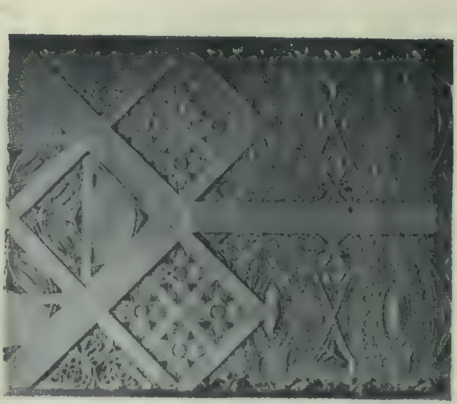

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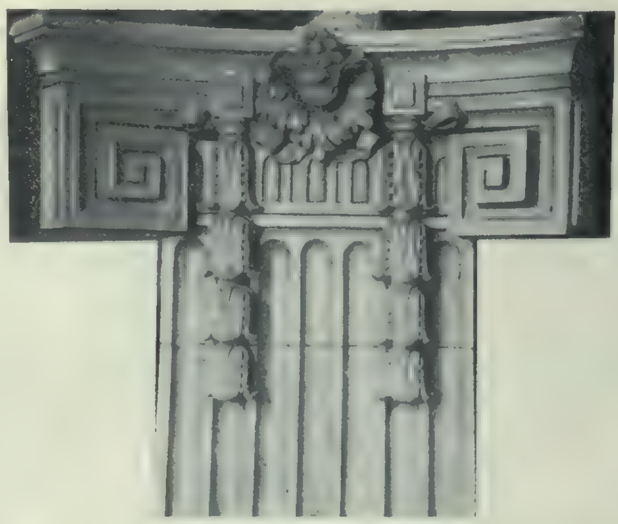

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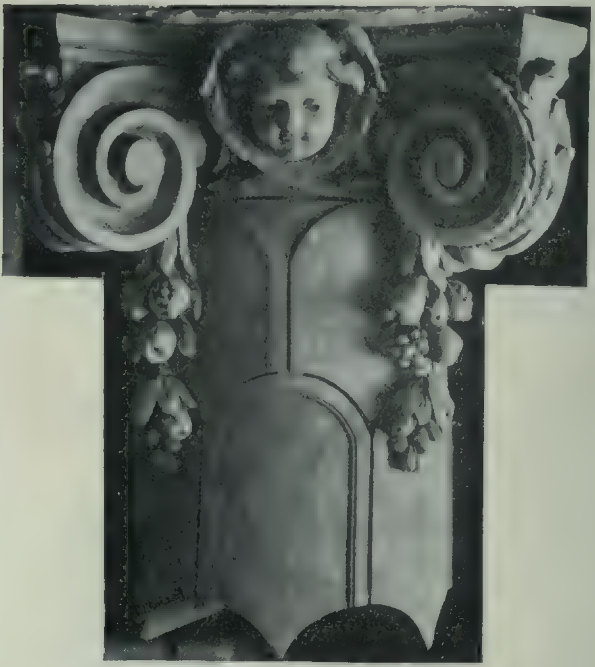

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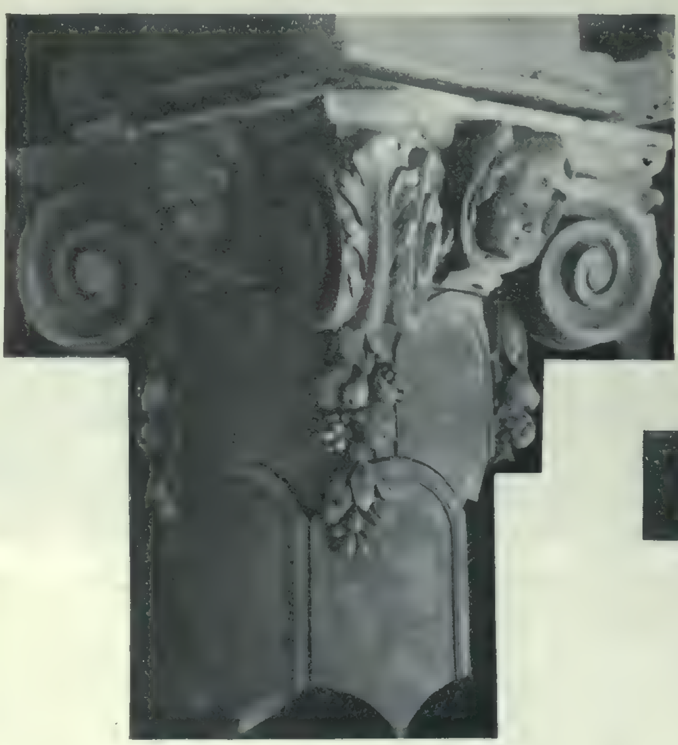

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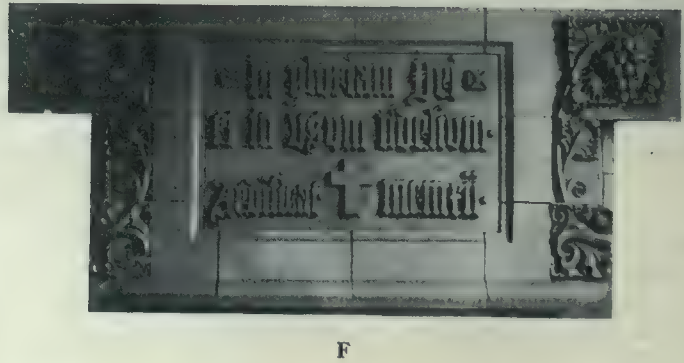

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A and B—Detail of ornament in Prudential Building. Fineness and sharpness of ornament are quite in keeping with nature of material, which would not be so if stone were substituted. C—Interesting detail adapted to the material, fillets elaborated to avoid wide and uneven lines from shrinkage in burning of material. D and E—Classic columns of usual form can never be executed successfully in terra cotta owing to number of joints necessary and unevenness of lines. In these examples a cleverly designed column is shown to suit joints in material. (Illustration by Messrs. Doulton, Limited.) F—Panel from St. John's Church, Saskatoon. Note jointing of margin and panel of one piece in low relief.

the enclosing walls of skyscrapers it is often employed very clumsily, but its clumsy treatment is not always due to a perverted use of the material as a material, so much as to the unsuitability of the ornament as ornament. It would be folly, for example, to apply low relief ornament in terra-cotta to the upper storeys of a twenty-storey office building, because no ornament at such a height from the ground would be effective or clearly defined, except to the few inhabitants of the top floors of neighboring skyscrapers. This, however, is as much a mistake of architectural design as would be applicable by the same reasoning to whatever material was used. Mr. H. D. Croly, in "The Architectural Record," has stated "that terra-cotta ornament should not be used when precision, delicacy and refinement of line are required. On the other hand, terra-cotta is just as effective as carved stone, when the ornament is seen from a greater distance, and when the architect intends that its effect shall be merged in the general appearance of the building."

When buildings are not ornamented in detail the effect produced, apart from their mass, their proportions and their salient lines, must be regulated by the texture and color of the materials used. It is in the possibilities afforded by an artistic combination of texture and color that some of the greatest and most peculiar merits of terra-cotta consist.

Great strides have been made in giving a more varied texture and tone to architectural terra-cotta. For a high building, it is not ornamental detail that is required in design, but a treatment at once flat, simple, screen-like and monotonous, for terra-cotta more than any other material lends itself from its very composition to such requirements. In the best designed skyscrapers of New York and elsewhere one will find the qualities enumerated above combined. The aesthetic value of these qualities consists chiefly in the manner in which terra-cotta by its texture, color and ornamentation has assisted in bringing out the massiveness of the big buildings combined with comparative lightness.

Glazed and Colored Terra-Cotta

Besides possessing the good qualities of lightness in weight, the possibility of molding before hardening, and its ability to resist fire, terra-cotta opens up a great field owing to the fact that it can be successfully glazed and colored, serving an aesthetic purpose which cannot be arrived at in any other way by other materials. When an architect wishes color to play an important part in the exterior design of his building he has no alternative but to use terra-cotta. It is more than probable that the great future of terra-cotta in this country will be associated with its enlarged and improved use as highly colored material.

One sometimes wonders why buildings in our large cities should be so bereft of color. The fact that they have some bright color about them in contrast with the many sombre and uninspiring edifices which line the streets of our cities, will make colored terra-cotta increasingly popular. Of course serious mistakes may be made in the injudicious use and selection of color, and also of the kind of glaze selected. To this reason probably is due the timidity of architects to venture in its general use. We are told also that color is suitable only for sunny climes, and that it makes no claims to the Northerners' tastes, who favor, one might think, their "grimy hives of industry."

Successful colors can be obtained in blue, green, yellow, grey and others. A white and cream-colored dull-glazed material is being largely used at the present time, and the Carrara-ware manufactured by Messrs. Doultons of London, England, has found much favor in this country, owing to the excellence of its manufacture. This closely resembles the general texture and surface of marble. Needless to say terra-cotta that has a highly glazed surface is not to be advocated from the artistic point of view.

The Savoy Hotel, London, England, is a good example of the right use of two colors, where green bands and panels used sparingly afford a charming combination with the cream color of the walls. Parkhurst Church, Madison Square, New York, is an admirable example in which the colored glaze may be applied to buildings whose height does not make the upper storeys too remote from the eye. Every part of the building in which decoration was appropriate has been embellished with very delicate and beautifully patterned ornament, and the yellow and green terra-cotta has been used to make this shallow ornament additionally interesting.

Another advantage of glazed terra-cotta is that it can be so readily cleaned and made "to look like new." In our manufacturing cities stone and brick buildings in a few years become begrimed with soot and smoke, whereas a glazed terra-cotta building can be always washed down in a few hours with a hydrant.

Glazed terra-cotta has been adversely criticised for use in our cold climate, as in a few instances where it has been used the frost has affected the glaze and caused it to crack. The failures, however, have occurred only where an inferior make of terra-cotta has been chosen, and the lesson to be learned in this case is to insist on none but reliable material. Polychrome architecture, as a recent writer has said, is not only beautiful in itself, but it would tend to revivify our almost obliterated color sense; furthermore, it would increase public interest in buildings. Anything that will fix attention on the nation's architecture is to be welcomed and encouraged (even by the investor could he but see it) and the correct use of terra-cotta undoubtedly will accomplish this end.

There is always some uncertainty regarding what is the best material to line the chambers of a continuous kiln. In kilns in which high heat is to be used for the burning of fire brick, or high class white face brick, it is a good policy to use all fire brick. In case only ordinary building and common brick should be burned in such kiln, a good hard burned brick will answer the purpose, but it has a drawback that in case higher heat wants to be used, the kiln is worthless. In order to overcome some of this trouble, and still not go to the expense of using all firebrick, it is a good plan to use buff colored brick, which can usually be bought cheap from the face brick yards. Seconds and thirds will answer well for such purposes, and a kiln thus built will more than outlast a kiln built of common red hard burned brick.

The manufacture of pottery is one of the most important branches of the clayworking industry in the United States. During the year 1912 the value of the production was $36,504,164, according to the report of the United States Geological Survey. The increased value of the output, over that of 1911 was almost $2,000,000. Ohio was by far the greatest producer, being credited with a value of $15,508,735 and New Jersey was next, with more than $8,000,000. Six states had productions of more than a million dollars each.

The New Hotel Vancouver

Noteworthy structure embodying unusual features of design and construction. Estimated cost $2,500,00

EXCAVATION is proceeding rapidly on the site of the Granville Street wing of the new C. P. R. Hotel Vancouver at the corner of Georgia and Granville streets, and work will be inaugurated on this portion of the scheme without delay. Steady advancement is in evidence week by week on the central section of the hotel, which will be sixteen storeys high, including a roof garden. The brick and terra cotta facing has reached the upper storeys and every effort will be made to complete this part of the structure by next July.

Some idea of the tremendous amount of work involved in erecting this huge hotel will be derived from the fact that upwards of four hundred men, in addition to thirty teams, are constantly employed on the job. The heavy equipment in use consists of one steam shovel, three steam hoisting engines and two electric hoisting engines. The cost of the entire contract will be approximately $2,500,000. Upwards of three thousand tons of steel has been employed in erecting the central portion and it is estimated that altogether four thousand tons of steel will be used before the remainder of the work is completed.

The porte cochere on Georgia street will be decorated with brick pilasters trimmed with terra cotta, and in the entrance vestibule, marble mosaic and terrazzo tile will be used for the floor and ornamental plaster for the ceiling. The vestibule will contain twenty pillars, each of which is to be panelled in marble to a height of four feet and above that in Austrian oak. A similar style of wainscotting will be used for the entire ground floor. The main stairway will be finished in marble and will have solid bronze balustrades. The ground floor of the central portion is to be occupied by the main office and rotunda, ladies' tea room, banquet hall, and several private dining rooms. The first floor of the porte cochere will contain a tea room for ladies, the floor above that being planned as an elaborate suite to be reserved for the use of distinguished visitors. A large convention hall under the light court, measuring 50 x 100 feet, and surmounted with a stained glass dome, will be one of the features of the Granville street wing. Directly underneath this hall, and in the basement, provision has been made for a billiard hall of similar dimensions. The basement will also contain a large grill room, bar, barber shop and sample rooms. Space will be provided in this wing for several small stores, the C. P. R. ticket and telegraph offices and a writing room. There are four main entrances altogether, one of these leading directly to the convention hall.

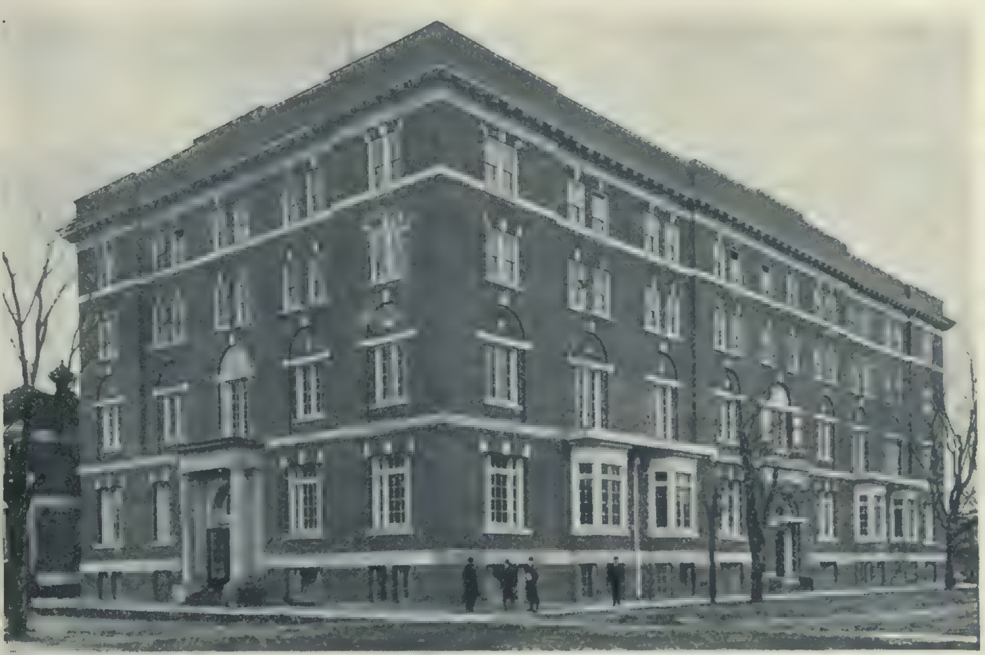
Central portion of Hotel Vancouver under construction.

The Granville street wing, the next section of the hotel to be erected, will be eleven storeys high, where it adjoins the main building, and seven storeys on the street frontage, with a light court placed directly in the centre. In order to conform with the architectural scheme of the whole building, the addition of an extra storey to the existing Howe street wing adjoining another new eleven-storey section will be found necessary. There will be seven hundred bedrooms altogether when the hotel is completed, each room being planned to have access to a private bathroom. All bedrooms will be fitted with solid oak doors and will be finished in white enamel. The hotel will be equipped with eighteen electrically-operated elevators. The roof garden on the sixteenth storey will measure 60 x 200 feet.

Progress of work at rear of central portion of new Hotel Vancouver.

The equipment and finishings throughout will be of the most elaborate description, no expense being spared to enable the contractors to erect one of the finest hotels on the continent. Mr. Francis S. Swales, architect for the C. P. R., designed the building. The general contractors in charge of the entire work are Messrs. Skene & Christie, Vancouver. It is estimated that the whole contract will be completed in January, 1915.

A firm of brick machinery manufacturers in the United States has recently introduced a new use for electricity in brickworks. This consists in separating the front of the mouthpiece and the pug-mill from each other by means of an electrically insulated collar. The negative wire from an electric dynamo or accumulator is then connected to the mouthpiece, and the positive wire to the end of the pug-mill. When the machine is at work making wire-cut bricks, a current of electricity is turned on and the amount of power required to drive the machine is reduced from 25 to 30 per cent. The electricity appears to decompose the water in the clay to a small extent and the gases developed then act as an exceptionally perfect lubricating medium, enabling an unusually short mouthpiece to be used even with the most delicate clays.



Y.M.C.A. Brantford, Ont. Architects, Messrs. Burke, Horwood & White, Toronto, associated with Mr. Lloyd D. Barber, of Brantford.

New Y.M.C.A. Building at Brantford, Ont.

OF the many architectural features of Brantford, Ont., the most conspicuous alike in point of design and construction is the new building just completed for the Y. M. C. A. of that city. This new structure, which has been most carefully designed to fulfil the requirements for which it is intended, is situated at the corner of Darling and Queen streets, forming an attractive addition to Brantford's handsome buildings.

The new structure is four storeys high with basement. The outside walls are faced with red pressed brick supplied by the Milton Pressed Brick Company, with raked out grey mortar joints, all the trimmings being of Indiana limestone. The ordinary construction is of wood joists, the floors being carried on steel frames supported throughout by steel columns. The style of architecture is very simple, following the Georgian or Colonial precedent, the aim being to secure for the building a domestic as well as an institutional character after the manner of most structures of the kind.

Commencing with the basement there are bowling alleys, billiard room, exercise room, swimming pool and the accompanying locker rooms adjacent to the pool. The size of the pool is 20 ft. x 60 ft., the water for its use being filtered by a modern filtering plant, a precaution which indicates the solicitude for the welfare of the members.

The general lobby on the ground floor is approached from the main entrance, and opening off the lobby are the reading and reception rooms.

The second floor contains a large auditorium, 80 ft. x 30 ft., which can be turned into small class rooms, or committee rooms, if desired, by means of accordeon doors. This apartment, which has a seating capacity of two hundred, is reached directly by the main staircase through the main lobby. It is being used almost every evening for purposes of amusement and instruction.

Next to this is the boys' supper room in close proximity to the main dining room and kitchen. The rest of the second floor is taken up mainly with classrooms, general toilettes and physical director's room. An innovation is to be found in the clubrooms for business men, also located on the second floor. These apartments include billiard room, lounging room and a spacious dining room, with its adjacent kitchen and storeroom. The club rooms are arranged with due attention to comfort, the aim of course being to afford the members an opportunity of cultivating the social side as far as possible.

The general lobby, the dimensions of which are 32 ft. x 62 ft., has an alcove at one end, and at the other a large fireplace which makes for the homely aspect of the building. The boys' lobby is also equipped with a fireplace. Off the general lobby is the main staircase running right through the basement to the fourth floor. Considerable space is devoted to the gymnasium. This latter is really a wing in itself occupying two storeys, the dimensions of the gymnasium being 50 ft. x 74 ft. An interesting feature about it is that it possesses a large running track in the form of a gallery.

The total area of the main floor is 13,270 square feet, of which 9,270 are in the main building and 4,000 in the gymnasium. The ground floor is finished throughout in quartercut white oak, and the principal rooms, including the lobbys, with terrazzo floors, with marble mosaic borders.

The third and fourth floors are occupied with dormitories and bedrooms, the number on each floor being thirty-two. Several suites of rooms are also provided for the use of those desiring the privacy of exclusive apartments. Shower bathrooms are installed within convenient reach of the sleeping rooms, so that nothing is left undone to cater for every reasonable requirement.

In the form of an extension a section of the fifth floor is fitted as a laundry, which is accessible from the ground floor by means of a service stair and elevator. As all the laundry work will be done on the premises, special types of up-to-date machinery are installed.

The vestibule, main entrance and the entrance to the boys' section have marble dados and stairs. The third and fourth floors are of hardwood throughout being maple and the trimming is of white wood stained mahogany.

The building is electrically lighted throughout, the conduit system of wiring being done by the Lyons Electric Company, Brantford. The power supply is derived from two return tube boilers installed in the basement by the Waterous Engine Company, Brantford, by which means also the building is steam heated.

The structure has a frontage of 149 feet on Darling Street and 78 feet on Queen Street, the total height from the street line to the roof being 58 feet. The roofing is of standard felt and gravel by the Brantford Roofing Company.

The building, which is one of the best of its kind in the country, involved an outlay in the neighborhood of $140,000. Local material was used in its construction as far as possible.

Brantford Y.M.C.A. Detail of Boys' Entrance.

Y.M.C.A. Brantford. Detail Main Entrance.

All the rooms are attractively finished and harmoniously decorated, and the whole detailed finish of the structure has been carefully handled with a view to simplicity and effectiveness.

The work has been carried out most satisfactorily by the general contractors, Messrs. Schultz Brothers, Brantford. The heating, plumbing and ventilating was done by the Drake Avery Company, Hamilton.

Messrs. Burke, Horwood and White, architects, Toronto, have given the city of Brantford a building which is a credit to all concerned, this distinction being shared by Mr. Lloyd D. Barber, architect, Brantford, who superintended this important part of the work.

Why Brick Houses Are Cheaper

AN Indianapolis architect, who was recently asked by a prospective home builder why so large a number of small houses were being constructed with brick exteriors, instead of frame, as in the past, and questioning the economy of brick construction, made the following statement, reported by Brick and Clay Record:

"There is a belief in the minds of a great many people that brick construction costs from 40 to 50 per cent. more than frame construction. Experience and investigation, however, have shown this belief to be a fallacy. The large number of brick residences that have been built during the last year have done much to establish the fact that brick is really the best material for the economical builder to use.

"An investigation of the costs of building materials with the aid of an architect will prove both interesting and instructive, especially when the brick construction is compared to the cost of frame construction. In frame construction, labor is employed in seven different instances, namely: (1) The studding, which forms the frame of the building; (2) the sheathing, (3) the building paper, (4) the weather boarding, (5) the lathing, (6) the plastering, and (7) the painting, which requires three coats to get good results. In brick construction, but two processes are necessary, (1) the brick work and (2) the plastering.

"Carefully compiled statistics show that the actual cost of brick walls over frame varies from 15 to 40 per cent., depending largely on the price of the face brick selected. As the walls of any building cost only about 10 per cent. of the total, brick construction would add only from 2 to 4 per cent. to the total first cost of the building. As it is necessary to repaint a frame dwelling every few years, it will readily be seen that brick construction, besides being the best, is the cheapest. A building constructed of brick is much easier heated than a frame one, and the saving in fuel is an item to be considered. Also, it must not be forgotten that with the faces and shades of brick now being manufactured it is possible to build a handsomer building of brick than from any other material."

The day is fast waning when architects will tell clients that it is impossible to build in brick unless an expenditure of a large amount is contemplated; experience has proven a costly teacher, but the lesson is well taught and the knowledge widely spread.

The Use of Terra-Cotta as Applied to Ecclesiastical Design

TERRA cotta as a building material has come much into evidence in this country during the past decade. Its possibilities are illimitable for exterior facing work. It is used, in the rough, for fireproofing steel, constructing floors and partitions, and also in many shapes and forms for interior finishings. That it is peculiarly adapted for ecclesiastical buildings is the purpose of this article to demonstrate.

In the first place, the general desire of the building committee of a church or similar institution is to obtain a monumental building, with certain accommodation, at a reasonable outlay. The general trend of public taste is toward a stone exterior, also—more especially in the case of an Episcopalian or Roman Catholic Church—the desire is expressed for a Gothic design. The working of stone in carving and tracery for such a composition is generally found to run to a prohibitive sum. The introduction of wood tracery into a stone-faced building, unfortunately so common in this country, is unthinkable to any student of Gothic in its true examples. Rather let the architect, if a stone exterior be insisted upon, design a building which does not call for tracery. The problem remains: how is a church to be produced, retaining the beautiful features of the old and standard examples and at the same time complying with the demand for an economical outlay? Terra cotta is certainly one reply to this question. The argument has been used, by aesthetics, that the material is an imitation. This is not so. It is a natural growth from the use of baked clay in brick form. It is a medium entirely by itself and as yet is but in its infancy.

Its possibilities are unlimited and it calls for the careful study of the architect of to-day to understand its manufacture and to discover its adaptibility to almost every school of design. Every separate block of this material, it is true, is made and finished by hand. How comes it then that terra cotta can show so much saving over stonework? The answer to this question is that the man who understands his medium can so arrange his design that the molds for tracery, modelled work, string courses, etc., call for repeats. It is very evident that this tends to economy. Again, modelled work, giving the effect of elaborate carving, can be introduced and repeated indefinitely. This work, when it is drawn from the molds prior to being placed in the kiln, is all finished and undercut by hand.

The material in question may be used in conjunction with brick or stone, or entirely by itself. In the building chosen to illustrate this article, a warm shade of buff terra cotta was selected in conjunction with a deep red facing brick from Redcliffe, Alberta. A happy combination is formed with a light buff terra cotta inclined to grey, in conjunction with a rough surfaced grey brick. Upon reference to the photographs, it will be noticed that the design of all the clerestory windows is identical, also the transept windows are similar in detail to those of the chancel and the tower: yet the effect of the whole is pleasing, and not tiring. The ornamental panels under chapel and chancel windows are repeated in the tower. The doorways on both sides of the building correspond, and the intricate modelling introduced as surrounds these entrances shows the possibilities of this material.

St. John's Church, Saskatoon. View from S.E.

The ornamental work in the upper portion of the tower and spire calls for careful consideration and earnest consultation between the architect and the manufacturer, every block in the tapering portion being made to dovetail into the block adjoining; also the same applies to the blocks above and below, provision being made for metal cramps.

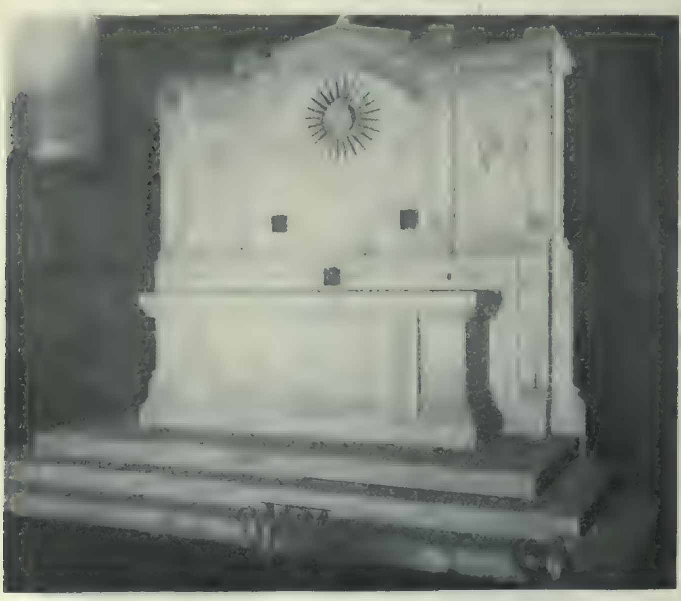
The designing of tracery calls for expert knowledge of the medium. The layout must permit of the clay being sectioned into pieces of a similar size, to prevent uneven shrinkage in the kiln, and the laying out of same, by an expert, is also a consideration, the contractor avoiding much unnecessary outlay, in centering, if the work is so sectioned that the mechanic can construct his arches without the aid of a carpenter. It is not the purpose of this article to deal with the possibilities of glazed terra cotta for exterior work or even to touch upon the vast field opened up in the question of coloured faience as applied to exterior facing.

The use of glazed work for a building of the class under consideration is not to be recommended. Let the architect select a material in which the block, both body and surface, is the same tone and colour.

Is this material suited to a construction where it is subjected to heavy crushing strains? Yes, the blocks are made hollow with reinforcing webs designed to take the pressure. At the same time the architect, in his specification, should call for filling with cinder or breeze concrete at his discretion. This particularly applies to buttress blocks and corbels. In the case of pinnacles and projecting ornaments, these are secured by dove-tailing and dowels as in stonework.

Terra cotta is peculiarly adaptable for the interior dressings of ecclesiastical buildings. Here glazed work can be used with discretion. The tracery will naturally correspond in colour with the exterior, and the architect will be wise if he adheres to the same colour throughout, on the interior structural work.

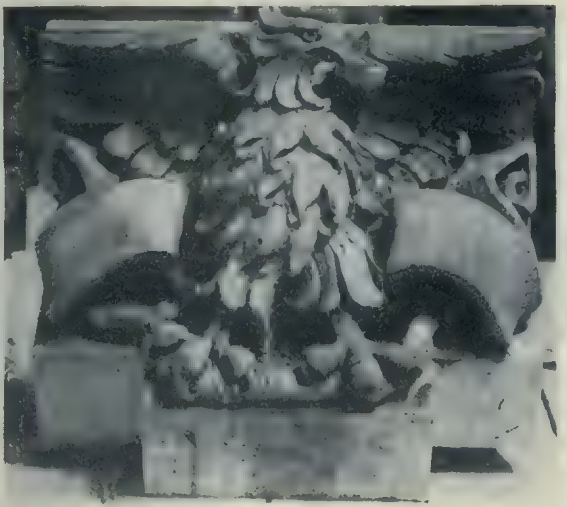
The question of the interior finish of the walls seems to call for consideration here. Why not brick again? Granted that climatic conditions are a consideration, hollow brick construction and provision of sufficient air space should easily dispose of any doubt on this point. Cathedrals in all ages were lined with



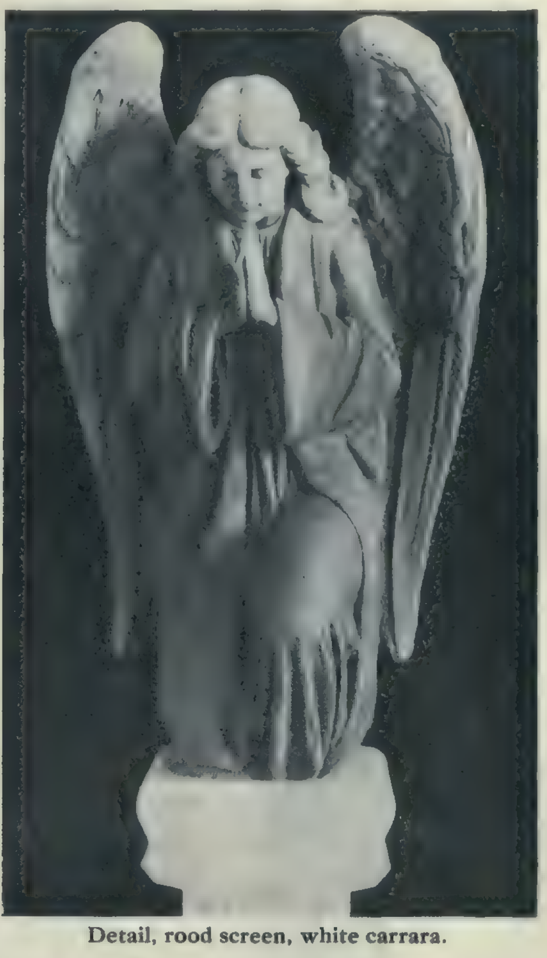
Detail of altar and reredos. Doulton carrara terra-cotta.

Detail of rood screen, pulpit and lectern. Doulton carrara terra-cotta.

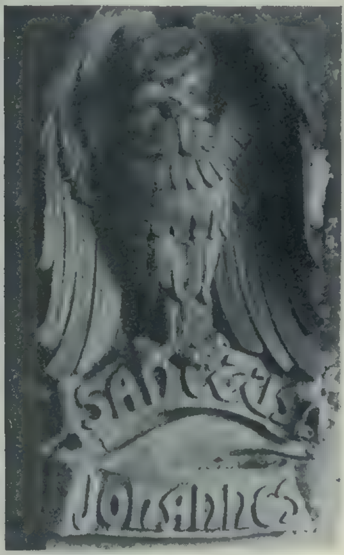
St. John's Church, Saskatoon. Interior view from west end. Roof and interior fittings unfinished.



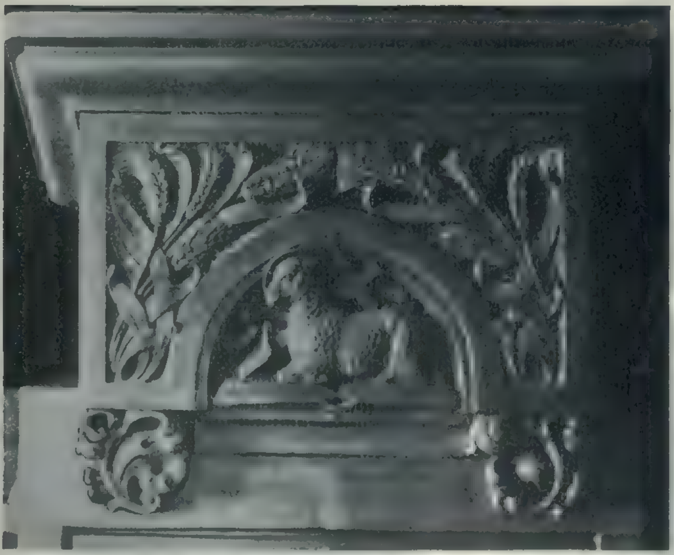
Corbel under clock in tower (exterior).



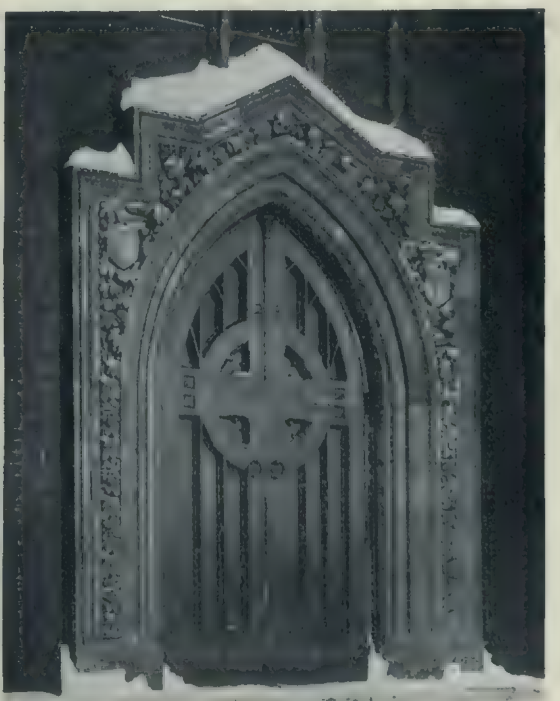
Detail, rood screen, white carrara.



Symbolic eagle panel, east window and tower (exterior).

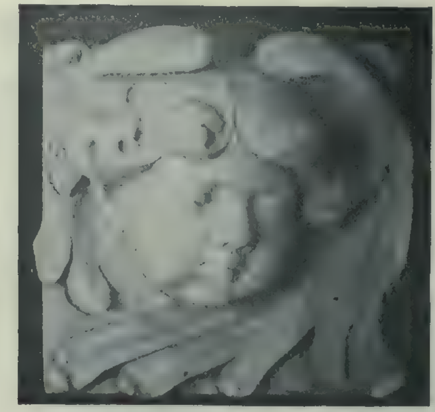


Pulpit reading desk.



St. John's Church, Saskatoon. Detail of south transept doorway.

Ornamental symbolic tile inserts in lustre ware in reredos, pulpit, etc.



Boss at finish of label mould to windows (interior).

Ornament exterior western porches.

Ornamental panels, upper portion of rood screen.

Lectern—white carrara terra cotta.

Angel panel in reredos.

stone, churches in Europe and elsewhere have used brick interiors for generations. There is nothing more pleasing to the eye than a colonnade of arches executed in really high-class brickwork. Terra cotta is suitable introduced in the form of lofty column shafts, ornamental caps, label molds, bosses, corbels, etc. In the church here shown the interior walls are of a light buff Portage facing brick, and the structural dressings are of the same warm buff tone as the exterior. Pleasing variation can be obtained by alternating the colour of the pointing in horizontal bands, say every four or five courses. In this building the column shafts are in brick with ornamental terra cotta broaches, but, as before mentioned the material in question gives excellent results for shafts with fine moldings.

The question of fittings as apart from structure is one deserving of close attention. What architect, with a real interest in his work, but enjoys the study of an altar, reredos, font or rood screen?—furniture which can make or mar his composition. What more appropriate finish to a building as suggested above than terra cotta?

Here he has the chance to show the possibilities of Faience Work, in delicate colouring and modelling.

Sun and symbol in reredos. Background and rays in pottery gold.

The manufacturer of terra cotta, to-day, can supply any harmony in form or colour—even giving a metal finish if so desired. To refer again to the illustrations:—The material selected for the fittings was a dull glazed white finish, with spots of brilliant colour in special-made tile inserts, the whole being pointed up in white, the effect of the mass, in contrast with the general rich tones of the woodwork and other fittings, is pleasing.

The details and drawings for this work cannot be too carefully studied; every molding and finish should be detailed. Tracery should be set out in "full-size" in every case, with sections of all mullions and branches. Mullions should be designed in two sections, interior and exterior, with vertical joint in glazing grooves, and horizontal joints to assure rigidity. Intersection of all moldings should, in every case, be carefully projected.

All modelled work should be drawn in light and shade with charcoal or colour, and plentiful sections should be given.

The architect in his specifications should call for photographs of all modelled work, to be submitted by the manufacturers before the clay is kilned, and also for setting plans, showing the number and position of every block, to be delivered prior to shipment of the material. Also he should provide for the careful checking of every shipment, with prompt ordering of missing blocks, or any remakes necessary from breakages, chipping, etc.

The illustrations accompanying this article are from photographs of St. John's Episcopal Church, Saskatoon, erected during the past year from plans prepared by Messrs. Thompson, Daniel and Colthurst of that city. The entire detail throughout is the personal work of Mr. T. Brammall Daniel. The general contractors are the Geo. H. Archibald Company, Limited, of Winnipeg and Saskatoon, and the cost of the completed structure will be in the neighbourhood of $126,000. The contract for the terra cotta was let to Messrs. Doulton, Limited, of London, Eng., for $16,160, including freight and duty.

An Electrically-Operated Plant at Inglewood, Ont.

ONE of the few modern clay-working plants operating in the neighborhood of Toronto is that of Shale Products, Limited, which is located at Inglewood, on the Hamilton-Allendale branch of the Grand Trunk and the Teeswater branch of the Canadian Pacific Railroads.

The company was organized in 1912 by Messrs. T. H. Graham, J. M. Scott and J. R. Scott, all of Inglewood. In building, designing and operating the plant they have associated with them Mr. M. B. Cheney, ceramic engineer, graduate of the Ohio State University, who has had extended experience in the manufacture of clay products.

About three-quarters of a mile below the plant on the Credit River is located the company's hydro-electric power plant. The site was originally that of a flour mill and the company has built a new dam and installed a complete new outfit. The turbine is the vertical type, was supplied by Messrs. Chas. Barber & Sons, of Meaford, Ont., and is the largest they build. This is controlled by a compensating type Woodward governor, which takes care of any fluctuations in the load. Connected to the turbine by an eight-ply by 24-in. Leviathan belt is a 125 kv.a. generator. This generates 2,300 volts, and together with the motors at the plant was supplied by the Canadian Westinghouse Company, Limited. The transmission line to the factory is No. 6 bare hard drawn copper wire.

The electrical installation at the consuming end consists of three 30-watt transformers and one small transformer for lights, two large and three small motors. The three larger transformers step the voltage down to 550 volts for use in the small motors. The latter are used in operating conveyors, pump and fan.

The machinery driven by the larger motors is divided into two units. The first of these is made up of three drypans and three thirty-foot elevators. The motor here is 2200 volts, 125 h.p. The second unit is made up of the brick machine, pug mill, cutter table, tailings conveyor, and clay feeder, and is driven by a 2200 volt, 150 h.p. motor. In the case of the large motors the winding is direct to the transmission line.

The company's shale deposits cover an area of two hundred acres, the outcrop beginning west of the plant and extending to the top of the Niagara Escarpment, a distance of three-quarters of a mile and an elevation of 300 feet. This embraces the red burning Medina

Continuous kiln under construction at Inglewood.

Machine room, showing pug mill, brick machine and tailings conveyor.

shales, the cap being freestone and brownstone. This material lies close to the surface and in mining it there is practically no stripping.

At present this material is being teamed into the plant, but to complete the design a tramway will be built and provision made for ample storage in order to operate the year round.

The factory buildings are low and very conveniently arranged. The dry grinding is done in three heavy duty dry pans. These are set on full gravity setting and empty into 30-ft. center chain elevators. These in turn discharge over three piano wire screens, the screened clay falling direct into a large storage bin, the tailings returning to the dry pans. The storage bin holds enough clay to make 150,000 brick. The ground clay feeds onto a 50-ft. center to center horizontal conveyor. This is built of frictionless troughing rolls, steel frame work and squirrel cage pulleys. The belt used is a 24-in. six-ply Leviathan. By a large chain elevator the clay is delivered to the clay feeder, the storage capacity of which is five hundred cubic feet. From there the clay is run through a 16-ft. pug mill and the "999 Special" brick machine. A side-cut automatic cutter finishes the machine work on the brick, and they are hacked onto double-decked dryer cars. All imperfect brick are conveyed back to the pug mill and worked over, which is the first step in sorting, in order to secure a high-grade surface and true shape.

The drying takes place in a coal fired radiated heat dryer, there being twelve tunnels with a holding capacity of 100,000 brick. This type of equipment affords the most accurate means for controlling all drying factors, which assures added efficiency.

The brick on the cars are placed on a transfer car and run into the chambers to the setters on portable track. The transfer track forms the axis of the plant, running entirely through it and affords a simple and rapid means of moving all material.

The burning takes place in an eighteen chamber producer-gas fired kiln. This is the most convenient type of kiln in use as well as being one of the most economical. All the factors that lead to the best results in burning are under full control. The producer-gas plant has four pressure producers and a coal storage with a capacity of four hundred tons. It is conveniently located along the Grand Trunk siding so that there is but one handling of all coal. Next to the producer building is a small building containing two fans and a small boiler. The boiler supplies steam to the producers, to a small vertical high speed engine on one of the fans and also to the factory. There are two fans, one driven by steam, the other by a motor, either of which is of sufficient capacity to give good draft to the kiln.

On either side of the kiln is a stock yard, that on the east side being along the Canadian Pacific siding, while the one to the west is along the siding of the Grand Trunk.

The machinery, dryers and kiln were supplied by the C. W. Raymond Company, Dayton, Ohio. Most of the belting was furnished by the Main Belting Company of Canada, Limited. The brick work on the kilns and dryer was done by Messrs. J. H. and G. S. Warwood, brick contractors. The fire brick were supplied by the Elk Fire Brick Co. of Canada, Limited. All frame buildings, all excavating, and concrete work have been done by the company.

The modern equipment and excellent shipping facilities of this company place it in the front rank of up-to-date Canadian plants for the manufacture of high-grade vitrified brick out of the Medina shales.

View at drawing end of dryer.

Interior of power house, showing governor, gearing and exciter.

Brick Plants of the Twentieth Century

A Consideration of Possible and Practical Economies—Utilization of Waste Heat—How the Manufacturer's Profits are Burned Up

By Charles A. Millar, Toronto*

IN dealing with this topic one must of necessity go back to earlier days and note the gradual evolution which has taken place in brick-making and brick plants. We do not propose to make the brick yards of Egypt a background for this article, but will merely revert to one short generation. Even that in fact is unnecessary, for to many of our readers there will immediately loom up a vision of horses going the weary round of grinding out the clay, and the men with wheel-barrows bringing it to the machine. To many this may seem a travesty on brick-making of to-day in our large cities where we have powerful machines turning out from 25,000 to 100,000 a day. It was only the demand for more brick, however, that foisted these modern appliances upon us, otherwise we should still be on the old tread-wheel; moreover the brick plant of the future must be different from any that has yet been seen, and indeed there are indications that some of our more aggressive manufacturers have started along these lines already. We make the following observations in the special interest of plants in close proximity to large cities.

The modern plant must be spacious, bright and clean, economical, smokeless and noiseless. How, it may be objected, could these qualities be attained around a plant where one's very existence depends on dirt, smoke and noise? In many plants built some years ago the idea seemed to prevail that to exclude all light except what was admitted through the crevices was the proper thing to do. What a relief, however, it affords one to walk around a plant such as the Don Valley (Toronto) or Mr. John Price's new plant (Toronto) where these essentials have all been taken into consideration! Think of the different conditions for the man who has to do the real work!

Not the least important feature of brick-making plants is economy. It is said that in the United States alone every year ninety million broom handles are thrown away, and that, too, in the face of depleting forests and scarcity of timber. But when one considers the fuel waste around our yards the broom handles vanish into ashes in comparison. Is there not some sane method of utilizing all the heat we must of necessity have for drying and burning our wares? Enough heat is wasted from our kilns to dry all the products we manufacture were it used in the right way along the line of radiation. Not infrequently the steam plant is old and shaky and requires more coal as a steam producer than does a new one. The steam pipes leak at the joints—more coal; the fan is half choked up with dirt and grease so that it throws only about half the air it should—more coal; the ducts leading to the fan are open or cracked and we cannot understand why we are not getting better results, and all the time the fireman is shovelling your profits into that insatiable furnace. One is inclined to the belief that the plant of the future will be run by electricity and every particle of heat will be utilized until after it has travelled perhaps hundreds of feet under ground and every heat unit extracted for our benefit in drying our wares.

Then, again, what shall we say of the waste in burning brick? One calls to mind the picture of the stage coach travelling for weeks to get a glimpse of the last pine tree in Canada. It is loaded with tourists who have travelled thousands of miles to see this relic of past ages. You hear the driver explaining that years ago the ground was covered with these great trees, but that bush fires and lumbermen kept on chopping and burning until only this one remains. The brick man also got his share, for he would consume from half to one cord for every thousand bricks burned. What shall we say of such waste to the future generation? Take for instance an up-draft kiln containing three thousand bricks. As soon as set and scoved from ten to fifteen cars of wood are piled around it and the burning begins. For five days at least men are ever ramming in the wood. As soon as the heat passes through the brick it is gone. In this way we are only burning the surplus profits which at the end of the year have frequently disappeared in similar manner with the heat. In comparison with this we have the latest type of gas-producer kiln where the gas is extracted from coal and every unit of heat is conserved until it has passed through the burning chamber, heating the next one and steaming a third; and while this type is ideal (especially from the salesman's point of view) it is as yet a rich man's kiln. There is not the slightest doubt that in some respects the gas producer is a perfect kiln, but there are still defects which must be remedied before one can

Mr. Chas. A. Millar.

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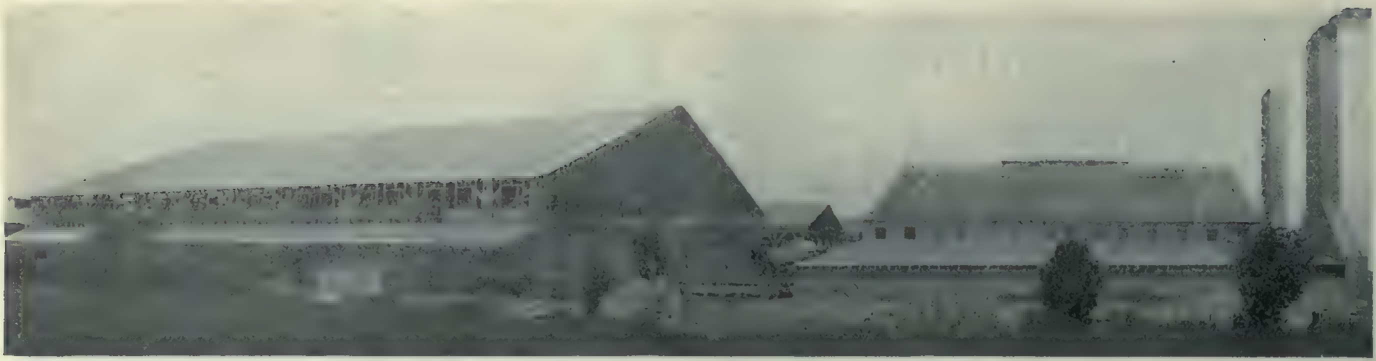
*President Canadian Clay Products Manufacturers' Association.



Typical example of an up-to-date gas producer kiln.

obtain as good a class of ware as from the older type of down-draft, fired from both sides. In the gas-fired kiln the heat is always travelling in one direction, effecting a saving of 50 to 75 per cent. in burning.

Much more could be said along the line of economy, but if the manufacturer would take the trouble to examine his own plant the value of these hints to him might be realized.

In the effort to secure a smokeless plant, splendid results have been obtained by the use of slack instead of lump coal, and with forced draft on good suction a wonderful improvement will be noted. Instead of firing once an hour, as is the custom with three-quarter lump, two or three small shovels are put on three or four times an hour, which produces more flame with much better combustion and consequently less smoke. When a steam plant is in operation another method has been found to work out well. That is to turn your exhaust, or a portion of it, into your chimney which seems thereby to reduce to a minimum the density of the smoke. In many places the smoke is not a nuisance, but the manufacturer must ever keep in mind the fact that with this great cloud of smoke passing from his plant gold dollars are floating away. Experts tell us that we are now only getting about thirty per cent. of the heat out of our coal and wood, the rest being wasted by poor combustion.

A plant may have a great deal of machinery and still make very little noise if properly set up and kept oiled and in repair. Have you ever noticed that most of the noise is needless and does not produce profits to the owner, in fact quite the reverse? Better work can be accomplished to the music of a piccolo than that of a bass drum, so put in a silencer.

Lessons from the Recent Depression in the Brick Industry

By W. H. Freeborn, Brantford, Ont.

THERE has never been a year in the history of the clay-working industries which opened with brighter prospects for the brick trade than the one which is now drawing to a close. So far as Canada is concerned there are many contributory factors which, taken in conjunction with each other, indicate a season of unusual development. The exceptional prosperity which marked the year 1912, both as regards agriculture and business generally, apparently lent color to the belief that we as a nation were passing through a year of unprecedented activity. Among the factors which contributed to this assumption might be mentioned the financial and commercial activities of the country. An examination of the bank returns gave to the student of public affairs the impression that there was plenty of money in circulation, and that as a result business would equal that of any previous year. Another factor worthy of consideration was the continued advance in the price of lumber owing to the scarcity entailed by reason of the mild winter of 1912-13. The result is that lumber yards are at present depleted to a greater extent than has been the case for years past. This will likely mean heavy buying next winter, so that instead of lumber easing off in price it is more likely to advance. The high price of lumber would appear to have reassured the brick manufacturer with the possibility of a vision of something good for him and his business.

Assuming that we are experiencing a considerable set-back in the brick trade and that the output is not up to former years, the question naturally arises that there must be a cause for so sudden a change. If the opening of the present year were so auspicious and encouraging to us from financial and other view-points, giving us inspiration for doing and expecting greater things, what is it that brought about so sudden a depression in the brick business, such as has been experienced by every brick manufacturer all over the country? Without being pessimistic one is inclined to think that a reaction has set in and whether it be temporary or prolonged is a question beyond one's power of vision to foretell.

First of all, are we producing more building material than this country can continue to absorb, resulting in a reduced demand for material, creating disappointment in the carrying over of heavy stock and of entailing losses to the manufacturer? In some localities this may be apparent, but it cannot with accuracy be applied to the country as a whole. If we admit that the supply of brick is greater than the demand, the question arises whether brick making as a commercial proposition is a safe investment. Being a staple product brick is an absolute necessity. The smallest hamlet and the most prosperous and progressive city demand the product at a reasonable cost; therefore, we unhesitatingly say that brickmaking is a safe investment.

The science of brick-making has of late years been brought to a high standard and with modern machinery, proper locations and adequate facilities for careful production, success would seem to be assured, provided, of course, that the requirements of the public are amply catered for and that brick-making enterprises are conducted on a proper commercial basis. In the opinion of many the present depressed conditions among clay brick manufacturers in our large centres is due in part at least to the fact that large plants are poorly managed and an inferior article is manufactured. Underselling in the market is the inevitable result with its attendant consequences. The inferior product brings a poor price, produces low dividends and at the same time minimizes the efficiency of the plant. At a time such as the present a great deal might be accomplished through judicious advertising. By placing his products before the public through the agency of trade and other journals, the manufacturer often benefits largely as a result. Admitting that a depression exists in the brick industries we can only look forward hopefully to the unborn future and let each man make his business a part of himself, so that when the inevitable boom arrives he will be prepared to meet it both successfully and profitably.

A New Face Brick Plant at Meaford, Ont.

By M. B. Baker, Kingston, Ont.

CLAY products, including bricks, tile, sewer pipe, terra cotta, paving bricks, roofing tile, etc., are made from two raw materials. First we have the unconsolidated true clays, which are formed from rock decomposition, and secondly, clay rocks, which are called shales. True clays are plentiful in the southern states beyond the glacial margin of the recent glacial period in North America. South of this margin, rock decomposition has developed a considerable thickness of its products. These are the only true clays to be found in America. In Canada, however, the recent glaciation ploughed off all such clays, or mixed them up with such a percentage of ground rock that our so-called clays are nothing more than indiscriminate mixtures of clay, sand, rock-flour, gravel, and boulders. True, there are many places where the melted ice supplied water which resorted this material to such an extent that the finer grained material was kept by itself and these are the deposits which are used in Canada in the manufacture of common bricks and drain tile.

All higher grade products, such as pressed brick, terra cotta, sewer pipe, flooring and roofing tile, are made in Canada from shales. These shales are old clay accumulations which resulted from rock decomposition, were carried by streams and deposited in large bodies of water. They are therefore clean, even-grained, continuous, and homogeneous throughout, and were laid in horizontal beds whose thickness and regularity can be relied upon. Since they are the results of rock decomposition the product is a pure clay. They are therefore the highest grade raw materials that we can get for the manufacture of clay products.

In Ontario, only two shales have as yet proved quite satisfactory in manufacture, although many others have been used. These two are known as the Hudson River shale and the Medina shale. They lie together, the Medina being the uppermost bed, and they outcrop in a belt starting between the city of Toronto and the town of Beamsville, and extend in a north-westerly direction towards Georgian Bay. Here they outcrop between the towns of Thornbury and Meaford (see Fig. 1). About the Toronto end a number of brick plants have been established, e.g., Don Valley, Mimico, Port Credit, National Brick Company at Cooksville, Brampton, Milton, as well as glazed sewer pipe plants at Hamilton, Mimico and Swansea. Until this summer there was no plant on the northern end of this belt. All the intermediate portions of the belt are so covered by later rock formations and glacial drifts, that they are hopelessly buried so far as their economic value is concerned.

It has been already stated that the Hudson River shale outcrops between Thornbury and Meaford on the shore of Georgian Bay and it was on this property that the Meaford Brick Company established its face brick plant. The exact location of the deposit is best shown by the accompanying map sketch (Fig. 1.), the shale area being shaded. It covers approximately seven hundred and fifty acres and is one hundred and forty-three feet deep to the level of Georgian Bay, but has been drilled by this company another sixty feet below water level. It extends from the water's edge southward to the Collingwood gravel road as shown on the map. From this point southward it is overlaid by upwards of two hundred and fifty feet of mixed limestones, sandstone, and glacial drift so that it is of no economic importance beyond this road. This is shown by the sketch (Fig. 2) and it will be noted that this gravel road marks the base of this high escarpment which overlies the shale beds. This high escarpment marks the shore line of a pre-historic lake, just as the present shale bank marks the shore of the present Georgian Bay. In Fig. 2 an attempt has been made to show these relationships and it is hoped that this will

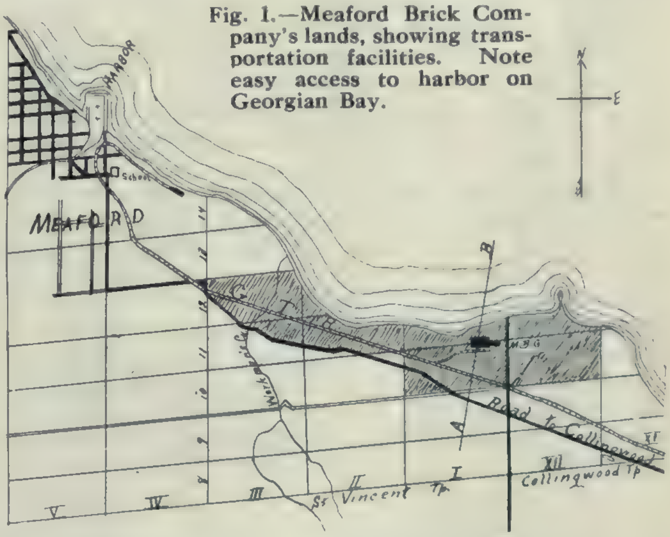


Fig. 1.—Meaford Brick Company's lands, showing transportation facilities. Note easy access to harbor on Georgian Bay.

be understood by the reader. The shale beds are here shown as a bench or shelf extending northward from the high escarpment to and even beneath the present water level. These beds of shale lie almost flat as shown in the sketch. Referring to Fig. 1, it may be stated that at the west end the shale beds were cut off by the stream marked there as Workman's Creek. Formerly this was a large river which cut out a deep broad valley and has, by its wandering where it entered the old lake, cut out a broad fan which extends from approximately its present position all the way westward to Meaford Harbour; so that in this area the shale has been cut out and eroded to the present level of Georgian Bay.

Towards the east, the shales dip or slope and are gradually covered by a deeper and deeper layer of boulders. The writer in his geological travels has never seen an area where boulders have been so abundantly dropped as here. They are actually in almost solid beds so much so that one can step from boulder to boulder. This great accumulation has of course cut off, from an economic standpoint, the use of the shale any farther east than the town line between St. Vincent and Collingwood as shown in Fig. 1. From these descriptions it is seen that the Meaford Brick Company has secured all the economically available shale on the northern end of this belt.

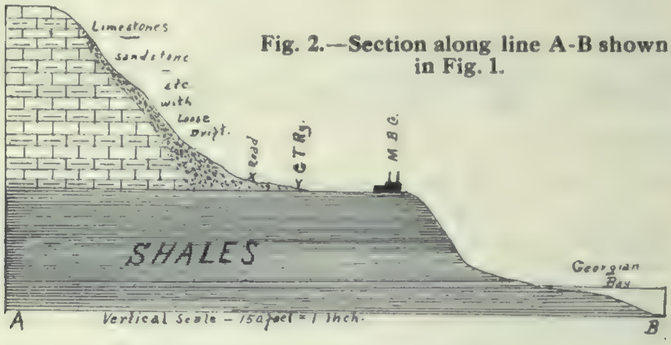


Fig. 2.—Section along line A-B shown in Fig. 1.

Hudson River shale is very much the same thing wherever found and is a remarkably high grade product. Below will be seen a series of analyses taken from various localities using Hudson River shale, and it is striking to note the remarkable similarity in their composition. The first two represent samples taken from the Meaford Brick Company by the writer, and the others as indicated represent samples also taken by the writer in preparing a Government Report for the Bureau of Mines of Ontario in 1906 on "Clay Products of Ontario."

Locality	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Loss by Heat
1 Average Meaford	58.42	16.18	7.41	3.53	3.18	8.88
2. Average Meaford	59.34	17.46	7.86	2.64	2.92	8.48
3. Port Credit	56.46	18.19	7.43	2.56	2.93	8.52
4. Don Valley	57.86	20.00	6.83	2.92	3.25	5.74
5. Mimico	57.12	18.52	7.28	3.92	3.32	6.40
6. Milton	53.20	17.73	6.91	6.00	3.24	9.58

It will be seen at once how remarkably uniform in character, at least from the standpoint of analysis, these Hudson River shales are. But as they were all laid down at one time and in the one body of water, it would be expected that they would be much alike. It is therefore quite to be expected that a company operating on an easily obtainable Hudson River shale would have much the same success in manufacture.

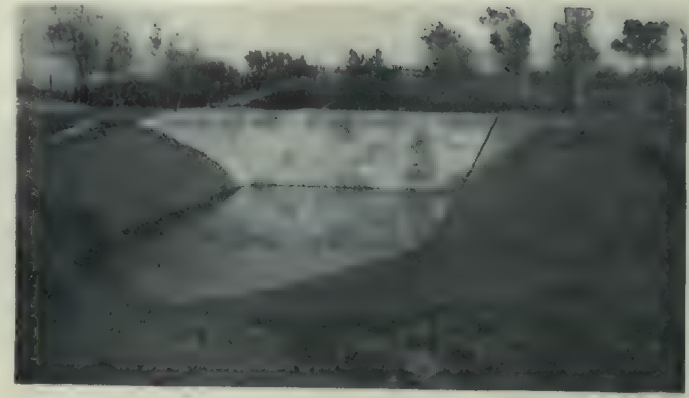


Fig. 3.—Reservoir at the Meaford Brick Company's plant.

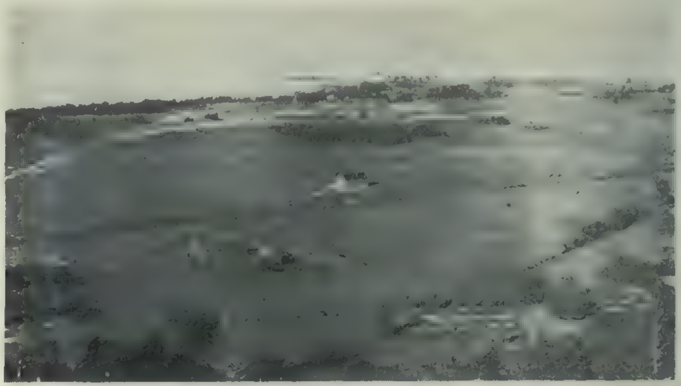


Fig. 4.—Bird's-eye view of the property.

The following will be a brief outline of the process of manufacture as used by the Meaford Brick Company. As shown by Fig. 2 and also in Figs. 3 and 4, these flat-lying shales come right up to the grass roots. Fig. 3 is a reservoir which this company built by damming one of the small gullies near the edge of the bank. This ensures a fresh water supply and shows clearly the flat-lying shales coming right up to the surface of the ground. Fig. 4 is a bird's-eye view of the company's property taken from the top of the high escarpment to the south. It serves to show the absolutely flat shelf-like character of these shales as described in the fore-going part of this article. These shales are ploughed by means of a hard-nosed road plough. The loosened shale is then gathered by wheel scrapers and conveyed to a clay hopper, beneath which a belt conveyor is running. This conveyor carries the shale to a large storage bin which feeds directly into the pan-mills, which grind the shale till it will pass through a ten mesh screen. The screened product is carried to storage hoppers which feed directly to the dry-press machine, or to the pug mill of the stiff-mud machine, as desired.

In the dry-press process the brick are made on a Berg machine, and are set on steel cars, 500 to a load. This is the first time the shale has been touched by hand. These cars are run on railway tracks directly into the kilns for burning where the bricks are piled ready for burning. This is only the second time, and the last that the bricks are handled till ready for shipment.

In the stiff-mud process the ground shale enters the pug mill of a Freeze machine capable of making eighty thousand bricks per day. Here it is mixed with just enough water to make it a stiff putty, it is then forced through the machine as a solid bar with beautiful smooth faces and sharp corners. This bar is cut by fine wire into bricks, which pass on to an endless belt from which they are lifted by hand and piled on steel cars 500 per load. This is the first time the shale has been touched by hand in this process. These cars are then run into tunnels where they are left to be dried. This drying is done by a current of air made hot by the waste heat from the burned kilns and drawn through the tunnels by a large fan. When the bricks are thoroughly dry, which requires from 30 to 40 hours, the cars are run as before into the kilns where the bricks are lifted off to be set ready for burning. This again is only the second time and the last that the material has been touched by hand since being ploughed in the pit.

The burning of both the stiff-mud products and the dry-press products takes place in down-draft kilns which are shown in Fig. 5. The principle of these kilns is that the fire is built in separate pockets, passes up through fire-brick flues to the dome of the kiln, here it bends over and passes down through the loosely set brick, out through a perforated floor into flues which lead to the large chimneys. There are three kilns to each stack. When the bricks are burned they are all red in color and are loaded directly into freight cars, or onto stock piles for later shipment. The company has a siding from the Grand Trunk Railway. This is built in a shallow cut, as shown in Fig. 5, so that the floor of the car comes on a level with the yard thus facilitating the loading very materially.

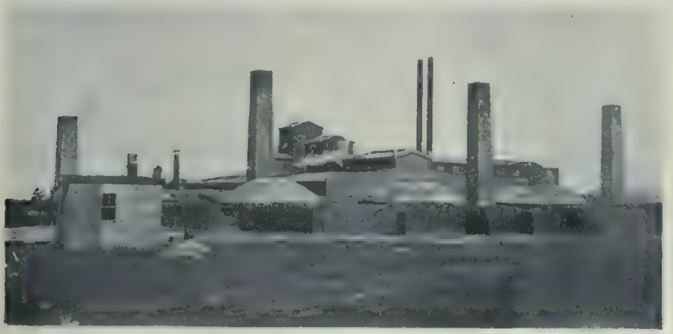


Fig. 5.—Down-draft kilns at Meaford Brick Company's plant.

The Meaford Brick Company has so far confined its operations to brick making, but with such an unlimited supply of high grade shale it should have no difficulty in adding from time to time the manufacture of any of the other structural materials. There is little doubt that tile for roofing and floor, hollow-block for the inside walls of buildings, paving bricks, sewer pipe and terra cotta will be added in the course of time.

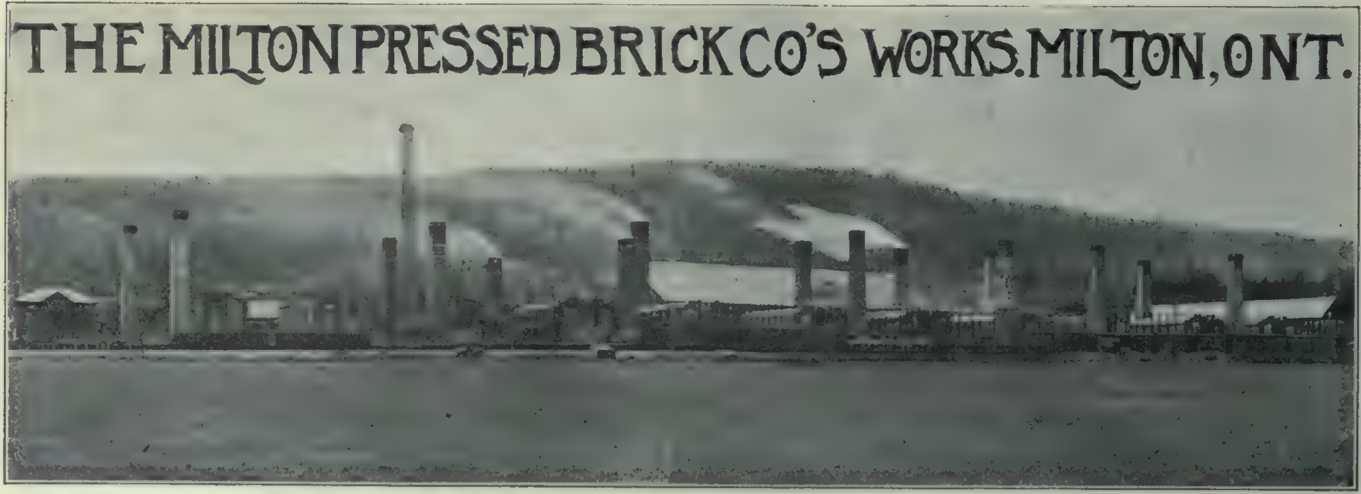
New Brick and Tile Plant at Brantford

THE remarkable industrial activity of the city of Brantford has received a fresh impetus in the building and equipment of the new plant owned and operated by the Ideal Brick and Tile Company, Limited. This plant is situated to the east of the city, and the fact of its being located on a bank of serviceable red clay goes to emphasize its value as a commercial asset of the company, seeing that the outlay which haulage of the raw material would entail under other circumstances is here avoided. The plant is thoroughly equipped with soft-mud and drain-tile machinery, and as an example of the economical methods in use at this factory it is sufficient to state that the exhaust of the steam power is used in drying the product. This process is effected in a Bechtel drier. By its means the brick are thoroughly dried without checking or cracking, and the full capacity of the firm's Martin A machine is satisfactorily handled. The plant, which has been running throughout the season, is turning out the very finest grade of soft-mud brick and drain tile; indeed it is not too much to say that the grade of the material produced is the best that can be manufactured by this process.

The Bechtel truck system is in extensive use in the brick yards. By this system the company's material is handled with remarkable ease, while at the same time the finished product is left in excellent condition. The firm has been doing exceedingly well up to the present. With the object of adding to the productive capacity of the plant the owners have in contemplation the provision of four round down-draft kilns. All of which goes to show that the expansion stage has already been entered upon, and that a period of successful development is already in progress.

Every kiln should have a pyrometer and recording draft gauges. They determine the best draft at each stage of the burning and enable the burner to maintain this draft. The pyrometer keeps the burner wide awake and alert and shows quickly any change in the kiln temperature. Their use saves loss of fuel and damage to ware.

Ideal Brick and Tile Company's plant at Brantford, Ont.



Making Pressed Brick at Milton, Ont.

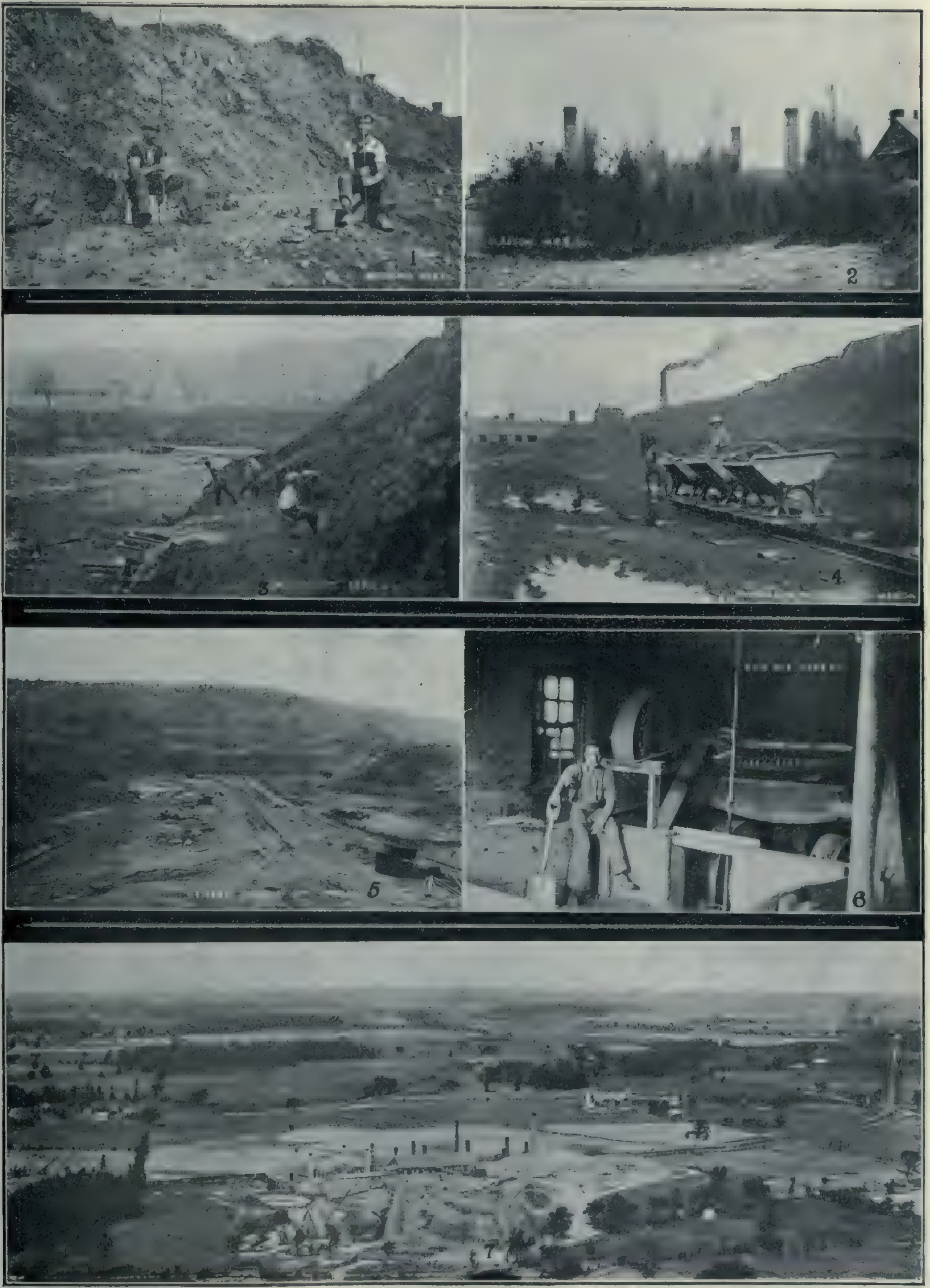
THE Milton Pressed Brick Company's plant is one of the most successful in the country. The plant, which is conveniently situated just outside the town of Milton, Ont., has been in operation for about twenty-four years. The firm has been under the same management ever since it was first organized, Mr. J. S. McCannell, the president and manager, having been associated with the company since its formation.

The plant has a capacity of 125,000 face brick a day, a fact illustrative of the enterprise which characterizes the company in meeting the increasing demand for Milton brick. Red and buff dry pressed bricks are manufactured, as well as several varieties of fireflash effects in both red and buff colors. The company own 300 acres at Milton and are very fortunate in the clay they possess there. The pit runs in strata of red and buff colors, and is pure shale with practically no impurities of any sort. This shale is of the Medina formation and has been tested to a depth of 400 feet. The shale is worked from the bank with a fifty-foot face and runs in colors of red and buff alternately. It is blasted out with dynamite and hauled in cars to dry pans. The material is then ground, being tempered to a slight dampness just sufficient to allow it through the screens, which reduces it to the fineness of powder. In producing other shades of brick by flashing in the burning, the Milton company claim to be the pioneers.

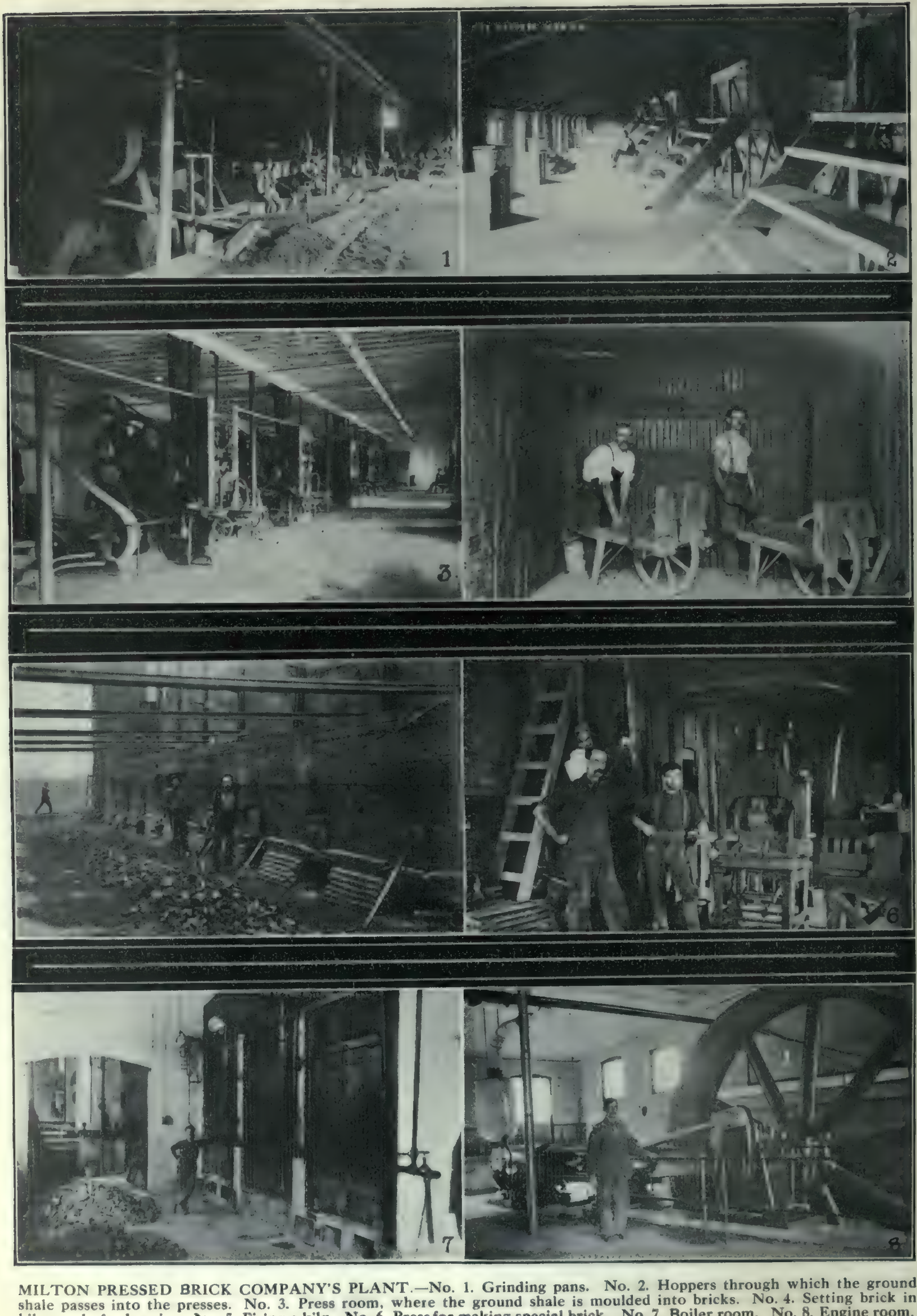
The press room contains eight Boyd presses and extensions are being made to admit three more of the same make. Each press has a capacity of 18,000 to 20,000 brick a ten-hour day. The great advantage in having all the machines from one factory can be readily understood when it is considered that the stocking of spare parts which will fit lal the machines minimises

Mr. J. S. McCannell, President and Manager of the Milton Pressed Brick Company.

Show room in the Toronto office of the Milton Pressed Brick Company. The walls of this room consist of eleven solid brick panels, each panel representing a different grade of brick.



MILTON PRESSED BRICK COMPANY'S PLANT.—No. 1. Drilling, preparing for blasting. No. 2. Blasting the shale. No. 3. Shale beds No. 4. Hauling shale to grinding pans. No. 5. Shale beds. No. 6. Grinding pan. No. 7. Bird's-eye view of plant and farm.



MILTON PRESSED BRICK COMPANY'S PLANT.—No. 1. Grinding pans. No. 2. Hoppers through which the ground shale passes into the presses. No. 3. Press room, where the ground shale is moulded into bricks. No. 4. Setting brick in kiln, ready for burning. No. 5. Firing a kiln. No. 6. Press for making special brick. No. 7. Boiler room. No. 8. Engine room.

as far as possible the time lost in effecting repairs. The press room is 200 feet long.

There are at present fifteen kilns in operation, each having a capacity of 200,000 brick. Of these kilns thirteen are down-draught and the other two up-draught. The company are building several more down-draught kilns. The engine room contains a 360 h.p. Wheelock engine, which provides the power required, while there are three boilers of 90 h.p. each used for steam purposes. The water required for the plant is obtained by gravity from a reservoir.

The shipping facilities which the company possess are excellent. They have a C. P. R. siding at the plant which will hold 25 cars, and they have also first-class arrangements for switching on to the Grand Trunk Railway, which is situated within a convenient distance of the factory yards. It is interesting to mention that there are 25 men employed continuously in the work of loading brick for shipping.

The various processes of brick-making naturally entail a good deal of labor and at present about 150 men are employed, of whom a number, like Mr. McCannell, have been connected with the company since they started.

The plant has been running winter and summer for many years, and the company are looking forward to next year as one of the best in the history of brick production at Milton.

A Successful Sand-Lime Brick Plant at Brantford

AT the present time when the productive capacity of brick-making plants is increasing in every direction, it is gratifying to find that the industries of Ontario are keeping abreast of the times in supplying an ever-increasing demand for all kinds of brick manufactured in the Dominion. One of the most modern plants to be found in Canada to-day is the sand-lime brick factory at Brantford, Ont., owned and operated by the Schultz Brothers Company, Limited. This plant, which was among the first of its kind to be located in Canada was installed in 1907. It has a capacity of 20,000 bricks a day, and so rapid has been the firm's progress that despite the present temporary dullness in the market their plant is working at maximum capacity, a fact which in itself testifies to the quality of the brick turned out.

In the Berg system, which is the one adopted at this plant, the steps in the process are four in number, consisting of the slaking of the lime, the mixing of the lime and sand, the pressing into moulds, and the baking or curing. In the process of slaking only sufficient water is added to the lime to bring about the hydration. Two kinds of sand are used, soft or fine, and coarse. The company have a considerable area of land right in the immediate vicinity of the plant, and from this pit the coarse sand is taken, while the soft sand is obtained at a second pit a short distance away, being conveyed to the factory by teams. Before the mixing of the sand and lime takes place, the lime requires to be slaked. The lime used at the plant is strong magnesia lime, about six cars of which (22 boxes to the car) are used per day in the process of brick-making. After being watered to some extent before it is put into the cylinder, the lime is slaked by a mechanical process under a steam pressure of 100 lbs. to the square inch. The slaking goes on through the night, which is generally found to be the most convenient time, and the lime is ready to undergo the mixing process next morning. Prior to this the lime is fed through a grinder to pulverise it, this process rendering it as fine as powder before reaching the sand. The mixing machine consists of a steam jacketed drum with interior rotary blades operated by suitable gearing outside and at one end. This drum is filled by means of a funnel at the top. When the drum is charged, the interior mixing blades are set in motion and the contents are heated by means of the steam jacket surrounding the drum. A vacuum pump attached to the apparatus removes the steam and air from the drum. When the sand has been properly dried the required quantity of finely pulverized lime is introduced into the drum through a special aperture and the mixture is again stirred and heated. After wetting by the addition of the necessary quantity of moisture the mixture is given sufficient time to allow a preliminary combination of the sand and lime to take place and produce a mixture of sufficient tenacity to allow of easy molding. In the preparation of the sand, great care must be exercised. It is first put through a steam dryer and from there it is conveyed to a bin capable of containing a full day's output of the finished product. After it leaves the bin in which it is sifted and mixed the sand is taken on to the measuring machine. The chemical action set up by the presence of silica in the sand and magnesia in the lime effects the required chemical combination. After being measured and mixed to the required consistency by single shaft mixers it is then conveyed by means of an elevator to the first floor where it undergoes further treatment before introduction to the press. This operation is continuous and automatic from first to last. The firm use a four-mold improved Berg press, the capacity of which, as already stated, is 20,000 bricks a day. After emerging from the press the molded bricks are piled on open cars. These cars when filled are run into the steaming cylinder. This latter is large enough to accommodate the maximum day's output of the plant, being 6 ft. x 80 ft. long. The cylinder having been filled it is closed and sealed, and steam under a pressure of 120 lbs. per square inch is applied. The period of baking occupies about twelve hours to perform. It is the usual practice at this plant to operate the press during the day and to steam the day's run through the night.

This process completes the manufacture of the bricks, which are then taken out and piled into the stock sheds in the yards ready for shipment. Every facility is at the firm's disposal for rapid loading of the finished product, there being sidings of the Grand Trunk Railway and the Canadian Pacific Railway alongside the yard. Although the company specialize in making the natural color sand-lime brick they also turn out red and buff brick that have become popular of late. A feature of the plant is that the same process serves for all three varieties, the only variation in manufacture being with regard to the coloring which is done at the time the sand and lime are being run through the measuring machines.

The Berg make of machinery is in use throughout the factory, steam power being supplied by a 75 h.p. Goldie & McCulloch engine. The high pressure boiler was installed by the John Inglis Company, Limited, Toronto.

A new record was established at the Herscher, Ill., plant of the Illinois Brick Company when, one day early in September, it made 300,000 brick in eight hours. This is the largest number ever turned out in one day at this plant, the former record being 298,000. The brick were handled by seventeen men, or an average of 19,650 per man in eight hours, or forty-one brick per minute.

General view of York Sandstone Brick Company's plant, showing transportation facilities.

The Manufacture of Sand-Lime Brick

Last Word in Methods and Equipment at the New Plant of the York Sandstone Brick Company, Limited

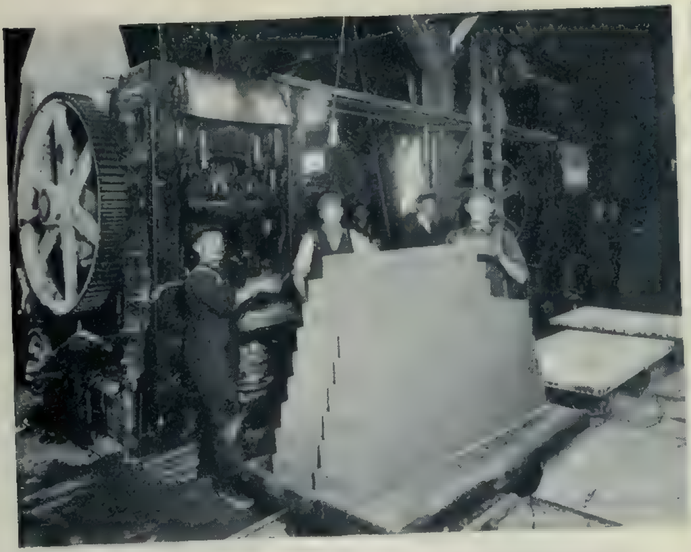
THAT sand-lime brick as a modern clay product is gaining in popularity every day would seem to be established by the increasing number of plants erected exclusively for that particular process of manufacture. One of the most up-to-date plants and the first of its kind to be located in Toronto is that of the York Sandstone Brick Company, Limited, which is conveniently situated in East Toronto, near York Station on the Grand Trunk Railway, at the corner of Gerrard Street. As recently as March, 1913, the ground was broken for the erection of a forty thousand capacity plant for the manufacture of sand-lime brick. Substantial buildings of brick and concrete and a large sand drying shed of one thousand tons capacity were erected, the construction work being completed in July.

The company has a capital of $80,000, of which $55,000 is preferred and $25,000 common stock, all fully paid up. The board of directors of the company is as follows:—Mr. Alex. McCurdy, president; Messrs. Douglas Ross, Walter Page and D. L. Tarleton, and T. J. Smyth, managing director, who is also president of the York Sand & Gravel Company, Limited, with whom the York Sandstone Brick Company have entered into a twenty-five-year agreement for its supply of sand in the manufacture of sand-lime brick. Mr. Smyth is also a member of the well-known builders supply firm of Smyth & Ryan. Having had such a wide experience in the various processes of brick manufacture, and of builders' requirements generally, he is eminently fitted for his managerial position in the York Sandstone Brick Company and it is not surprising to find that he experiences little difficulty in maintaining the full running capacity of the plant. The importance of sand-lime brick as a factor in the market of today is evidenced in the success which has attended this project.

The process of manufacture is interesting. The sand which is sharp, free from loam and other impurities, is conveyed from the pits by a radial inclined belt-conveyor to the top of the sand shed, where it passes over a coarse screen to remove the large stones and gravel. It is then conveyed by gravity down a radial chute to any part of the shed desired. This shed, which has a capacity of one thousand tons, is divided into sections enabling the sand to be used from one end while the other is being filled and dried. The excess moisture having been eliminated from the sand it is fed through a slot in the floor of the shed onto a belt conveyor located in a tunnel under the floor. It is then carried to the elevator which raises it to the top of the shed and deposits it on screens. Passing over these it is caught at the bottom on another belt conveyor and carried to the sand hopper, from which point it is fed into wet pans by a measuring device fed by gravity.

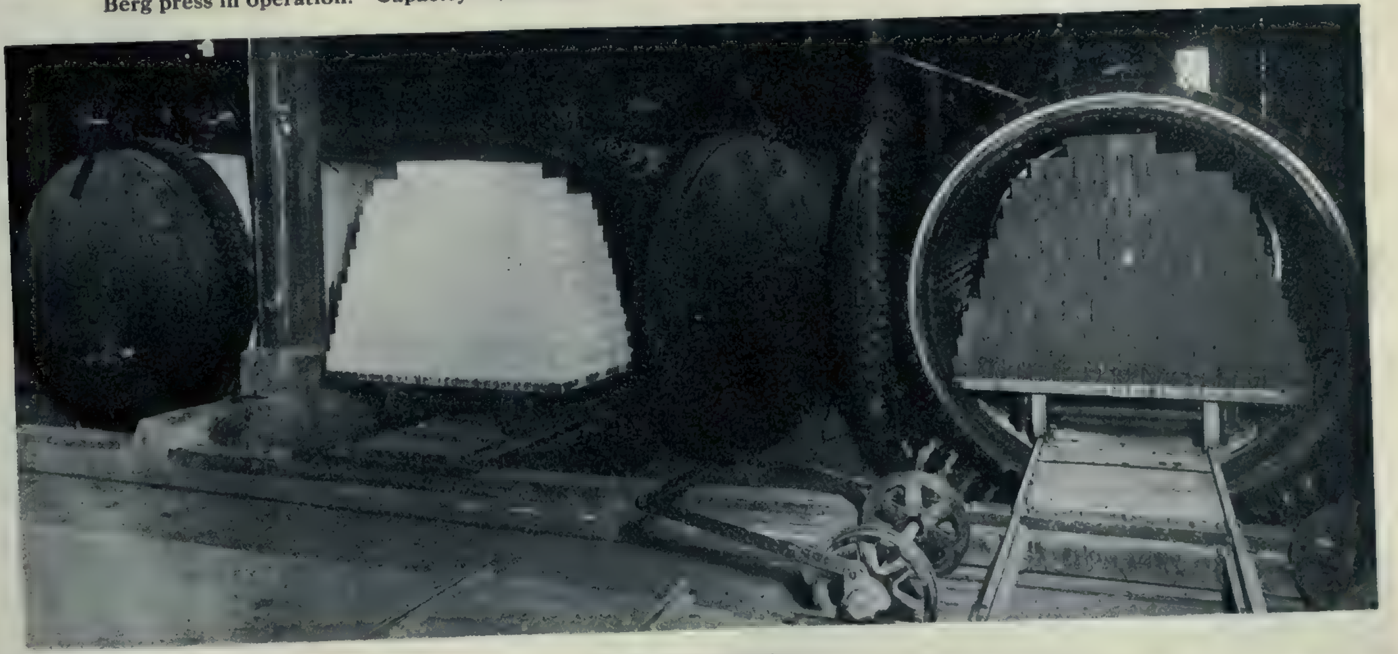
The process of dealing with the lime and reducing it from its raw state is equally interesting. First of all the lime is unloaded from cars at the door of the lime room. Passing through a jaw crusher it is elevated to the hydrating room. Here water is added to slack the lime and it is then fed into silos from which point it is transferred into the wet pans as required. This system of handling the lime is known as the Pre-Hydrating system and so far as the York Sandstone Brick Company is concerned it has proved very satisfactory. Having now been properly mixed and ground in exact proportions the lime and sand from the wet pans is passed into the presses and subjected to a pressure of 25,000 pounds a square inch. The brick are then taken from the presses and loaded on Berg sand-lime brick cars which are run into the hardening cylinders. These cylinders are hermetically sealed and the brick are then subjected to a further steam pressure of 125 pounds a square inch. This process takes approximately ten hours. The cylinders are then opened and cooled and the brick, being finished, are now ready for shipment. In this respect the company's own siding on the G. T. R. offers every facility for the rapid loading and shipping of the finished product.

Accessibility to the works is an important point and in this the company is well served by a good wagon



Berg press in operation. Capacity 22,000 daily.

Heavy duty wet pan.



Hardening cylinders.

View of plant showing belt conveyor.

Hydrating room.

The York Sandstone Brick Company's Plant

road which leads into the yards from either Gerrard Street or Danforth Avenue.

As regards machinery, the York plant is one of the best equipped in the Dominion, none but the latest types of equipment being installed. The machinery consists of two Berg King B presses, two heavy duty Berg wet pans, three hardening cylinders, and as already stated, eighty Berg sand-lime brick cars. A Berg high pressure boiler, capable of developing 150 h.p., is also installed. Motor power is supplied by a Westinghouse motor, 150 h.p., driven by hydro-electric power, also a 25 h.p. motor which is used to drive the lime hydrating equipment and sand conveyor system.

The brick made by the York Sandstone Brick Company, Limited, is the only product in Toronto which has a frog or stock mark, a point which invariably meets with the approval of every builder. A few of the points of superiority which the company claims for this brick are: uniformity in color, size and quality (it being uniform with standard stock and facing brick) freedom from culls and bats, the portion of broken brick being extremely small. As an evidence of their staying qualities the sand-lime brick manufactured by this company have passed a crushing test at the School of Practical Science, of 99,600 pounds per whole brick or 3,030 pounds per square inch, this test having been made on a brick only one week old. Another feature is the absorption test, which runs from eight to twelve per cent. of moisture, whereas clay brick is said to run as high as thirty-five per cent. While iron melts at about nineteen hundred degrees of heat it is estimated that sand-lime brick will require some three thousand degrees Fahr. A building of sand-lime brick is declared to be drier than one built of clay brick, so that the greater freedom from dampness renders the sand-lime brick building warmer in winter and healthier all the year round. Because of this freedom from excessive moisture such a building is less liable to crack in frost.

Among the local job contracts in which the York Sand-Lime Brick have been used recently are, Shea's New Hippodrome, Terauley Street; Picture Theatre, Queen Street West; factory on Dundas Street; warehouse on River Street; church on Spadina Avenue. In addition to heavy deliveries by teams, from two to three cars have been shipped daily during the last month. Sand-lime brick manufactured by this company are sold at $7.00 a thousand, f.o.b. car at the plant. The company's offices are at 123 Bay Street, Toronto.

Brick Paving Construction at Welland, Ont.

By D. T. Black, Town Engineer

UNTIL recently Welland was content with macadam pavements, but the heavy increase in traffic due to its rapid growth, the introduction of a street railway system and the many openings in the macadam surface for water mains and sewers, made its streets almost impassable. The Council of 1912 commenced their first permanent street pavement improvements when a contract for brick on 5-inch concrete base was awarded in March to Mr. C. H. Kaumeier, Port Huron, Mich., for 40,000 square yards, to cover the three main streets—known as East, West and South Main Streets. Each street has a single street railway track and terminates at one of the three railway stations, the total length being nearly two miles. The original tender called for pavements 32 feet, 35 feet and 45 feet in width, but these were changed later to 35 feet, 40 feet and 45 feet. The contract price was $109,892.50, but before the contract was commenced the base was changed to 6-inch concrete and with other minor alterations the estimated cost was increased to $118,912.52. The amended price per square yard was $2.47 and on track allowance $3.39. Both prices included all grading to thickness of pavement. The work was commenced in May, 1912, but owing to bad weather and other conditions only one-third of the total contract was completed last year. Operations were resumed this spring and completed successfully this fall.

Brick pavement under construction at Welland.

The work proceeded in the order of rough grading, curbs, fine grading, concrete base and brickwork. The sub-grade was rolled with a 12-ton steam roller. Previous to rough grading the catchbasins (street gutters) were placed by town employees. The catchbasins consisted of concrete pipe (24-inch diam.) with special castings cast in a local foundry. The curbs were all of concrete made in lengths of 5 ft. 6 in., 1 ft. 6 ins. in depth, and 6 in. in thickness. The core was composed of one part cement, two parts sand and four parts gravel and a wearing surface one inch thick of one part cement to two parts sand. Under the curbs a trench one foot in depth was cut. This contained tile drain (4-inch diam.) with the remaining part of the trench filled with gravel. Most of the curbs at street crossing corners have radii of ten feet. The few exceptions where the streets did not meet at right angles have radii varying from 8 feet to 40 feet. The amended specifications called for a concrete base of six inches of concrete, having aggregates of one part cement to seven parts Lake Erie sand and gravel mixed (sand not to exceed 50 per cent.). This base was laid in a fairly wet condition, straightened off with template and tamped. The sand cushion was 1½ inches in depth when loose. The bricks used on this contract were all Metropolitan Block and were carefully culled before and after rolling. The bricks were rolled with a 5-ton horse roller until a smooth surface was obtained. Provision for expansion was made with a 1-inch asphalt joint along each curb. The filler used was cement grout of sand and cement in equal parts, applied in two or three coats with a brush and squeegee.

After the final application of the filler, the pavement was kept closed to traffic from seven to fourteen days. The street railway tracks consisted of 6-inch T-rails, weighing 60 pounds a yard, spiked to cedar ties and oak ties under joints. The depth of concrete below the base of rail was one foot, composed of the same aggregates as the 6-inch concrete base. This allows of 6 inches of concrete below ties and 6 inches between ties. The ties, with rails spiked, were blocked up to grade in advance of the concrete mixer, thus allowing the construction of the track concrete and side base at the same time. The space between the rails and that outside, making the track allowance 8 feet 3 inches in width, was also paved with Metropolitan Blocks.

During construction a change was made in the track allowance outside of the rails. At first three courses of stretcher bricks were laid parallel with the rail, but the vibration of the cars showed signs of destroying the grout joints. The stretcher courses were then eliminated and the header course continued from curb to rail. So far this has proved more successful. In all cases the outside brick was kept from ¼ inch to ⅜ inch below the top of the rail.

Completed brick-paved thoroughfare at Welland, Ont.

The Catherine Street pavement was awarded to Mr. C. H. Kaumeier at prices much similar to those of his other contract, the same specifications being used. The pavement was 24 feet in width, and totalled some 900 square yards. Bessemer Blocks were used instead of Metropolitan.

It may be of interest to state that during the present year 1.8 miles of sewers have been constructed. All of these have been of single and double strength vitrified sewer pipe and varied in diameter from 8 inches to 20 inches. The depths were from 8 feet to 17 ft. 6 ins. The manholes were all constructed of concrete, with straight walls 9 ins. in thickness, the aggregates being one part cement to six parts Lake Erie sand and gravel. The total cost of the entire works was $20,051.59.

New St. Paul's Church, Toronto

THE new St. Paul's Anglican church on east Bloor Street, Toronto, which has just been opened, presents features of absorbing interest, particularly to the building trade. A detailed article illustrative of the design and construction of the new edifice appeared in The Contract Record and Engineering Review as recently as June 4, 1913, therefore reference to a few of the main features will suffice here. Architecturally the style of the new building follows the early English and the decorative periods of Gothic. The lines on both the interior and exterior and ornamental detail have been carried out with due regard to the magnitude of the church, so that the impression obtained is that the building represents the harmonious adaptation of Gothic architecture to a special problem in planning design. The whole exterior of the church is of stone with stone trimmings, while the interior has been designed after the cathedral style. The exterior dimensions are, length 220 ft.; width 140 ft.; height 97 ft.; interior length of nave, 152 ft.; width of nave and aisles, 75 ft.; width of nave, aisles and side aisles, 105 ft.; width of transepts 130 ft.; height of apex of roof, 91 ft. The floor is of composition stone flags, and the aisle between the pews of composition red tiles. The choir is paved with white, green and pink marble tiles, and the steps leading to the choir and communion table are of white marble. The roof is of open timber work with Gothic tracery. The architect was Mr. E. J. Lennox, 164 Bay Street, Toronto, who has achieved noteworthy success in the designing and completion of the church, which involved an outlay of about $350,000.

There is real economy in the storage shed or bin, aside from the solution of the wet clay problem. Repairs or accidents may cause you to shut down the augur, but the grinding machine is still delivering its regular supply. Should the grinding machine get out of order, the brick machine is not handicapped, for the bin holds a surplus.

The Frontenac Floor and Wall Tile Company's Plant.

New Clay Industry at Kingston

WITH the starting of the plant of the Frontenac Floor & Wall Tile Company, Limited, in Kingston, Ont., this month to manufacture floor, wall and decorative tile, the Canadian trade, which has hitherto depended on the English and American market for these goods can be supplied with the Canadian-made article. That there is a growing demand for ceramics, art mosaics, encaustic, wall and decorative tile, is evidenced by the fact that last year 5,000,000 feet, valued at over half a million dollars, was imported into the country.

The company started building operations in August and the plant was completed by November 1st, Wm. McCartney & Sons, of Kingston, being the contractors. The factory is of brick and steel construction, 96 x 270, one storey, with two large kiln buildings connected and has a floor space of 24,000 sq. ft. The plant is within sixty miles of the largest and finest felspar and silica mines in American and both felspar and silica comprise over 50 per cent. of the proportion of raw material used to produce tile. The balance of the raw material, which is china clay, is imported from England. The shipping facilities are excellent, the company having both the G. T. R. and the C. P. R. right at their door as well as being able to ship by water. Electric power is used throughout.

The factory is equipped with modern clayworking machinery supplied by the Patterson Foundry & Machine Company, of East Liverpool, Ohio, the Model Machine Works, of Trenton, N.J., and the kilns by John Lovitt, of Trenton, N.J. It will have a capacity of one million square feet of tile per annum. About eighty hands will be employed at the outset.

In the process of manufacture of this tile, the crude clay is put in the blungers where it is mixed with water before passing through sieves composed of phospor bronze fire of 120 strands to the square inch. These sieves eliminate all sand and foreign matter from the clay. The liquid clay then passes through electric magnets which eliminate any particles of free iron which may exist in the clay. Less than one-quarter per cent. of this free iron in the clay would cause a defect in the finished product. The liquid clay then passes to the settling tanks from which it is pumped into filter presses. These filter presses are so constructed as to hold minute particles of clay, the excess water filtering through pressed chambers. The clay being taken from the filter presses contains about 30 per cent. of moisture. It is then dried on steam coils and passed through crushers and pulverizers. These pulverizers run at high speed and reduce the clay into dust which passes through a 16-mesh screen to eliminate coarse particles. The dust is then taken to the presses which are so constructed with a hammered steel screw working in phosphorus bronze nuts as to obtain a pressure of eight tons to the square inch, pressing various sizes and designs, which are formed by the chilled steel dies. The tile are then in compressed dust form and are put in fire clay boxes which are placed in patent up and down draft kilns. The reason the tile is encased in fire clay boxes is to keep the direct fire from flashing the ware. The firing of the tile is continued for about 96 hours and is brought up to a finishing point by about 1400 degrees centigrade. It then requires about 72 hours cooling. The tile are then drawn from the kiln and are sized, shaded and assembled in the different patterns and designs.

The Frontenac Floor & Wall Tile Company, Limited, is a purely Canadian company, with a capitalization of $250,000, practically all of which is Kingston money.

Extensive Operations of the Nova Scotia Clay Works, Ltd.

THE Nova Scotia Clay Works, Limited, with head office at Halifax, N.S., incorporated February 29, 1912, has just completed its construction work started some two years ago. At the time the company was formed it had only one modern, up-to-date plant, situated at Pugwash, N.S. The company's market covers a wide area, including Newfoundland, Cape Breton, Prince Edward Island, and all the Northumberland Strait, ports in Nova Scotia and New Brunswick, as well as having rail connections as far as Campbellton, Fredericton, St. John and Halifax. It was recognized that to take proper care of the brick and clay manufacturing business, it would be necessary to establish modern plants equipped with the most up-to-date machinery at various points in their territory, so the firm decided to establish three additional large plants at Pugwash, N.S.

The next plant to be built was at Annapolis Royal, N.S., situated on the Annapolis River, and commanding all the Minas Basin, Bay of Fundy, the Western Nova Scotia ports, as well as being provided with rail connections throughout the entire Annapolis Valley. This plant is particularly well situated to cater to the St. John, New Brunswick trade, being only a matter of five or six hours sail. The third plant has been established at Lantz Siding, near Elmsdale, a point on the Intercolonial Railway, about 36 miles from Halifax. Though it has no water connections it is well provided with shipping facilities by rail into Halifax, and also to all points served by the Intercolonial Railway throughout Nova Scotia and New Brunswick.

It is expected that owing to the great development work the Government has in contemplation for the port of Halifax, a considerable demand will be created for the products of the company. The Elmsdale plant, in addition to manufacturing ordinary stock brick, will also produce hollow terra cotta blocks, farm tile, pressed brick and sewer pipe, for shipping throughout the entire Maritime Provinces.

With the advent of modern fireproof buildings there is a growing demand for fire-proofing materials, such as hollow clay blocks, and this branch of the clay manufacturing business is proposed to be taken care of in a thoroughly up-to-date manner. All kinds of fire-proofing will be manufactured in the various sizes and it is expected that this department of the business will show increasing expansion as time goes on.

The company has provided for the growing demand for drain tile by installing an up-to-date tile manufacturing plant at the Elmsdale works. It is evident, judging from the encouragement the various Governments are giving the farmers, that scientific farming, which includes under-draining, will shortly be taken up on a large scale by the farmers of the Maritime Provinces, and as this development will include the use of drain tiles the firm has made ample provision to meet any demand that may arise.

All the company's plants are equipped with down-draft, continuous burning kilns, the latest type of machinery, steam shovels and cranes for handling the clay, sand and brick, and every known appliance that will produce a better class of clay product.

The combined plants will have an output of 30,000,000 brick a working season, which is more than at present consumed in the Maritime Provinces. Having an eye to the future, however, and believing that the Maritime Provinces are only beginning to come into prominence, the management has undertaken to provide so that when the demand arises the company's plants will be in a position to meet it.

The products of the firm are said to compare favorably with those manufactured by any other plant throughout Canada or the United States. The clay is thoroughly ground and mixed and is burned in the kiln at an even temperature resulting in the maximum quantity of hard brick and the minimum quantity of soft. At present the kilns are producing brick approximately 95 per cent. hard, which is a very high percentage compared with the product turned out by the old scoved, up-draft kilns which have been in vogue in Nova Scotia and Eastern Canada for so many years past.

In addition to its other properties the company has a shale deposit at its Pugwash works which has remained undeveloped so far. This shale has been tested by expert clay-working engineers and has been pronounced the best that has come to their notice, either in the United States or Canada. Samples of paving brick have stood tests unequalled by any other paving block manufactured on the North American continent. It is the intention of the company to commence the manufacture of paving blocks at an early date.

Having gone through two years of construction work the firm is now in a position to handle any trade that may offer from its territory. Judging by the high quality of its products and its determination to set a high standard, the future of this enterprising company would appear to be assured.

Excellent business is reported by the Silicate Brick Company of Ottawa for 1913, both in output and sales. Over six million brick have already been disposed of this year and another two million are sold for winter delivery. The firm state that they have furnished brick for every large building in the Capital this year and that Ottawa has never experienced a better year for large office and warehouse buildings.

Large Radial Brick Chimney in Quebec

Radial brick chimney at Donnacona, P.Q.

The Alphons Custodis Chimney Construction Company, of New York, has recently completed a large radial brick chimney for the Donnacona Paper Company, Limited, of Donnacona, P.Q. The chimney is among the largest in Canada, it being 175 feet high and nine feet inside diameter at the top. The massive foundation is of concrete, eight feet thick and twenty-five feet wide, reinforced with steel rods. The lower thirty feet of the chimney proper is octagonal in shape, built of red brick, giving the structure a pedestal effect. Surmounting this is the round Custodis radial brick column, deep cherry-red in color. Having been worked out to a very graceful design the taper is most pleasing. At the top will be noticed a decorative effect of lace-like pattern. This has been accomplished by building the upper fifteen feet with buff-colored radial brick, interspersed with deep red brick, forming the pattern. The extreme top is covered with a cast iron cap. The name "Donnacona" has been built into the red column with buff-colored radial bricks. Each letter is six feet high, the whole sign being over eighty feet long. The contrast between the deep red column and the light buff letters causes the latter to stand out very prominently, so that the sign can be read for a great distance. The construction of the column is similar to that which the Custodis chimney company have employed in some two hundred radial brick chimneys they have built in Canada, and similar to that which was used in building the tallest and largest chimney in the world, 506 feet high and 50 feet inside diameter at the top, for the Boston & Montana Consolidated Copper & Silver Mining Company, at Great Falls, Montana. The stupendous size of this chimney can be imagined when we realize that were the Washington monument placed within the chimney, a double team of horses could be driven between the outer walls of the monument and the interior of the chimney, the Washington monument being but fifty feet wide at the base, as compared with a width of seventy-six feet of the chimney at the same point. By reason of the unusual size, weighing over seventeen thousand tons, and the difficulties attending the scaffolding and handling of materials at such great heights, it is asserted that the building of this radial brick chimney at Great Falls, Montana, was the finest engineering achievement in chimney building ever accomplished. The special feature in the construction of these chimneys is that they are built of perforated radial brick, cut on a radius to fit the diameter of the chimney as the diameter varies in the height. The blocks being perforated vertically to their beds, the mortar in the horizontal joints enters the blocks from three-quarters of an inch to an inch, keying one to the other, as it were, with a mortise and tenon joint. The perforations allow a more thorough and homegeneous burn of the block, on account of which they have greater crushing strength than if the blocks were solid. The perforations form also an insulating air blanket around the chimney, having the effect of cutting down materially the radiation and producing a more even temperature with a steadier draft. Another quality claimed for the perforations is that not only do they strengthen the stack but lighten it also, thus making for smaller and less expensive foundations. The blocks are also acid-proof, and when used with a specially prepared mortar, produce an acid-proof chimney, many of which have been built in Canada and the United States for smelters, chemical plants, paint works, and other manufacturing plants where acid fumes are produced. When it is remembered that these fumes are destructive of steel, concrete, or ordinary brick, it will be conceded that the introduction of this acid-proof chimney is a welcome innovation in view of the expense often occasioned by renewals and repairs.

Dean Galbraith's Jubilee

Dr. John Galbraith.

Engineers from all parts of the North American continent gathered in the engineering building of the University of Toronto on the evening of December 5 to pay tribute to the worth and work of Dr. John Galbraith, Dean of the Faculty of Applied Science, on the happy occasion of the fiftieth anniversary of his entrance as a freshman and the thirty-fifth anniversary of his founding of the School of Practical Science. The function was the twenty-fifth annual dinner of the University of Toronto Engineering Society, and those present included eminent engineers and public men, leading educationists and a large muster of undergraduates, close on six hundred guests in all being present. The gathering was presided over by Mr. F. C. Mechin, president of the Engineering Society. The toasts were:—"Canada," proposed by Mr. G. M. Smythe and responded to by Col. W. N. Ponton, Belleville; "The Dean," proposed by Mr. Hyndman Irwin; "University of Toronto," proposed by Mr. W. E. Phillips, responded to by President R. A. Falconer, University of Toronto; and "The Profession," proposed by Mr. O. G. Lye, responded to by Mr. R. A. Ross, C.E., Montreal, and Mr. H. F. Ballintyne, of New York.

Reference was made during the evening to the eminent position which Canada occupies today in the engineering world and the enormous influences exercised over the profession by the Engineering Faculty of the University of Toronto. The dominant feeling of the gathering was one of profound veneration for the guest of the evening, and the fact that so many prominent engineers had come from points so far apart as Montreal and Pittsburg to honor him was a tribute which falls to the lot of few men to receive.

Among the guests present were:— President R. A. Falconer, University of Toronto; Mr. F. C. Mechin, President of the Engineering Society; Col. W. N. Ponton, Belleville; Sir Edmund Walker, President of the Bank of Commerce, Toronto; Mr. T. W. Gibson, Deputy Minister of Mines; Dr. R. A. Pyne, Minister of Education; Mr. Thos. Galbraith, brother of Dean Galbraith; Professors C. H. C. Wright, Peter Gillespie, R. W. Angus, A. H. Laing, and T. R. Rosebrough; Mr. J. S. Dobie, President of The Ontario Land Surveyors' Association; Mr. Willett G. Miller, Provincial Mineralogist; Mr. R. A. Ross, Montreal; Mr. J. L. Morris, Pembroke (who was the first graduate of the School of Science); Mr. H. F. Ballintyne, New York; Mr. M. Bowman and Mr. D. A. Ludgate, of Pittsburg; Mr. J. W. Tyrrell, geologist; Mr. H. B. Stuart, Hamilton; Mr. C. H. Marrs, Hamilton; Mr. E. H. Downer, Hamilton; Mr. W. J. Francis, C.E., Montreal; Mr. G. H. Duggan, chief engineer Quebec Bridge; Mr. D. C Tennant, Montreal; Mr. J. A. DeCew, Mr. J. H. Challis and Mr. C. S. 'Pinhey, of Ottawa; Mr. H. J. Bowman, Berlin; Mr. Eric Armour, K.C., Toronto; Mr. Chas. H. Mitchell, Toronto; Mr. J. G. Clark, Toronto; Dr. Bruce Macdonald, Toronto; Mr. Z. A. Lash, K.C., Toronto; Mr. David Mollitor, C.E., Toronto; Dr. W. H. Ellis; and the following past-presidents of the Engineering Society:—Mr. T. Kinnard Thompson, New York; Professor H. E. T. Haultain and Mr. T. R. Loudon, Toronto; Mr. E. A. James, Toronto; Mr. R. J. Marshall; Mr. W. B. McPherson; Mr. R. E. Ritchie; Mr. T. H. Hogg, etc., etc. Letters expressing regret at their inability to be present were received from:—Sir George W. Ross, Toronto; Mr. Frank B. Gilbreth, C.E., New York; Sir Edmund Osler, Toronto; Sir John Gibson; Sir J. P. Whitney; Sir Wm. R. Meredith; Mr. J. W. Flavelle; Dr. J. A. MacDonald; Mr. J. Butler, C.E., Montreal; Mr. T. R. Deacon, C.E., Mayor of Winnipeg (who was to have responded to the toast of "The Profession"); Major R. W. Leonard, etc.

Having received his early education in Port Hope, John Galbraith entered the University of Toronto in 1863, graduating with a gold medal in mathematics and being Prince's prizeman in addition. For ten years succeeding his graduation he followed the profession of civil engineer and was identified with the construction of the Intercolonial, Midland and Northern railways. In 1878 he was given the chair of civil engineering on the founding of the School of Practical Science in Toronto, and today he is still the leading spirit in the councils of the Faculty of Applied Science, which is the successor of the School of Practical Science under the University Act of 1906. The steady growth of the Faculty since its inception is in itself a high tribute to the genius and personality of Dean Galbraith and today a large body of engineers in Canada and other countries look back with the warmest affection and the highest appreciation to the man who, above all others, showed them how to do things.

The sentiment of the evening was neatly expressed by Mr. Hyndman Irwin in his toast to Dr. Galbraith: "We enter the University as students to find him the Dean of Engineering in the University; we leave as engineers to find him the Dean of Engineering in Canada."

Contracts have been awarded for the construction of the last sixty-mile stretch of the Kettle Valley line and for the substructure of the 1,000-ft. bridge over the Fraser River at Hope. Steel has been laid for more than one hundred miles and two hundred more have been graded.

Personal Mention

Mr. R. B. Smith has been appointed Secretary-Treasurer of the Stinson-Reeb Builders' Supply Company, Eastern Townships Bank, Montreal.

Mr. E. B. Bonnell, city clerk of Moose Jaw is receiving applications for the position of city engineer. Applicants are required to state experience, references and salary desired.

Mr. Leonard W. Rundlett, City Commissioner of Moose Jaw, Sask., has resigned and will close his connection with the office on January 1.

Mr. James Clifford, formerly district engineer of the Illinois Central Railroad at Chicago, has resigned and been appointed assistant engineer, maintenance of way, C. P. R. western lines, with office at Winnipeg.

Mr. George Janin, Chief Engineer of the City of Montreal, has applied to the Controllers for permission to retire on a pension of three-quarters of his salary. The Controllers refused the application, however, on the ground that it would create a precedent. Mr. Janin is entitled to half his salary on retirement.

Mr. A. H. Harkness, B.A.Sc., consulting engineer, Toronto, was the lecturer at a well-attended meeting of the Engineering Society of the University of Toronto on Wednesday, November 26th. His subject was "The Construction of Modern Skeleton Frame buildings." The lecture was illustrated with lantern views.

Mr. S. W. Black, president and general manager of the Black Building Supply Company, Limited, Toronto, sailed on the 15th ult. for Europe and will make an extended tour of about six months' duration. During his absence the business will be under the capable direction of Mr. N. W. Drummond, secretary-treasurer of the company.

Mr. P. H. Moore, lately mining engineer and manager for the Canadian Allis-Chalmers Limited (mining, crushing and cement machinery department), has accepted the position of general manager of Rock & Power Machinery, Limited, with head office at Toronto and branch offices in Halifax, Montreal, Sudbury, Cobalt, Winnipeg, Calgary and Vancouver.

Mr. George T. Clark, city engineer of Saskatoon, Sask., has resigned after a service of five years. A graduate of the University of Toronto, with honors in mathematics and civil engineering, Mr. Clark commenced his professional career on the construction of the Temiskaming and Northern Ontario Railway. For a time he was employed in the roadway department at Toronto, following which he was resident engineer for three years with Messrs. Galt & Smith on water and sewerage works.

We have received from the Herbert Morris Crane & Hoist Company, Limited, Peter street, Toronto, a number of interesting pamphlets regarding some of the features of their plant, of which Mr. Malcolm R. Meldrum is director and general manager. To mention but a few of the numerous lines to which reference is made there are particularly good illustrations of the Morris triple-gear chain blocks, hand overhead travelling crane, travelling worm-gear chain block and the Morris Q. E. F. runway. The reputation which the Morris company have achieved for all-round excellence and reliability is proverbial not alone in Toronto but also in many parts of the Dominion where their peculiarly adaptable makes of chain blocks and travelling cranes are so well and favorably known. The company make a practice of shipping all blocks on the same day as that on which the order is received, so that there is no delay or loss caused by unnecessary waiting.

Mainly Constructional

The News in Brief—From Coast to Coast

The Pedlar People, Limited, Toronto branch, have removed from their old premises at 113 Bay Street to the new building at the corner of College and Markham streets.

City Engineer Craig is preparing an extensive report on the paving operations that have been conducted in Calgary during the past year, both by the municipal plants and repairs by private companies.

Foley Brothers, Stewart and Faquier have been awarded the contract for the second section of the Intercolonial terminal scheme, Halifax, the price being $5,208,743. The contract let is for the dockage facilities and wharves at the port following the letting some time ago of the first section of the work, which provides for a new entrance of the railway into Quebec.

The Dominion Government has voted $350,000 towards the construction of the Second Narrows bridge, which the Burrard Inlet Tunnel & Bridge Company have invited the Provincial Government to take over.

Good progress is being made in the construction of the line along the north shore of Burrard Inlet, and it is anticipated that a regular passenger service will be inaugurated on January 1 from Dundarave to North Vancouver.

A Building Owners and Managers' Association has recently been formed in Winnipeg with the object of enabling owners and managers of large buildings to get into closer communication with each other for mutual protection and benefit.

Mr. H. D. Chamberlain and Mr. R. H. Somers, of Chamberlain, S.D., are about to establish a large brickmaking plant at Fort George, B.C., which is located about 450 miles north of Vancouver and midway between Prince Rupert and Edmonton railroads.

One of the oldest contractors in Montreal has passed away in the person of Mr. Joseph Bronsdon, aged 93. He was interested in many of the early big contracting works in the district, notably the Government building on St. Helen's Island, the St. Eustache bridge, and the Lachine Canal.

Work has been commenced on a big drainage system for the north-western section of Victoria, B.C. The sewer will run from Burnside Road along the ravine and beneath the concrete bridge on the Gorge road to the shore of the Arm. Along this same route will be located the line of the C. N. P. Railway.

The new brick works recently completed at Elmsdale are said to be among the largest and best equipped of any in the provinces east of Montreal. The Nova Scotia Clay Works, Limited, are the owners, Mr. John R. McLeod is the president, and Mr. R. C. McDonald, vice-president and general manager.

The general annual meeting of the Povince of Quebec Association of Architects will be held in the association rooms, City Hall, Quebec, January 17th. The examinations for the admission to the study of architecture or registrations will be held on the 26th January, and on the following days, in the rooms of the association, 5 Beaver Hall Square, Montreal, at nine o'clock in the forenoon, each day.

Mr. Griffiths, Engineer of Public Works, who recently investigated the Second Narrows bridge project at Vancouver, has made his report which is now in the hands of Premier McBride. Mr. Griffiths was instructed to go into the question of cost and ascertain if it would not be possible to build a bridge across the Second Narrows at an expenditure much less than the $2,250,000 quoted in the estimates of the intermunicipal company.

The Pacific Great Eastern Railway intend establishing extensive yards and terminal facilities at Newport at the head of Owen Sound. The scheme will include the taking over of the two Indian reserves there for terminal and townsite purposes. The reserves contain about 1,100 acres and considerable water frontage, where wharves are to be built. The line along the north shore will be used largely for passenger traffic and Newport will be the sole shipping point.

The Ottawa Corporation by-law to provide for the construction of the new $8,000,000 waterworks has been quashed by Mr. Justice Lennox on the ground that according to the powers conferred by the Provincial Legislature the vote of the people must first be obtained. The Judge said that were the by-law allowed to stand the property of every landowner in the city would be mortgaged for a sum equal to the present debenture of the city.

A new hotel scheme for Kingston, Ont., has been adopted by the Board of Trade. Mr. Geo. F. Balfour, of Montreal, who is the prime promoter, has secured an option on the British-American hotel property, on which site he proposes erecting a $200,000 fireproof house, up-to-date in every particular. The intention is to provide one hundred and twenty-five rooms with rotunda, grill, dining and ball rooms. The equipment and furnishings are to cost about $60,000.

Upwards of twelve million dollars will have been spent upon the Hudson Bay Railway scheme by the end of 1915. So far, including office expenses, nearly $4,400,000 has been expended and the three contracts for the railway proper aggregate $8,577,000, to which must be added administrative expenses. The harbor and terminal expenditure will be some millions. There is much dredging to be done, and in addition docks, terminals, ice-protection piers and similar works must be executed. The end of the railway leading from Port Nelson may be commenced next spring and the scheme should be completed some time in 1915.

Speaking before the Canadian Club, Montreal, Mr. F. H. Wentworth, Secretary of the National Fire Protection Association, condemned many of the present buildings as fire traps. Ordinary brick and stone buildings were valueless as fire stops, because the windows were of thin glass and the window frames of wood. "We must," said Mr. Wentworth, "come eventually to the equipment of all commercial, factory and office buildings with metal window frames and wired glass. This will mean the abolition of the conflagration hazard in our cities." He also condemned the use of shingles, as they ignited easily and caused flying sparks. The height of buildings should be limited.

The Court of Appeals, Montreal, has reversed a decision of Mr. Justice Archibald in the case of C. G. Wills & Company, contractors, England, vs. the Central Railway Company of Canada. The parties could not agree over the construction of the line from Midland, Ont., to near Montreal, the contractors claiming that certain amounts were due under the contract. The company, on the other hand, claimed that the contractors had not fulfilled their obligations. Mr. Justice Archibald gave judgment for the contractors, restraining the company from giving out the work to another firm or doing it themselves. The Court of Appeals found that $2,373 is due to the contractors, but quashed the injunction and terminated the contract.

Among several railway projects to engage the attention of parliament next session is that of the Canadian Alberta Company, who will apply for incorporation with power to construct a line of railway commencing at a point on the C. P. R., one mile west of Blairmore, thence in a northerly and westerly direction. The Calgary and Edmonton Railway Company will apply for an act authorizing the construction of a line from a point on the north and south branches of Sheep Creek, Alta., also a line to a point on Trap Creek. The C. P. R. will also apply for an act authorizing the construction of lines from a point on its Swift Current south-easterly branch, and the Esquimalt and Nanaimo railway will seek an act extending the period for the construction of its authorized lines.

From a report issued by Mr. S. H. Jarrett, Building Inspector, Vancouver, we learn that the permits issued for November, 1913, totalled 101, of the value of $300,565, as against 186 of the value of $1,538,795 for the same period in 1912. The total number of permits for the eleven months of this year were 1929, of the value of $10,248,803, as compared with 3035 permits of $17,898,067 value for the same period in the previous year. This serves as a pretty reliable index to the trade conditions in Vancouver this year. The building operations for the past month, together with their money value, consisted of 57 dwelling houses, cost $42,585; four apartment and rooming houses, cost $226,000; five factories and warehouses, cost $9,600; twenty-nine offices and stores, cost $21,770; repairs and alterations six, cost $610.

British Enterprise in Canada

The well-known English firm of Sutcliffe, Speakman & Company, Limited, of Leigh, Lancashire, Eng., have decided to open a branch house in Canada with staff and stores suited to the requirements of their Canadian trade. The managing director of the firm, Mr. E. R. Sutcliffe, has just completed a visit to this country and we understand that he has been favorably impressed with the prospects which the future offers. The company specialize in brick-making machinery, one of their specialties, the Emperor Press, having gained a very wide reputation as being in the forefront of modern machinery for the manufacture of sand-lime brick. This press has been installed by the government of New South Wales for their extensive plant at Sydney, with results which are eminently satisfactory to the makers. The Emperor Press is made in three sizes, the Single, with an output of 15,000 bricks a day, the Duplex, with an output of 26,000 bricks a day, and the No. 0 size, with a capacity of 10,000 bricks a day. Mr. Sutcliffe is convinced that in the near future sand-lime brick will be in great demand in Canada, particularly in Western Canada, an element in their favor being that the Emperor Press can be installed at less cost than clay plants.

Another specialty of the firm is their press for the manufacture of pressed plastic brick. It is plain that this press will make brick in the plastic state quite stiff and dry enough to go directly from the kiln to the machine without the need of drying sheds. In other words it gives the same quality brick as produced by the stiff mud system with all the advantages of the dry press system in addition. This plastic press, in Mr. Sutcliffe's opinion, will exercise an important influence on the future of the shale brick-making industry in the Dominion.

The automatic bottom dump car manufactured by Messrs. Bechtels, Limited, Waterloo, Ont., embraces in its design and construction a number of points worthy of investigation. It is built for exacting conditions and hard work and is recommended on the ground of its durability and simplicity. This firm make a scoop dump car which is particularly easy to operate, and also an automatic grip for all cars, to be used with a continuous running cable which enables the car to be stopped at any point without the attention of the operator. Winding drums and portable track are also manufactured by the company.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Ont.
Extension of intake pipe is contemplated by Town Council. Mayor, Mr. Mulligan. Town Engineer, Mr. Leblanc.

Leamington, Ont.
Town Council contemplate drain repairs. Clerk, R. M. Selkirk.

Pavements and sidewalks are contemplated by Town Council. Clerk, R. M. Selkirk.

Additional water mains on Fox St., Georgia Ave. and Morgan Ave. are contemplated by Town Council. Clerk, R. M. Selkirk.

Ottawa, Ont.
Paving planned by Board of Control. Mayor, J. A. Ellis. City Engineer, Arch. Currie, City Hall. Report being submitted to Board of Control re cost of placing all streets in city in good condition. Estimates completed.

Chlorination buildings, $5,214, planned by City Council. City Engineer, Arch. Currie, C.E. Excavating.

Tilbury, Ont.
Council contemplates extending present water mains 6,000 ft. Clerk, W. A. Hutton.

Toronto, Ont.
Paving materials required by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 16th. Specifications, etc., at Room 12, Purchasing Dept. Annual supplies:—1. Asphalt (refined); 2. Vitrified paving blocks; 3. Granite or stone sets; 4. Treated wood blocks; 6. House numbers.

Repairing, Dawes Rd., cost $6,000, contemplated by York Twp. Council. Clerk, W. A. Clark, Jarvis and King. Work is requested by deputation of property owners. Grading and resurfacing with double macadam.

Waterproofing subways for C. P. Rly. Co. Engr. Grade Separation, B. Ripley, 262 Avenue Rd. Plans, etc., at office of Engineer will will receive tenders until noon Dec. 27th. for labor and material in connection with waterproofing of eight subways. Grade Separation.

Tenders received until Dec. 16th for laying and jointing 36-in. water main from High Level Station to West Toronto in 3 separate contracts. Tenders also received for laying 20 in. main. Plans at Works Dept., Room 9, City Hall. Board of Control. Mayor, H. C. Hocken.

Pavements recommended by Board of Control. Commr. of Works, R. C. Harris. Bitulithic on Lamb Ave, 18 ft., $14,521; Keele St., 24 ft., $24,219; asphalt on Bloor from Sherbourne to Avenue Rd., $32,138; brick block on Overend, $6,292; Front, $13,165; Tate, $4,226. Approved by Committee of Works.

Walks on 13 streets, estimated cost $24,000, recommended by Board of Control. Mayor, H. C. Hocken. Approved by Committee of Works. Commr. of Works, R. C. Harris.

Pavements recommended by Board of Control. Commr. of Works, R. C. Harris. Asphalt on Winchester, Boler and Leslie, estimated cost $10,712; 2 lanes, estimated cost $5,587. Approved by Committee of Works.

Board of Control, Mayor, H. C. Hocken. Tenders received until Dec. 16th for grading on Braemore Gardens, Hiawatha and McGregor ave. Plans at office of Commissioner of Works.

Rocmac pavement contemplated by York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis. Engineer, F. Barber, 57 Adelaide E. Ratepayers in Burton have petitioned for pavement. Referred to Engineer.

Sewer contemplated by York Township Council. Clerk, W. A. Clarke, 40 Jarvis street. Council passed by-law to construct 775 ft. of sewer on Kennedy ave. north of city limits and 357 ft. on Barrie ave., 12-in. and 15-in. sewer pipe to be used.

Sewers planned by Board of Control. Mayor, H. C. Hocken. Tenders received until Dec. 16th for sewers on Annette, Blackburn, Clifford, Danforth, Gerrard, Norway Place, Oriole Parkway, Orchard Park Blvd., Waverley Rd., Wharram, Woodbine and Moore Park Drainage System, Western Section No. 1, Moore Park Drainage System, Western Section No. 2. Plans at City Hall.

Vancouver, B.C.
City Council have decided on paving South Cambie, Victoria Drive, Commercial Drive, Helmcken, Drake, Alexander, Cordova, Cornwall and Vine St. and 11th Ave., cost $311,776.36. Engineer, F. L. Fellowes.

Paving, cost $171,500, is contemplated by City Council. Engineer, F. L. Fellowes. Cypress St., Prince Edward St. and Venables St., Campbell, Ave., Fir St., 13th Ave. and 11th Ave. Materials, asphalt, granitoid, asphaltic and brick, wood block.

South Vancouver, B.C.
Box drains on Gladstone St. and via 54th and 56th Sts. to Victoria Drive, cost $4,317, recommended by Municipal Council. Clerk, Mr. Springford, Fraser and Wilson Rd. Engineer, Mr. Clement.

Winnipeg, Man.
Watermains planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James ave. General contractor, J. W. Astley, Engineer of Construction, City Yards. Watermains in Blake street, $118.40; Grey street, $135; Winnipeg ave., $220.80 and St. James St., $67.50.

Tenders received by Board until Dec. 15th for 200 manhole frames, 250 manhole grates, 220 mud baskets, 650 manhole brakes, 500 catch basin hoods, 500 catch basin hinges and pins, 1,000 long steps, 3,000 short steps. Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

East Princeton, B.C.
Waterworks system planned by Town Council. General contractors, The British Columbia Portland Cement Co., Ltd., 615 Hastings St. W., Vancouver. Sec.-treas., A. R. Briggs. Materials for dam—pipes, hydrants, etc., required.

Ottawa, Ont.
Chlorination building (Lemieux Island), cost $5,213.54, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Plumbing and heating, M. M. O'Connel, 212 Gloucester, $932.54. Mason, carpentry, electric wiring, motor and mixer, Alexander & Campbell, 587 Lisgar St., $4,282.

50 hydrants, cost $5,000, required by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractors, McDougal's Ltd., 529 Sussex St.

Railroads, Bridges and Wharves

Bracebridge, Ont.
Extension to wharf and sheds planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Jas. Roddick, 40 Wellesley St., Toronto.

Cap Chat, Que.
Extension to pier planned by Dominion Govt., Dept. of Public Works. Secretary R. C. Desrochers, Ottawa. Tenders received but no contracts awarded. New tenders will probably be called.

Capreol, Ont.
Station, cost $5,000, National Transcontinental Railway, Ottawa. General contractor, J. A. King, Capreol. 1½ stys., concrete foundation, frame and brick facing construction, shingle roofing, electric lighting, stove heating, maple floors, plumbing, stucco plastering, plate glass, grilles, blackboards, vaults, safes, screens, fire extinguishers. Foundations partly in.

Charlottetown, P.E.I.
Dredging required by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Tenders received by secretary until Dec. 23rd. Plans, etc., at Dept., Ottawa. Dredges and tugs not registered in Canada shall not be employed.

Kamloops, B.C.
The city will ask government to dredge whole of the "Riverside" waterfront and erect piling and sheeting for a wharf, city to build the deck and make other improvements.

Little Dipper Harbor, N.B.
Breakwater planned by Dom. Govt., Department of Public Works. Secre-

tary, R. C. Desrochers, Ottawa. General contractors, Maritime Dredging & Construction Company, St. John.

Ottawa, Ont.
Steel bridge (Pretoria Ave.). New plans are being prepared by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E.

Pontoon bridge, temporary, cost $6,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. To be erected instead of temporary wooden bridge. Plans in progress.

Bridge, cost $50,000, planned by City Council. Mayor, J. A. Ellis. City Engineer, Arch. Currie, C.E. Contractors are invited to inspect details and visit site. Tenders will be called in about a week or two. Steel bridge with walks cantilevered out, concrete abutments and piers. Plans drawn.

Port McNicoll, Ont.
C. P. R. contemplate erecting Section House. Gen. Supt., Mr. Arundel, Toronto.

Poupore, Que.
Training pier and revetment wall planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. No action taken on new tenders.

Sandhead, B.C.
Dredging, cost $70,500, required by Dominion Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Navigation Dredging Co., Ltd., Vancouver. Dredging 300,000 cu. yds. sand at mouth of Fraser River.

Sarnia Twp., Ont.
Reeve, Mr. Alf. Hellier, Sarnia. Specifications, etc., with Reeve, who will receive tenders until Dec. 15th for dredging Cow Creek Drain.

Summerland, B.C.
Wharf, cost $12,265, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractor, Andrew McConnell.

Sydney, N.S.
Dom. Govt., Dept. of Railways and Canals. Secretary, L. K. Jones, Ottawa. Resolution to be drawn and presented to the government urging need of terminals. Committee appointed by Board of Trade to interview City Council and prepare resolution. Messrs. P. D. Macneil, G. Fitzgerald, F. G. Konig, R. R. Chappell and Capt. A. J. Morrison.

Toronto, Ont.
Steel conduit, cost $540,000 (Island). Board of Control. General contractors, Roger Miller & Sons, Lumsden Building, wishes prices f.o.b. Toronto, on 3,500 ft. of 84-in. steel pipe ½-in. thick, cast steel, flange at each end, 4 only 72-in. gate valves. Above is for steel conduit across Toronto Island.

Victoria, B.C.
Public building and wharf. Dom. Govt. Dept. of Marine and Fisheries. Sec., Alex. Johnston, Ottawa. Building two storeys and tower, fireproof construction. Plans prepared.

Willon, Man.
Location of C. P. R. station at Willon at mileage 26.5 on Virden-McAuley branch, has been approved.

CONTRACTS AWARDED

Victoria, B.C.
Dump scow, cost $8,475, required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Wallace Shipyard, Ltd., 1165 Davie St., Vancouver. To be used in connection with harbor improvements. Capacity 260 cubic yards.

Welsh Cove, N.B.
Breakwater, cost $11,825 (Mace's Bay), planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Maritime Dredging & Constr. Co., St. John, N.B.

Public Buildings, Churches, Schools, etc.

Berlin, Ont.
Two schools are contemplated by Public School Board who will purchase two sites next year.

Chatham, N.B.
Sunday School building, cost $10,000, for Methodist Trustees. Pastor, R. G. Fulton. Architect, F. Neil Brodie, 42 Princess St., St. John. Work done by day labor. Roofed.

Coaticook, Que.
Post office fittings required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec. until Dec. 15th. Specifications, etc., at office of R. L. Deschamps Post Office, Montreal, Caretaker, Public Building, Coaticook, and at Dept., Ottawa.

East London, Ont.
Market building contemplated by City Council. Mayor, C. M. R. Graham. City Engineer, W. N. Ashplant, who has been instructed to prepare estimates of cost of erecting market building. If satisfactory by-law will be submitted to ratepayers.

Fort William, Ont.
City Council (Property Committee) recommend addition to City Hall, cost $10,000. Clerk, A. McNaughton.

Hamilton, Ont.
Hospital, cost $40,000, planned by City Council. Mayor, Jno. Allan. Architect, H. New Spectator Bldg. Plastering, furniture, fixtures, etc., required shortly. No tenders called yet.

Hawkshaw, N.B.
Church for Baptist Congregation. Pastor, Rev. A. A. Rutledge. Work will not start until next spring.

Montreal, Que.
Club house contemplated by Y. M. C. A., 127 Drummond St. Site has been purchased and building will probably be put up in spring.

Congregation of Notre Dame, Montreal, contemplate building a new church (St. Famille St.). Parish has purchased site.

Maissonneuve Presbyterian Congregation contemplate erecting a new church. Pastor, Rev. Dr. Scrimger, Adam St., Maisonneuve.

New Waterford, N.S.
Meeting of ratepayers to be called for the purpose of discussing the question of borrowing the sum of $12,000 to be used for erection of school building.

Ottawa, Ont.
Church, cost $6,000, for St. Peters Evangelical Lutheran Church. Pastor, Mr. Clemens, 250 Lyon St. Architect, Herbert Shleacow, Room 45, Sparks Chambers. Walls up.

Tenders to be called for main (high) chimney for Printing Bureau. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

New barns at Experimental Farm contemplated by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. Will be rebuilt by day labor under direction of manager.

St. Gabriel de Brandon, Que.
Public building planned for Dom. Govt. Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, Burnet & Alcide Leclaire, Lachine, Que.

Sussex, N.B.
Drill hall planned by Dom. Government, Dept. of Militia & Defence. Deputy Minister, Eugene Fiset, Ottawa. Tenders received by Director of Contracts, Ottawa, until noon, Dec. 22nd. Plans, etc., at offices of Officer Commanding 6th Div. Halifax, N.S.; Town Clerk, Sussex and Director General of Engr. Services, Headquarters, Ottawa. 106 x 72.

Toronto, Ont.
Sunday school, cost $55,000, for Walmer Rd. Baptist Church. Chairman Com., R. C. Dancy, 153 Spadina Road. Carpenter, Jos. McKenzie, 359 Yonge St. Painting, F. G. Roberts & Co., 104 Wells St. Trimming interior.

School (Howard), planned by Board of Education. Sec., W. C. Wilkinson, City Hall. Tenders received by Sec. until noon Dec. 12th, for heating. Specifications, etc., at office of Supt. of Bldgs., City Hall.

School at Parkdale planned by Board of Education. Secretary, W. C. Wilkinson. Heating and ventilating, Callis, Sheppard & Abbott, 279 Brunswick ave., $945.00. Plumbing, Toronto Furnace & Crematory Co., 11½ King St. E., $220.00.

School on George Street, planned by Board of Education. Secretary, W. C. Wilkinson. Hot water heating, Lewis Legrow, 92 Harbor street, $408. Plumbing, Fiddes & Hogarth, King St. West, $159.00.

Victoria, B.C.
School, cost $44,200, Quadra St. N. Board, Secretary, W. T. C. Pope, 1127 Catherine St., has decided to throw out all tenders submitted and return cheques on account of lack of funds.

Westboro, Ont.
School contemplated by Westboro Public School Board. Trustee, Mr. Cole.

CONTRACTS AWARDED

Orillia, Ont.
Addition and alterations to post office and customs house, cost $31,485, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, C. Webb & Son, Orillia.

St. John, N.B.
Post office, cost $500,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Rhodes, Curry Co., Amherst, N.S. Ventilators, Jno. E. Wilson, Ltd., Sydney St., St. John, N.B.

Three Rivers, Que.

School, cost $65,940, planned by City Council. General contractors and carpenter, Belleville & Bolan. Heating and plumbing, Germain Bros.

Business Buildings and Industrial Plants

Barrie, Ont.

Bank, cost $12,000, for Bank of Toronto. Manager, H. A. Sims. Architect, F. Martin, Hamilton, Ont. Three stys., 25 x 90, stone construction, concrete foundation, electric lighting, plumbing. Plans drawn.

Caledonia, Ont.

Machine and moulding shops, cost $7,000. Owners and architects, Logan & Sons. White brick construction, electric lighting, equipment required. Plans in progress.

Copper Cliff, Ont.

General office for Canadian Copper Co. President, A. P. Turner. General contractors, Henderson & Angus. Purchasing Agent, Mr. Todd, care company. Two storeys, 140 x 80, mantels, built-in fireplaces, library fittings, bank fixtures, screens, seating, time recording clocks, vacuum cleaner, fire extinguishers, vaults. About completed.

Store, cost $10,000, for Cochrane Hardware Co., Sudbury. Architect, W. Workman, Sudbury. General contractors, Henderson & Angus, Copper Cliff. Three storeys, 120 x 40, electric lighting, hot water heating, birch floors, plumbing, sheathed, plate glass, fireproof doors and shutters, store front, safes, fire extinguishers. Roofed.

Dundas, Ont.

Storage pattern shop. Owners and architects, John Bertram & Sons Co., Ltd. One storey, 25 x 150, steel and corrugated iron construction and roofing, special sliding doors. Plans in progress.

Edmonton, Alta.

Store and office building, $110,000, for Edwin Auld, 662 15th street. Architects, Cauchon & Van Tyne, care owner. Building to be completed early in 1914. 7-storeys, 150 x 25, steel construction. Tenders open.

Galt, Ont.

Factory, cost $10,000, for Galt Knife Co., Ltd. Manager, Thos. Vair. General contractor and carpenter, Peter Nisbet, Henry St. Mason, Thomas & Hancock, Wellington St. Address communications to manager. Forge, store room, grinding room, boiler room and office. One storey, 45 x 140, concrete foundation, Milton brick construction, flat roof, steel window frames, vaults. Foundation partly in.

Glencoe, Ont.

Garage, cost $7,000, for Alex. Duncanson. General contractors, McPherson & Clarke. Two storeys, 40 x 70, white brick construction. Excavating.

Hamilton, Ont.

Warehouse, cost $16,000, for Geo. H. Rillett, 830 Main St. E. Architect, A. W. Peene, King St. W. General contractor, Geo. F. Webb, Wentworth St. S. Four storeys, 60 x 100. Walls started.

Bank for Bank of Nova Scotia, Head Office, Toronto. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Office and bank furniture and fixtures required. Plastering.

Kingston, Ont.

Machine shop, cost $68,000, for Canadian Locomotive Co., Ltd., Ontario St. Steel, Hamilton Steel & Iron Co., Ltd., Hamilton. To be erected between Earl and Gore streets. One storey, 278 ft. long, concrete foundation, brick construction, wooden reg. steel supports. Work to start.

Laval Rapids, Que.

By-law has been passed for factory for manufacture of pipes, in which Mr. Souillard, Mayor of Laval Rapids, is interested.

Leamington, Ont.

Addition to vinegar factory, cost $15,000, contemplated by H. J. Heintz Co. Manager, R. A. Logan. Architect, Company's staff. Equipment required.

Addition to factory, cost $50,000, for H. J. Heintz Co. Architect. Co.'s staff. Four storeys, 90 x 190, white brick construction, stone and cement foundation, electric lighting, maple, pine and concrete floors. Equipment required. Plans in progress.

London, Ont.

Creamery, cost $15,000, is contemplated by Silverwoods, Ltd. Manager, A. E. Silverwood. One storey, 35 x 100, reinforced concrete construction, concrete foundation, electric lighting, machinery required.

Lulu Island, B.C.

Factory contemplated by The Morrison Steel & Wire Co., 831 Powell St., Vancouver. Site purchased, 16 acres. Work not to start for some time.

Montford, Que.

Hotel, cost $100,000, for E. J. Shepherd, c/o Mr. Cromack, 60 Notre Dame E. Note corrected address.

Montreal, Que.

R. J. Young & Co., 179 St. James St. Nothing further will be done in the matter of projected dairy till new year.

Newport, B.C.

Foley, Welch & Stewart, 739 Hastings St., W. Vancouver, may erect a second sawmill 14 miles north of Newport, to cut ties and bridge timber.

North Sydney, N.S.

Cable office, cost $75,000, of Western Union Telephone & Telegraph Co., Ltd. Supt., W. E. Earle. General contractor, F. C. Redding. To be completed about the middle of Feb. Two storeys. Roofing.

Ottawa, Ont.

Business block, cost $145,000, for American Bank Note Co., Wellington St. Architect, J. A. Ewart, 193 Sparks St. Trimming interior.

Stores, cost $25,000. Owner and architect, N. D. Porter, Bank and Albert Sts. General contractor, R. Holmes, 80 Arlington. Heating and plumbing, M. M. O'Connell, 212 Gloucester. Electrical, J. A. Ellacott, 226 Bank St. Painting, day labor. Four storeys. Roofed.

Store and residence, cost $6,000. Owner and architect, F. E. Brunet, 145 Beechwood Ave. General contractor, Joseph Whelan, 1 Beechwood. Brick veneer construction, stone foundation, felt and gravel roofing, electric lighting, hot air heating, birch floors, plate glass, store fronts and fixtures. Excavating.

Addition to Bank of Montreal, Wellington St., cost $15,000. Architect, C. P. Meredith, 126 Sparks St. Roofed.

Extension to stores is contemplated by J. A. Laroque, 262 Dalhousie Street. Brick veneer construction, stone foundation, felt and gravel roofing, electric lighting, hot air heating, pine floors, plate glass, store fronts and fixtures.

Alterations to store contemplated by Lord Furniture Co., Rideau St. Interior alterations, fixtures and fronts. Work to go ahead at an early date.

Store extension is contemplated by A. P. Johnston, Bronson Ave. Stone foundation, brick veneer construction, felt and gravel roofing.

Alterations to Federal Hotel. Architect, C. J. Burritt, 193 Sparks St. Work started.

Stores and residences, cost $12,000. Owners and architects, Oakland Land Co., c/o W. J. Spratt, Sunnyside Ave. Two storeys, 50 x 50. Walls started.

Business block, cost $100,000, Albert, for Mrs. Cowie, Albert St. Architect, C. P. Meredith, 126 Sparks St. Trimming interior.

Business block, cost $100,000, for F. W. Carling, Metropolitan Bldg. Architect, C. P. Meredith, 126 Sparks St. Seven storeys. Roofed.

Factory, cost $14,000, for M. J. O'Brien, Raglan Place, Renfrew. General contractor, A. E. Spooner, Windsor House. Electric not let. Two storeys. Roofed.

Business block, cost $145,000, for American Bank Note Co., Wellington St. Architect, J. Albert Ewart, 193 Sparks St. Plastering, none. Painting, Geo. Higman & Sons, 176 Rideau St. Heating and plumbing, McKinley and Northwood, Rideau St. Roofing.

Prince Albert, Sask.

Offices, cost $40,000. Owners and general contractors, Craag & Co. Three storeys, 50 x 100. Above project is held over until next spring.

St. John, N.B.

Bank, cost $20,000, Main, for Royal Bank of Canada. Manager, T. B. Blair, King St. Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, Jno. Flood, 123 Duke St. Electrical, Frank E. Jones, Prince William St.

Bank of British North America, Market Sq., cost $50,000. Architect, G. E. Fairweather, 84 Germain St. General contractors, B. Mooney & Sons, 112 Queen St. Marble and tile work, Dom. Floor & Wall Tile Co., Montreal. Safe and vault equipment, J. & J. Taylor, 145 Front St. E., Toronto, Ont. Roofed.

Stratford, Ont.

Farquharson-Gifford Co.'s factory, Douro St. Architect, J. S. Russell, 21 Downie St. General contractors, J. L. Young, 240 Birmingham St. Four stys. About completed.

Sudbury, Ont.

Warehouse, cost $17,000, for Harris Abattoir Co., Ltd. General contractor, D. L. Brown. Refrigerating machinery may be required. Two storeys and basement, 200 x 60, felt and gravel roofing, electric lighting, hot water heating, temperature regulators, maple floors, plumbing, hard wall plastering, wood and metal lath, wire glass, one freight elevator, fire-

(Continued on page 147)

Tenders and For Sale Department

TENDERS
FOR
A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913**, for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. 49-50

TENDERS

Tenders for the Dredging of "Cow Creek Drain" will be received by the undersigned up to **December 15th, 1913**. For specifications, etc., apply to Alf. Hellier, Reeve of Sarnia Township. 50

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Hanover, Ont.," will be received at this office until 4 p.m. on **Monday, December 22, 1913**, for the construction of a Public Building at Hanover, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to the Postmaster at Hanover, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signature, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 28, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47226. 49-50

ENGINE FOR SALE

Second-hand 12 x 30 Wheelock Engine made by Goldie & McCullough, Galt. In good condition, low price, can be seen at our works.

Canada Printing Ink Company, Limited,
50 Toronto, Ont.

TENDERS
FOR
Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 16th, 1913.**

1. Asphalt (Refined).
2. Paving Blocks (Vitrified).
3. Granite or Stone Setts.
4. Treated Wood Blocks.
5. House Numbers.
6. Iron and Steel.

Specifications and tender form for any of the foregoing, may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders, the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, Dec. 1, 1913. 50-51

FOR SALE

Steam Driven Air Compressors
thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.
One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company
SHERBROOKE, QUE.
Montreal Office, - - - - E. T. Bank Building
50-53

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, December 27th**, for furnishing labor and material in connection with the waterproofing of eight subways at North Toronto.

Plans and specifications may be seen at the office of the Engineer of Grade Separation at No. 262 Avenue Road, Toronto, where proposal forms may also be obtained.

The lowest or any tender not necessarily accepted.

B. RIPLEY,
Engineer of Grade Separation.
Toronto, Dec. 4th, 1913. 50

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, December 16th, 1913**, for the construction of the following works:—

SEWERS

Annete St., from Quebec Ave. to Runnymede Rd.
Blackburn Ave., from Gerrard St. to Mount Stephen St.
Clifford St., from Walnut St. to Niagara St.
Danforth Ave., from Hillingdon Ave. to Woodbine Ave.
Gerrard St. and Hiawatha Rd. to Gerrard St. and Eighth Ave., via Gerrard St., Coxwell Ave. and Gerrard St.
Lane 1st W. of Grove, Foxley St. to 232 ft. N.
Moore Park Drainage System, Western Section Outlet No. 1, from Rosehill Ave. and Grace Terrace to Summerhill Ave. and MacLennan Ave. via Grace Terrace, Rosehill Ave., Clifton Rd., Oakwood Drive, Sighthill Ave. and Summerhill Ave.
Moore Park Drainage System, Western Section, Outlet No. 2, Grace Terrace from Rosehill Ave. to Clarence Street.
Norway Place, Woodbine Ave. to 620 ft. East.
Orchard Park Blvd., Orchard Park Rd. to E. End.
Oriole Parkway, Oriole Rd. to 122 ft. North of Gormley Ave.
Waverley Rd. North Limit Lot 48, Plan M. 252, to S.S. Kingston Road.
Warram Place, Belaise Drive to 100 ft. South of Belsize Drive North.
Woodbine Ave., Kingston Rd. to N. City Limits.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto), or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
Chairman, Board of Control.
Toronto, Dec. 3rd, 1913. 50

WANTED—Electrical man with knowledge of gasoline engines to sell and erect small isolated electric light installations. Good opportunity for young man. Reply giving age, experience and salary required, to Box 916, Contract Record, Toronto. 49-50

Business Buildings and Industrial Plants

(Continued from page 145)

proof doors and shutters, packing house fittings, fire extinguishers. Roofing.

Toronto, Ont.

Factory, cost $8,000, for S. B. Hinder, 109 Heath St. W. Architect, E. G. Wilson, 77 Victoria St. General contractor, J. W. Gratton, 488 Clinton St. Contract let on percentage basis. Two storeys, 49 x 61, brick construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, concrete and birch floors, galvanized iron, metal, sash, fireproof doors.

Warehouse for H. Greisman, 68 Adelaide E. Architects, Chadwick & Beckett, 18 Toronto St. General contractors, Consolidated Building & Supply Company, 104 Temple Bldg. Four storeys, 48 x 120. Roofed.

Four attached stores and residences, $10,000. Owner and general contractor, C. A. Scott, 625 Logan ave. Owner superintends construction and buys all material. Three storeys, 63 x 42, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot air heating, oak, spruce and birch floors, lime and sand plastering, wood lath, plate glass, built-in fireplaces, mantels. Plans drawn.

Brass foundry. Owner and general contractor, Jas. Sherlock, care Monarch Brass Co., 278 Dundas street. Brick construction and foundation, felt and gravel roofing, electric lighting. Plans drawn.

Theatre, cost $10,000. Owner and general contractors, M. J. Thaler & Son, 350 College. Architect, R. A. Abraham, 23 Jordan St. Trimming interior. To be opened about Dec. 15th.

Theatre, cost $6,000. Owner and general contractor, W. J. Bennett. 16 Howland Ave. One storey, 26 x 110, brick and steel construction, brick foundation, felt and gravel roofing, electric lighting, hot water heating, birch floors, lime and sand plastering, metal lath, plate glass, galvanized iron, store fronts and fixtures, seating. Tenders received by Owner.

Walkerville, Ont.

Dominion Bank of Canada, Head Office, Toronto, contemplate opening a branch. Bank fixtures, vaults, safes required.

Factory, cost $6,000. Owner and carpenter, W. E. Seagrave. Architects, Stahl & Kinsey. General contractor, H. Howe. Two storeys, 40 x 90, brick construction, concrete floors, patent roofing, metal sash, electric lighting, steam heating. Walls going up.

Stores and flats, cost $9,000, for C. L. Chilver. Architects, Smith & Walker. Tenders received by Architects after Dec. 15th. Two storeys, 80 x 30, cement and brick foundation. Plans in progress.

Winnipeg, Man.

Bank and office building, cost $225,000, for Quebec Bank. Architects, Brown & Vallance, 1006 McArthur Bldg. General contractors, Carter, Halls, Aldinger, Union Bank Bldg. Erecting steel work.

C. P. R. Hotel addition, cost $1,000,000. Royal Alexandria Hotel. General contractors, Westinghouse, Church, Kerr Co., Confed. Life Bldg. 12 storeys. Stone work up three storeys.

Yarmouth, N.S.

Bank for Canadian Bank of Commerce, head office, Toronto, Ont. Project abandoned.

Yarrow, B.C.

Shingle mill for J. H. Maddaugh, Vancouver. Work in progress.

CONTRACTS AWARDED

Ottawa, Ont.

Alterations to stores for Mrs. E. C. & S. H. Han, c/o General Contractor. Architect and general contractor, R. A. Kemp, 149 1st Ave. Carpentry, Esdale & Douglas, 318 Lisgar St. Plate glass, store fronts and fixtures.

Ridgetown, Ont.

Bank and offices, cost $12,000, for Royal Bank (W. A. Pow, manager). Architect, K. G. Rea, 54a Beaver Hall Hill, Montreal. General contractor, J. R. Sculland, Windsor, Ont. Two storeys, stone trimmings, Milton pressed brick construction.

Wilkie, Sask.

Skating and curling rink planned by Town Council. Sec.-Treas., T. A. Dinsley. General contractors, Hermanson & Hughes, Kerrobert, Sask. Frame construction, corrugated iron roofing, electric lighting, pine floors.

Residences

Bayfield, Ont.

Ten cottages, cost $10,000, contemplated by Deer Lodge Summer Cottage Co. (Geo. Rowntree, Stanley St.). Architect to be chosen. Frame construction, shingle roofing, pine floors.

Leamington, Ont.

15 residences, cost $25,000, contemplated by H. J. Heintz Co. Manager, R. A. Logan. Architect, Co.'s staff. Frame construction, shingle roofing, maple and pine floors, plumbing, lime and sand plastering.

Hamilton, Ont.

Four residences, cost $9,000. Owners and general contractors, McLarty & McNivin, 587 Barton St. E. 2½-stys., 17 x 35, brick construction, concrete block foundation, shingle roofing, gas and electric lighting, hot air heating, pine floors, plumbing, mantels. Excavating.

Montreal, Que.

Flats, cost $6,000. Owners and general contractors, Bourgon & Gagne, 1882 Notre Dame W. General contractors doing all trades. Two storeys, 25 x 66, felt and gravel roofing. Foundations in.

Flats, Notre Dame de Grace. G. A. Kell, 2 Fortune, will probably call for tenders for General Contractor shortly for flats. Concrete foundation, brick construction, felt and gravel roofing, electric lighting, hot water heating, pine floors, lime and sand plaster.

Residences, cost $7,000, Outremont. Owner and general contractor, A. Lafleur, 728 Champagneur Ave. Three storeys, 20 x 70, stone foundation, pressed brick construction, felt and gravel roofing, electric lighting, hot water heating, hardwood floors, lime and sand plaster, plate glass. Excavating.

Residences, cost $7,000, Outremont. Owner and general contractor, W. Ouimet, 1911 Esplanade, who wishes additional tenders on plastering. Contract to be let about Dec. 10th. Three storeys, 25 x 72.

Ottawa, Ont.
Residence, $10,000, for Mr. Quinn, care architect, F. C. Sullivan, Castle Bldg., Queen St. General contractor, T. A. Shore, 41 Chamberlain. Roofed.

Residences, cost $10,000, contemplated by Donald Fraser, 557 McLead St. Stone foundation, brick veneer construction, shingle roofing, electric lighting, hot air heating, birch floors, water heaters, built in fireplaces.

Residences, cots $8,000. Owner and architect, J. P. MacLaren, 104 Sparks St. General contractors, Bellfoy Bros. Mason, R. Edmondson, 221 Somerset St. Carpentry, R. J. Mackie. Other contracts not let. 2½ storeys, brick veneer construction. Foundations in.

Apartments, cost $14,000. Owner, Mrs. C. E. Hesser, 424 Lisgar St. Architect, A. Tracey, Gladstone Ave. 60 x 44. Foundations in.

Quebec, Que.
Seven flats, cost $9,500, for owner, architect and general contractor, Jos. Art Godin, 269 St. Denis. Day labor. Four storeys, 47 x 66, felt and gravel roofing. Roofing.

St. John, N.B.
Residence, cost $10,000, for Jno. Seeley, 100 Leinster St. Architect, F. Neil Brodie, 42 Princess St. General contractor, Jno. Flood, 123 Duke St. Roofed.

Toronto, Ont.
Residence, cost $7,000, for J. M. McKinley, 16 Dalton Rd. Architect, C. J. Gibson, 53 Yonge St. General contractor, A. J. Peppiatt, 81 Hilton. 2½-stys., 30 x 46, brick construction, slate roofing, gas and electric lighting, steam heating, oak and birch floors, lime and sand plastering, wood lath, marble tiling, art glass, mantels, built in fireplaces. Foundations in.

Residence, cost $30,000, for Jas. Ryrie, 400 Jarvis St. Architects, Burke, Horwood & White, 28 Toronto St. Carpentry, J. G. Scott Lumber Co., River St. Plastering, R. C. Dancy, 153 Spadina Rd. Painting, J. McCausland & Son, 11 Nelson. Plastering.

Residence, cost $15,000, for C. J. Read (in trust). Architect, C. J. Read, Confederation Life Bldg. Masonry, S. Young, 41 Hazelton. Carpentry, M. J. Madden, 62 Wilson ave. Plastering, E. J. Curry, Lumsden Bldg. Painting, J. O'Connor, 64 St. Clarens ave. 2½ stys., 20 x 43.

One pair residences, $5,000. Owner and general contractor, E. Taylor, 162 Delaware ave. 2½ storeys, 36 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Three attached stores and residences, cost $8,000. Owner and general contractor, W. Hughes, 24 Biggar Ave. Owner superintends construction. Three stys., 48 x 52, brick and steel construction, stone foundation, felt and gravel roofing, gas and electric lighting, hat water heating, oak, spruce and birch floors, lime and sand plastering, wood lath, plate glass, built in fireplaces, mantels, store fronts and fixtures. Plans drawn.

One pair residences, cost $5,000. Owner and general contractor, A. & A. Grant, 837 Logan ave. Owners superintend construction. 2½ storeys, 33 x 40, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Apartment, cost $6,000, for W. H. Mallory (in trust), 31 Queen St. W. Architect, W. H. Mallory. Tenders received by Architect. Three storeys, 24 x 60, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and birch floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Vancouver, B.C.
Apartment house, cost $20,000, for E. French, care architect, Raphael A. Nicolais, Birks Bldg. Two storeys and basement, two 50-ft. buildings with central court between, frame and brick veneer construction. Nine apartments on each floor, disappearing beds to be installed Plans in progress.

Walkerville, Ont.
Farm residence, cost $12,000, for Frank Walker. Architect, Stahl & Kinsey. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich. One and two storeys, 58 x 35, frame construction, cement foundation, shingle roofing, electric lighting, hot water heating, oak, maple and pine floors, plumbing, built in fireplaces, garage and barn, incubators required by owner. Foundations started.

Six residences, cost $9,000. Owners, Walkerville Land & Bldg. Co. Architects, Stahl & Kinsey, Strathcona Block. General contractors, Schmeid-Sisman, 387 Beaufort Ave., Detroit, Mich. Plumbing, Walkerville Hardware Co., and Geo. Schmeid. Electrical, W. A. Richards. Plastering, Jas. Reid. Painting, H. B. White. Two storeys, 108 x 29, stove heating, plastering.

CONTRACTS AWARDED

Montreal, Que.
Apartment house, cost $20,000. Owner and general contractor, J. A. Joly, 1205 St. Viateur St. Architect, Z. Trudel, 238 St. Andre St. Brick, Mr. Laliberty, Champagneur Ave. All other contracts to be given shortly.

Toronto, Ont.
Two detached residences, cost $6,000. Owner, A. Pugsley, 50 Central Ave. General contractor, T. E. Valentyne, 606 Shaw St. 2½-storeys, 24 x 32, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and spruce floors, lime and sand plastering, wood lath, built in fireplaces, mantles.

Winnipeg, Man.
Residence, cost $40,000, for Col. R. M. Thomson, 802 Trust & Loan Bldg. Architect, C. W. N. Chivers, Keewayden Bldg. General contractors, roofing and painting, Jas. McDiarmid & Co., Canada Bldg. Heating and plumbing, Fraser Plumbing Co., 44 Adelaide St.

Apartment block, cost $65,000, Grosvenor Ave. D. H. Bradley, c/o Architect, H. B. Scarlett, 797 Jessive Ave. General contractors, Winnipeg Stone Co., Elmwood. Three storeys. Plastering.

Power Plants, Electricity and Telephones

Lacombe, Alta.
Purchase of generator, cost $2,000, is contemplated by Town Council. Engineer, E. J. Tett, Elec. Light Commr. Installing 100 kw. 2,300 volt engine Type 3-phase, 60-cycle, generator 277 r.p.m. with belted exciter.

London, Ont.
Addition to Hydro sub-station planned by City Council (Water & Light Commission). Chairman, Philip Pocock. General manager, Commission, H. J. Glaubitz. No tenders to be called as work will be done by day labor in spring.

Storage cell, etc., planned by City Council (Fire & Light Com.) Mayor, C. M. R. Graham. General contractors, Northern Electric & Mfg. Co., Ltd., 131 Simcoe St., Toronto. To be used in connection with fire alarm system.

Moncton, N.B.
Telephone train despatching line to St. John, cost $10,371, planned by Dominion Govt., Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General manager, Intercolonial Railway, F. Gutelius, Moncton. General contractors, Hall Switch & Signal Company.

Napanee, Ont.
Tenders received until Dec. 15th for electric wiring and fittings. Plans at office of Dept., Station "F," Toronto, and Caretaker of building, Napanee. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa.

Picnic, Sask.
The Graham-Chatsworth Rural Telephone Co., Ltd. Plans, etc., at the office of Sec.-treas., Victon Rooke, who will receive tenders for construction of telephone system.

Princeton, B.C.
Tenders will be received for poles, will require boilers, dynamos, lamps, wire and fittings. To be installed at once. Princeton Coal & Land Co. Manager, Ernest Waterman.

Rossland, B.C.
Municipal Council is looking into matter of installing new street lighting system. Futher information from Clerk.

St. Thomas, Ont.
Commission contemplates purchasing iron poles and installing cluster light system on main streets. City Council (Hydro Dept.). Manager Dept., E. H. Caughell.

Winnipeg, Man.
Power house, cost $35,000, planned by Board of Control. Engineer, J. G. Glassco, City Light & Power Dept. General contractors, Ft. Garry Constr. Co., Ross and Arlington Sts. Roofed.

Motor generator set required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractors, Siemens Co. of Canada, Ltd., 707 McArthur Bldg. For supply and delivery of one 500 kw. motor generator set for the King St. sub-station at cost of $9,740.

Wyoming, Ont.
Town Council contemplate installing electric lighting system. Clerk, H. G. Taylor.

The John Inglis Company
Limited

Engineers and Boilermakers

Shipment of large tanks leaving our yards for the Canadian Explosives Limited, Montreal

If you are not familiar with our work we will gladly refer you to some one in your locality using "Inglis" products - they are all over Canada.

"Inglis" Boilers, Engines and Tanks, are in use from coast to coast.

Write us for Specifications, Prices, &c.

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A. Angstrom - Montreal Representative - 509 Canadian Express Building

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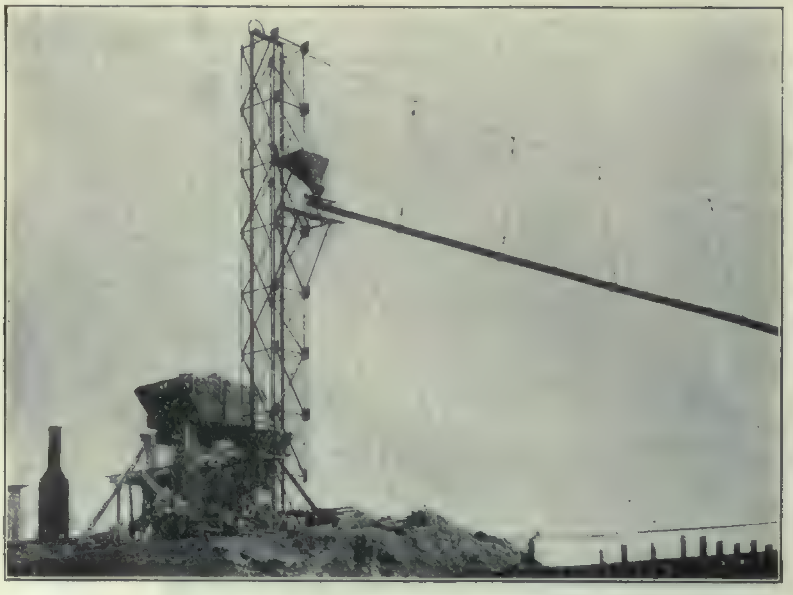

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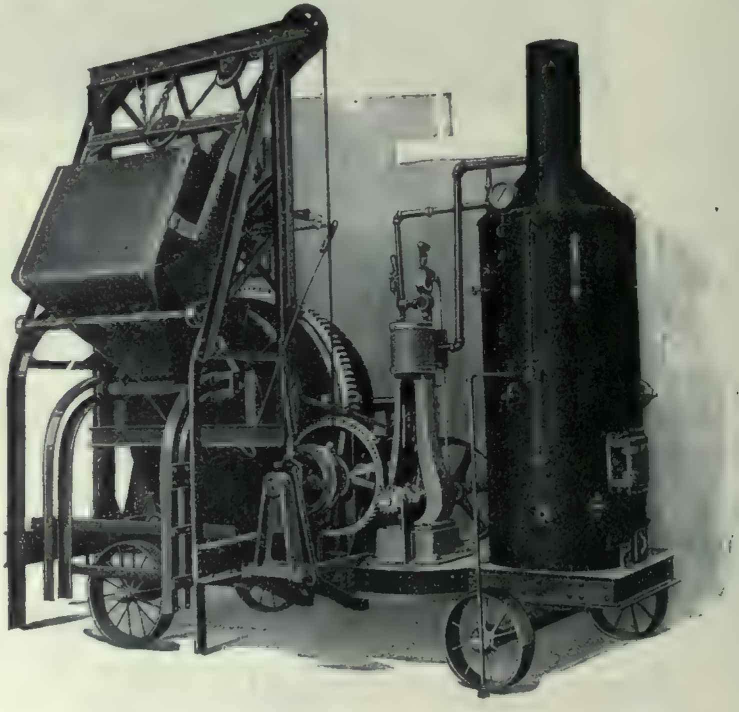

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Western Supply & Equipment Company, CALGARY
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which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the DOMINION WOOD BLOCKS we believe we produce an article that has no equal.

The Dominion Creosoting
Company, Limited
Vancouver, B. C.

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	18 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from ... ... $80 00 to	$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75
Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00
Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		15 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

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The greatest improvement in Sheet Metal for years; we now offer you the most serviceable Sheets that can be produced.

The first cost of these Sheets is but a little more than ordinary Sheets, but they last so much longer that it is much more economical in the end.

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Use ASBESTOCEMENT BUILDING MATERIALS

ASBESTOSLATE Roofs protect from fire without.

LINABESTOS and ASBESTOS BUILDING LUMBER check fire within.

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50% OF ALL FIRES DUE TO CARELESSNESS, OR PREVENTABLE CAUSES
PROBABLY 25% OF ALL FIRES INCENDIARY
STATISTICS
CANADA'S FIRE LOSS
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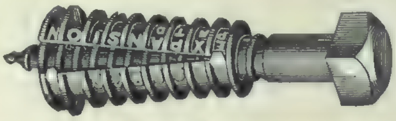
Expansion Bolts

The quickest, most secure, dependable and economical method of fastening railings, gratings, iron doors and window frames, pipes, shafting and machinery of every description to walls, floors or ceilings of hard substances such as brick, stone and concrete.

A hole is drilled, the SEBCO Shield inserted, which as the Bolt is tightened expands, embedding itself firmly in the material, allowing no movement of any kind.



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Screw Anchors

are non-rusting. They are used for fastening small fixtures of all kinds to marble, tile, etc.

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THE ONLY SYSTEM THAT HAS STOOD THE TEST OF YEARS IN THE SANITARY AND ECONOMICAL DISPOSAL OF REFUSE

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Hotchkiss Steel Forms

For walks—curbs—curb and gutter combined—driveways, roads, pavements, etc.

The benefit of 20 years' experience as successful contractors.

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Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

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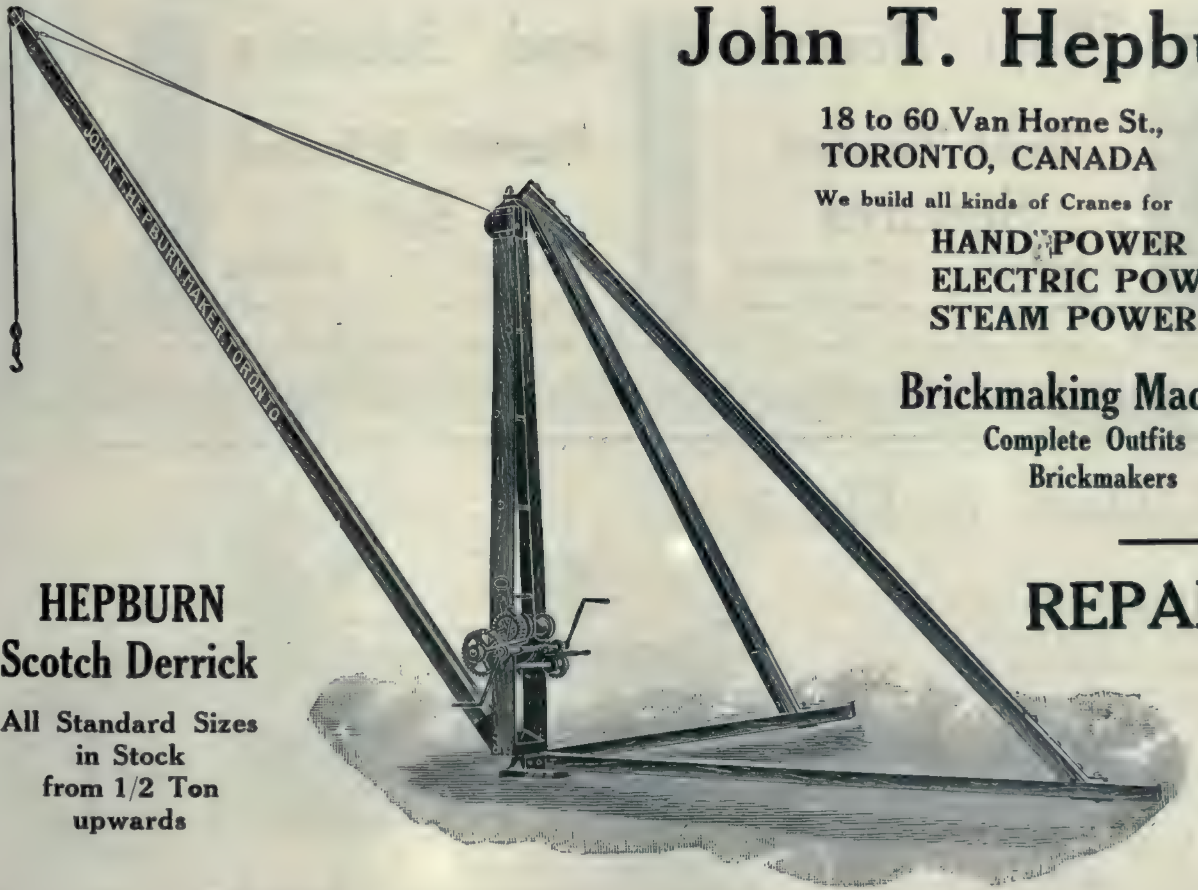
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Complete Outfits for Brickmakers

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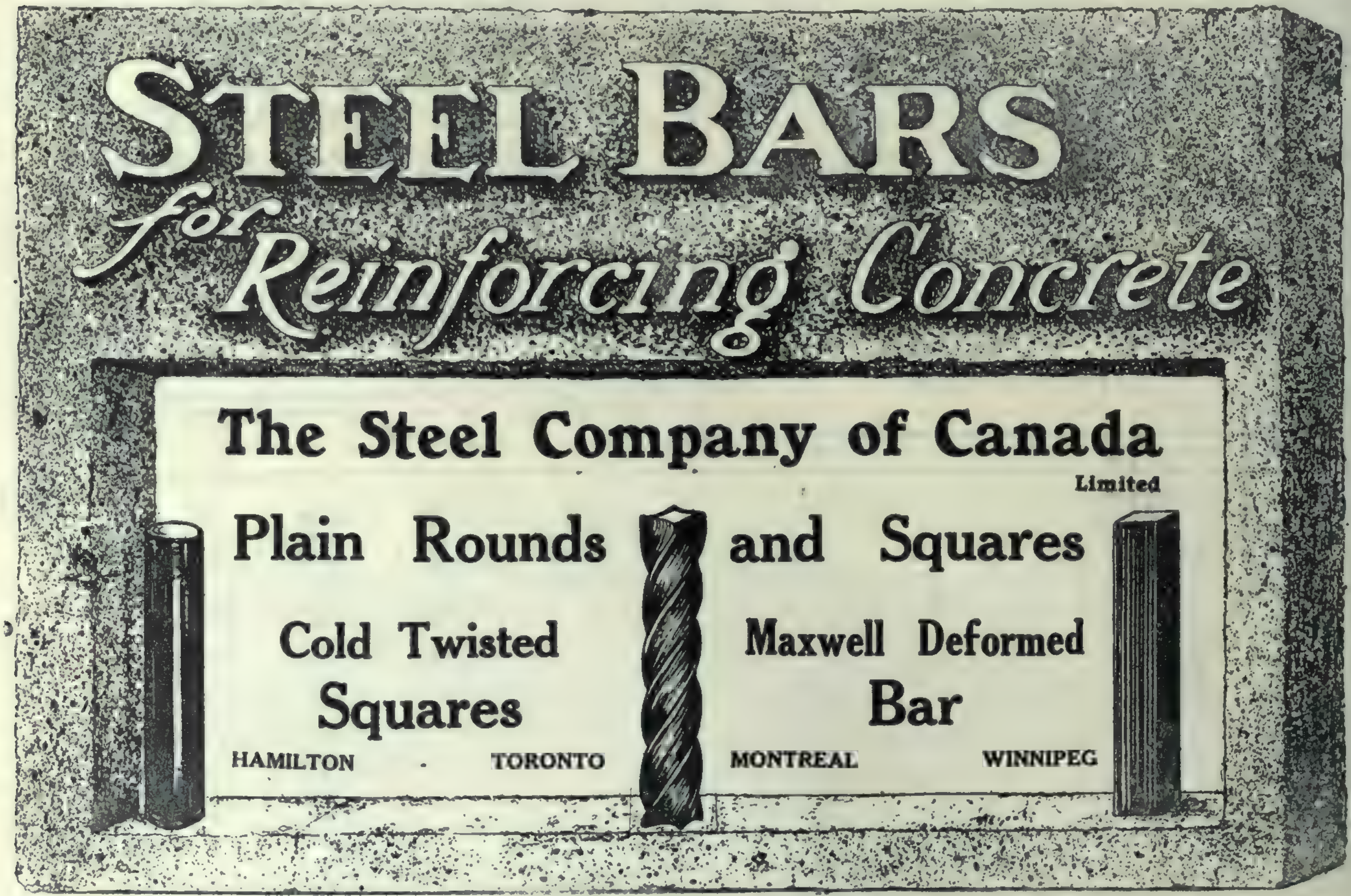

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Plain Rounds and Squares

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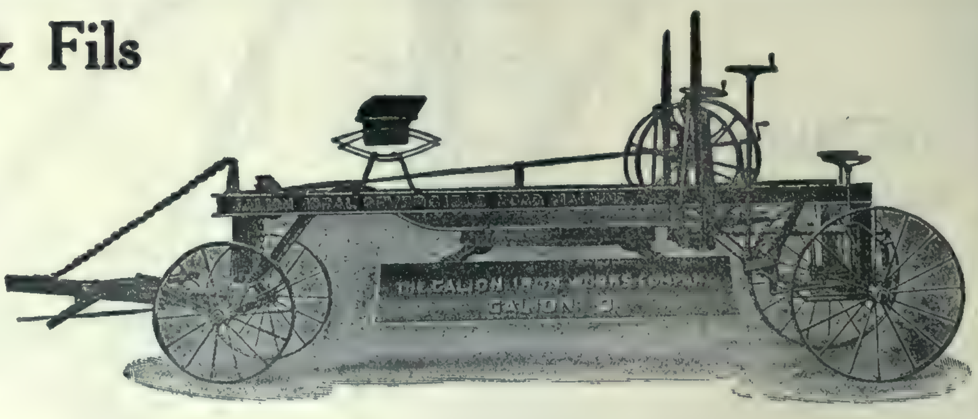
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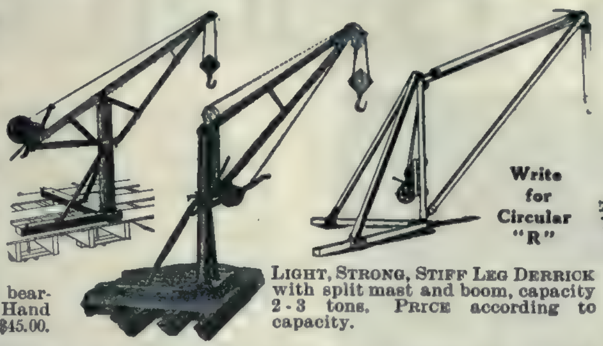
The Most COMPLETE LINE OF BUILDERS' DERRICKS MADE

Reinforced Standard 2500 lbs. capacity with geared winch complete $48.00 or for Hand and Power $51.00.

PEERLESS STEEL DERRICK full circle swing, self-lubricating bearings, $43.00 Hand and Power $45.00.



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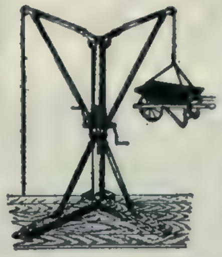
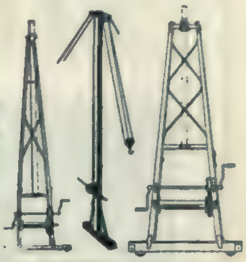


DOUBLE BOOM WHEELBARROW DERRICK full circle swing. Sufficient chain for 3 story building. PRICE $68.

"A" FRAME BUILDERS' DERRICK 1800 lbs. capacity $48.00; 2500 lbs. capacity $51.00.



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At these prices you can't afford to be without one of these derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

Don't Hire Men to Carry Up Your Material, Hoist It with a SASGEN DERRICK.

SASGEN DERRICK CO., 13 Jarvis St. TORONTO CHICAGO OFFICE: 2053-57 N. Racine Ave

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HAMILTON CANADA

STEEL

For Reinforcing Concrete
Plain Rounds Squares
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Cross Arm Braces, Plain and Galvanized

We can ship from stock

Ask for prices—they will interest you.

STEEL

Angles from ¾ x ¾ in. up to 2 x 2 ins.
Round and Square from ⅜ in. up to 1¼ ins.

Flats from ¾ in. up to 4 ins. in width, and other special sections.

Office and Works:
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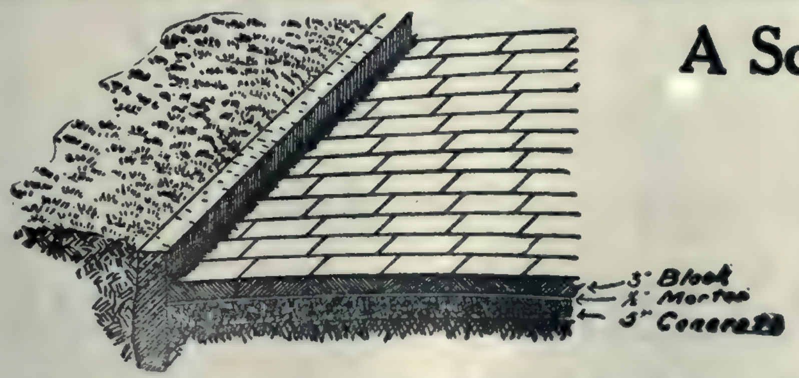

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Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature.
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Easily Repaired and easily Cleaned.

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Astrakhan Brick
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Rough and Smooth Surfaces

Salt Glazed, Enamel and Paving Bricks

Selected Fireplace Brick Carried in Stock

BLACK BUILDING SUPPLY CO., LTD. - TORONTO

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Seamless Steel Tubes

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Are Specified by the
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All Over the World

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Seamless and Lapwelded Steel Spigot Pipe

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2" ——— to ——— 60"
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The Right Quality
with
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WHAT MAKES *WEAR* IN A HOSE?

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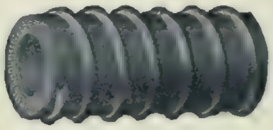

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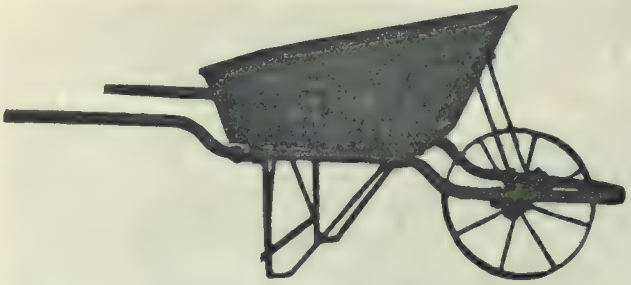

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ESTABLISHED 1886

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**Alphabetical Index of Advertisers
Page 16**

Vol. 27 December 17, 1913 No. 51

"Commercial Immorality" Exemplified at Vancouver

IN an extract accompanying the letter of Messrs. Warren Brothers Company, Boston, published in our issue of December 3, the following opinion was expressed:—"I believe more can be accomplished by placing even greater responsibilities upon public officials, holding them to a strict accountability for the proper exercise of their duties, and then providing adequate means for the detection, exposure and correction of any abuse of the powers which may be entrusted to them." We take this observation as our text in what follows.

On another page we publish a letter from "One of the Contractors" for a section of the Greater Vancouver sewerage work. A perusal of this letter and some acquaintance with the history of the Vancouver sewerage scheme incline us to the opinion that the Burrard Peninsula Joint Sewerage Board, the authority to whom the work has been entrusted, is not—like Caesar's consort—above suspicion. The letter is written under a non-de-plume, but its author is an established western contracting firm of sound principle and high reputation, and as no extravagant attack is made upon the in question, there can be no substantial objection to the contribution on the ground of its anonymity.

So far as we know, and so far as we are able to substantiate from our own knowledge and from local press reports, the letter constitutes a simple history of the case. If we are to believe our correspondent, and if we are to place one iota of confidence in the testimony of the Vancouver papers, the Burrard Peninsula Joint Sewerage Board got half a dozen leading contractors to tender upon three or four hundred thousand dollars' worth of work and after having obtained figures changed their mind and decided to carry out the work by day labor, "for the benefit"—we are told facetiously?)—"of Vancouver's poor during the winter months."

We are entirely in sympathy with those who have come down to a state of comparative destitution in a city of doubtful philanthropy and easy virtue like Vancouver, but we fail to see why good works should be done by local authorities at the cost of contractors. Right here, in our opinion, there is justification for the claim put forth editorially in our issue of November 12, namely, that in cases such as this the contractor should be reimbursed for the trouble and expense of tendering. The objection has since been made that if such a system were adopted we should soon have a number of unprincipled people in the business for what they could make out of it without doing any actual work, but we fail to see how this can be sustained in view of the fact that in undertakings of any magnitude the "privilege" of tendering is only—and need only be—extended to a limited number of firms qualified to tender by virtue of practical and financial competency. We find that the tenders submitted for the construction of the sewerage system at Vancouver ranged in value from $240,000 to $360,000. Six contractors submitted bids, and of eleven proposals—which included five alternatives—nine of the bids submitted ranged between $240,098 and $285,670, so that the Board can hardly defend its action on the ground of there being much disparity between the bids received.

It is an outrage to make such a sudden and radical change with the simple explanation that the proposals submitted were unsatisfactory and that the community will derive greater advantages by having the work carried out under day labor. Why not a specific statement giving full details of the bids submitted and recounting frankly the engineer's objections in each case? If there is a written law which punishes a man for steal-

CHRISTMAS, 1913

> ***"Thou may'st see a sunshine and a hail***
> ***In me at once; but to the brightest beams***
> ***Distracted clouds give way."***
>
> *—All's Well That Ends Well.*

ing from another man's pocket why not an unwritten law which can be brought into effect against a man who steals the fruit of another man's brains? Has competition reached such a point that contractors must submit tamely to any conditions imposed upon them? Surely contracting conditions are hedged in sufficiently with certified cheques and other securities without putting men to the laborious work of figuring quantities and alternative quantities for nothing. We reiterate our contention that it is commercially immoral to compel any man or body of men to work for nothing or to dispose of a man's work gratuitously through some ultimate change of plan.

It will be interesting to follow the construction of this section of the Greater Vancouver Sewerage System. We do not doubt for one moment that it will contrast unfavorably with contract work from the point of workmanship, time and cost. Under day labor where will be the incentive to essay a creditable performance? Whose reputation will be made? What single individual will suffer from the improper distribution of labor, or waste of time and materials? Certainly not the superintendent of construction whose position we see has just been advertised in the local papers. He cannot have the vital interest of the contractor. The salary of the superintendent and his assistants will be paid by the Board, the Board will pay themselves in some manner or other, and the man in the street will foot the bill, while the men who should have carried out the work occupy the side benches.

As a journal which has a recognized standing in the contracting world we should like to ask the Burrard Peninsula Joint Sewerage Board for an explanation covering in detail the matters which we have recited.

Completion of the Bassano Dam

FOLLOWING some three years' work, the Bassano across the Bow River, in the vicinity of Calgary, has been completed by the Ambursen Hydraulic Construction Company of Canada, Limited, Montreal, for the Canadian Pacific Railway. The work, entailing the expenditure of several million dollars, has been carried out under the supervision of Mr. J. S. Dennis, assistant to the president of the C. P. R. and head of the Natural Resources Department of the company. By means of the scheme a million acres of prairie land hitherto of little value for agricultural purposes is placed under irrigation and will be made productive. The remaining portion of the scheme will probably be built next year. The greater part of the earthwork for the canals, aggregating twenty million cubic yards, has been finished and operations well advanced on the principal structures. The remaining work to be done consists largely of placing over a thousand small structures, mainly wood, scattered over the irrigable tract covering the greater part of 2,000 square miles. The water supply comes from the Bow River.

The quantities, as shown by the records of the Dominion Government, are large, the river receiving the drainage from over five thousand square miles above Bassano. It has a heavy spring flow, the highest stages being reached between June 15th and August 15th, thus furnishing an ample supply well through the crop season. At other times its affords adequate quantity for conveyance through the main canal to the storage reservoir located within the irrigable tract. This provision of storage for a part of the irrigable area and in the vicinity of the farms is an assurance against certain classes of operation troubles.

The low water surface in Bow River is raised approximately 40 feet by the Bassano Dam, located 83 miles east of Calgary. It is a composite structure, the great feature being the concrete spillway 720 feet in length. This is built with regard to economy of material and is of the Ambursen type, with heavy floor on the bed of the stream, protected by suitable cut-off walls. Upon this are erected buttresses carrying a sloping deck with apron, the whole designed to pass 100,000 cubic feet of water per second with extreme height of 13 feet above the crest. The concrete portion of the dam is prolonged westerly within the Horse Shoe Bend by an earthern dyke with maximum height of 45 feet and length of 7,000 feet, containing about 1,000,000 cubic yards. Extending easterly from the dam is the main canal, five miles in length, partly in a deep cut of 70 feet bottom width, and which, being made in earth of somewhat treacherous character, has given considerable trouble. In this respect it is comparable with a number of similar deep earth cuts which have been made and successfully maintained under similar conditions on canals in Montana and adjacent areas. Beyond the eastern end of this cut, the main canal, the capacity of which is 3,800 cubic feet per second, divides, the smaller portion, with bed width of 30 feet and capacity of 800 cubic feet per second, turning toward the north, while the larger

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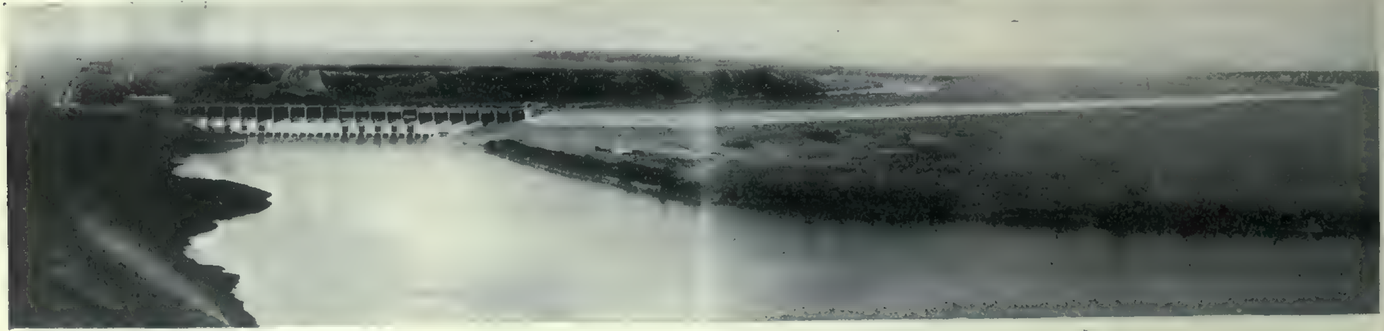
* The irrigation projects of the C. P. R. in Alberta were described very fully in an article by Mr. A. S. Dawson, Chief Engineer, C. P. R. Department of Natural Resources, in our issue of April 24, 1912.



Panoramic view of the great Bassano dam.

A corner of the dam.

Sluice gates.

branch, with capacity of 2,200 second-feet, continues toward the east. On the northern branch and its subdivision are many structures, such as drops and flumes, but the greater number of these are on the eastern canal and its sub-divisions.

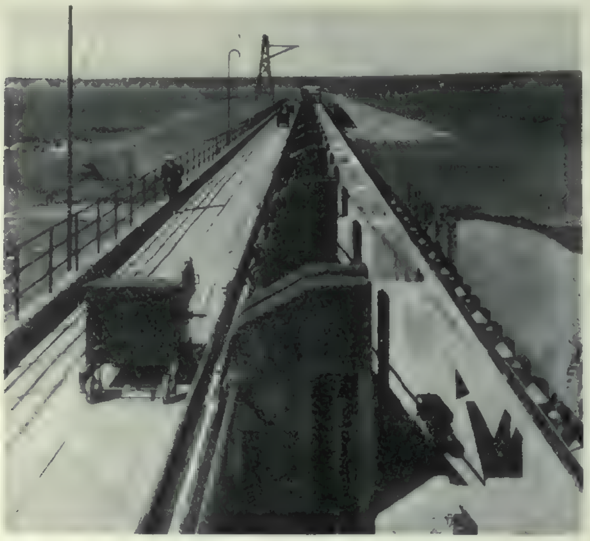
The most notable of the canal structures is the Brooks aqueduct, 10,000 feet in length, with capacity of 900 second-feet, crossing a broad low depression. The design of this aqueduct is novel, being based on careful study with a view to permanence and economy of material. Practically all the larger structures in the Eastern Section have been, or are being, built of concrete, the chief exception being several large wooden flumes. The drops in the canal are of substantial design, constructed of concrete and embody features found to be necessary for their permanence. There is a considerable number of high earth fills built in place of flumes. The smaller structures for distributing water to the farms or groups of farms, numbering over a thousand, have not yet been put in place. As a new country develops, it will be necessary to make a number of changes in the distribution system, with the result that by the time the smaller wooden structures need renewal, there exists such a difference in methods and transportation possibilities that the wood can then be replaced to advantage with concrete. At the same time the plans can be modified to suit the developments which have taken place.

The area for which water is being provided, in general, is undulating and with slopes towards the Bow and Red Deer Rivers. There are a number of distinct drainage lines traversing the country, and the topography, as compared with that of most of the plains region, is favourable for a relatively rapid run-off of excess water. There is a considerable number of partly closed depressions, such as are characteristic of all glaciated regions. Provision has been made for draining many of these or for connecting them up, affording outlets for the surplus waters. Thus the main drainage system has been provided in part by nature and in part by artificial means. In this connection experience has shown that, as far as possible, plans should be made in advance for delivery of water by rotation, allowing certain distributaries to be periodically dry so as to reduce the seepage of water from them and to permit the irrigated lands to be relieved from excessive saturation.

The first problem under the prevailing climatic conditions is to induce the farmer to exercise forethought and to use water at the right time; the second, and even more difficult, is to get him to appreciate the danger of using too much water. He is apt to assume that if a little water is a good thing, a large quantity is better, whereas, the larger quantity may be injurious to his crop and to his neighbours' fields, and ultimately may necessitate large, and otherwise unnecessary expenditures for deepening and extending the drains. In order to prevent the occasion for these large expenditures for drainage arising in the future, arrangements are made on many of the new

Panoramic view showing dam and head gates.

irrigation systems to deliver water on a measured basis, a certain minimum quantity being obtained at a flat charge assessed on all irrigable lands. For example, 50c or $1.00 is to be paid usually in advance, whether the irrigable land receives water or not, and for this, say, one acre-foot can be had. This minimum is set at the amount which is considered to be necessary for the production of the average crop under ordinary conditions, but it is not enough to result in water-logging the soil and in the consequent demand for drainage. For all quantities in excess of this minimum an additional charge is made and collected in advance. The result is that the irrigator, being called upon to pay out his money when he demands more water than the minimum, considers very carefully as to whether he really needs the water. Experiments have shown that the largest crop yields are obtained with the minimum amount of water applied, consistent with suitable plant growth, and that while many crops are tolerant of considerable amounts of water yet the yield is reduced in quantity and quality by such excessive application. The production of the best crops is, therefore, very closely joined with the conditions of carefully measured supply and the consequent avoidance of the necessity of incurring large expenditures for drainage of the irrigated lands. The plans already made and largely executed for the main drainage lines make ample provision for future contingencies. If the operation of the distributing system is carried on in accordance with the principles above noted, it is probable that any considerable large future expenditure can be avoided.



Looking across the Bassano dam.

Main canal.

The works have been advanced to a point where it is assumed that the final cost will be about $20.00 per acre of land irrigated for approximately 440,000 acres. This may be exceeded somewhat, but even if the cost rises to $25.00 per acre, or even more, it will still be less than the average of similar work executed in the United States. There, the prices of recently constructed large systems, with storage and with principal structures of concrete, average from $40.00 to $50.00 per acre irrigated. The relatively low cost of the Eastern Section, compared with the permanence of the work, is due to the large extent of the area irrigated and the simplicity of the entire system. It is understood that the preliminary surveys for the work on the Eastern Section of the Irrigation Block showed, as originally reviewed, a cost of approximately $16.00 per acre for 540,000 acres. Later it was found that the irrigable acreage must be reduced to about 440,000 acres, with accompanying increase in cost per acre. There is a probability at present that a new classification made on a more strict basis, taking the detailed surveys of each quarter-section, may cause a further shrinkage of the irrigable area with a corresponding increase in acreage cost. In explanation of the fact that the final cost will exceed the preliminary estimate of $16.00 per acre, it may be stated that there has been a general advance in costs of construction, accompanied by a demand for a larger number of permanent structures and greater elaboration of detail. The greatest factor, however, in increasing the acreage cost is that due to the general decrease of acreage upon which the cost must be distributed, due to the more rigid exclusion of small scattered tracts of land considered as non-irrigable. The era of low costs in irrigation construction has passed. Throughout the country the same condition prevails, namely, that the estimates of the engineers, as to what might have been accomplished four or five years ago under the then existing conditions, are being to-day exceeded in the actual operations. Engineers, like other professional men, are not prophets and must base their figures upon the experience of the past with such allowance as have proved wise; the increase in cost such as has taken place could not have been safely predicted.

The Eastern Section includes a million acres out of which there has been selected approximately 440,000 acres, lying in an altitude of from 2,300 to 3,300 feet, and which may be irrigated from the System as planned and nearly completed. The tract as a whole is a part of the Northern Great Plains, the surface of which has been modified by glacial action, with resulting heavy underlying deposits of sand and gravel, and particularly of clay, interspersed with large and small boulders. The resulting top soil on the glacial deposits is frequently loamy, usually very rich, and in places slightly sandy. Everywhere seen it is of suitable depth and quality for excellent crop production. The native vegetation, largely of various grasses, grows luxuriantly whenever there is an adequate supply of moisture.

Contour maps have been prepared covering the lands which can be reached by the canals. In the study of these maps the rougher, or more gravelly tracts have been eliminated as non-irrigable, leaving for consideration only those portions which appear to have an ample depth of good soil. There is no doubt as to the capability of these irrigable areas to produce highly remunerative crops if properly handled.

Correlation of the Engineer, Inspector and Contractor*

By F. L. Cranford†

BEGINNING less than one hundred years ago with the construction of the first steam railroad, nearly coincident as that was with the building of the steamboat, the other great factor of modern transportation, there followed an increasing volume of engineering work, not only in America but in all the great countries of Europe.

During the last twenty-five years the amount of construction work has been so enormous in volume as to make the previous performances by comparison little and unimportant. There has been in addition to a vastly increased volume, a great advance in skill in design and construction, in the application of scientific principles and methods, and in the adaptation of machinery upon engineering work. With this evolution and coincident with it there has followed a development of the contract system now in general vogue by the national, city, county and state governments and also by the great corporations, which brings into relation the engineer, the inspector and the contractor, and the works which these three agents are now performing are probably the most enduring contribution to this particular period of our civilized development.

It would seem to me fair to go a little further. The last century is no doubt going to take a very important place in the history of civilization, but its importance is not political. The great constructive political work in this century of our revolutionary period was in the eighteenth century and our civil war period was rather the correction of an error in the work of the seventeenth century than a constructive period of its own. In philosophy, literature and art there has not been any development which would eclipse for instance the Elizabethan period, but on the contrary, the nineteenth century's great work has been scientific—and scientific along many lines—agricultural, mining, mechanical, electrical, medical and surgical; but in no instance has the development been greater and the results so stupendous as in the engineering work witnessed in the construction of our railroads, canals, water power, city building, road building, harbor development, etc. The organization which in the main performed this work was the contract system with which we are all familiar, and therefore the relation to the other of the engineer, the inspector and the contractor—who may be said to constitute this organization—is a very important factor in the machinery of our present day civilization.

Within the memory of many actively engaged on public work, the duty of the engineer was limited to the drawing up of the plans and specifications of work and his relation to the contractor and to the work was largely that of a surveyor, giving lines and grades and making estimates. The inspector in many instances was not a subordinate of the engineer, but reported directly to the executive officer in charge of the work and frequently owed his place on public work to political considerations, rather than to any knowledge, experience or ability, that he may have had. The executive also exercised a much greater measure of control over both the contract and the contractor. The abuses which grew out of such a system were many and of such serious proportions as to threaten for a time the stability of the contract system. It is only a few years ago when the corruption which grew out of this imperfect organization was so great as to throw a stigma upon all who were associated with public work. With the perfecting of the organization which has largely taken public work out of politics and placed the engineer in charge, there has come, particularly to our cities, the only important advance in our municipal governments and it is a fair statement to make that this advance is due to the engineering profession.

Importance of the Engineer

The dominance of the engineer on our public work developed a conflict which raged with more or less severity between the practical and the theoretical and this conflict has been the important cause of most of the differences and disputes between us. The rule of thumb and the theoretical formula will always be a source of contention between the purely scientific engineer and the practical man; the former being skeptical of the value of the rule of thumb and the latter contemptuous of the theory of the engineer. When, however, both have had sufficient experience to allow them to grasp the fact that theory and rule of thumb spring from the same source if they are correctly interpreted, they will not be so far apart. Engineering is an exact science and its theory is therefore a formula tabulated from practice. The only difference between a formula and a rule of thumb is its more scientific form.

The Scientific and the Practical

As an example of the relationship between the scientific and the practical take a trip into the wilderness. What science will enable a man taken without previous experience out of our colleges or cities and placed in an unbroken wilderness to secure food and clothing and shelter; how quickly will he turn to the native or even to the savage for the practical help essential to his very life. The technique of the Indian in his skilful approach to, and let us say, capture of a deer and the various forms of knowledge required for the use of its flesh as food and of its hide as clothing and shelter, are no more remarkable nor less worthy of respect than the experienced practical man's skill and knowledge upon engineering work, and yet the remarkable Indian hunter is still a savage and his tribe will so continue without the scientific knowledge essential to civilization. So also the practical man must work with and under the scientific. The contractor, as the practical man, has found during the last two decades an increasing necessity for technical knowledge in the success of his work and a great improvement along these lines has already been accomplished. Is it not just as essential if not more so for the technical man to acquire a better and more sympathetic knowledge of the practical?

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† Road Contractor, Brooklyn, N. Y.

An engineering work is an economic problem always and the economic design and execution of any given piece of work must of necessity be greatly affected by the many practical considerations of its location with respect to transportation, labor, supplies and the geological formation, and of the technical and mechanical skill needed in its execution. The scientific engineer will not find the success he owes to his work or to himself without a proper knowledge of the practical problems involved. If the engineer's scientific knowledge is not of use to produce better work for less cost with proper relations to future development, it has been misdirected. The young engineer just out of college, placed as he usually is as a surveyor, lineman, or draughtsman, without authority or responsibility except as stated is, I am convinced, not given a fair chance to acquire either the scientific or practical skill needed in his profession.

There is a noticeable difference in the number of inspectors employed on public and private work, political considerations being still visible as a cause for this difference. A large number of inspectors is not helpful but practical skill and experience is necessary to proper inspection. It has been our experience that a small number of inspectors have not only been of assistance to hold within proper limits over-ambitious foremen, but have been of great assistance in matters of more importance, namely the safety of the work, the public and the workman; these questions have received too little attention in the past as the percentage of preventable serious accidents on public work has shown. Some believe it to be as high as fifty per cent., while the percentage of preventable minor accidents is much greater. A little less politics and more responsibility will strengthen the inspector in our organization just as it has benefitted the engineer. It may sound somewhat strained to talk about curbing politics with regard to inspectors, contractors being so free from such contamination; but seriously there is no doubt that political considerations were the important cause of writing into our public work, contracts and specifications, the usual iron-bound clauses in which the contractor surrenders any and all rights he may have as a citizen or under the laws and constitution of the state and nation calculated to hold him, his successors, heirs and assigns, to perform without cost any foible or eccentricity of the engineer and of which the engineer is sole judge.

Let me quote two clauses from contracts for the construction of the New York subway.

> "The specifications and contract drawings hereinafter mentioned and taken in connection with the other provisions of this contract, are intended by the Board to be full and comprehensive, and to show all the work required to be done. **But in a work of this magnitude it is impossible either to show in advance all details, or to precisely forecast all exigencies.** The specifications and contract drawings are to be taken, therefore, as indicating the amount of work, its nature and the method of construction so far as the same are now distinctly apprehended. The railroad is intended to be constructed for actual use and operation as an interurban railroad of the highest class, adapted to the necessities of the people of the city of New York. The contractor shall construct and complete the railroad in the best manner, according to the best rules and usages of railway construction, and if in the specifications or contract-drawings or in the provisions of this contract, any detail or other matter or thing requisite for such construction be not mentioned, **nevertheless the same is deemed to be included, and the contractor hereby undertakes to do the same as part of his work hereunder. And it is expressly agreed that the price to be paid to the contractor includes full compensation for every such detail, matter and thing."**

> "To prevent disputes and litigations, the engineer shall in all cases determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract; shall determine all questions in relation to the works and the construction thereof, and shall in all cases determine every question which may arise relative to the fulfilment of this contract on the part of the contractor. His determination and estimate shall be final and conclusive upon the contractor, and in case any question shall arise between the parties hereto, touching the contract, such determination and estimate shall be a condition precedent to the right of the contractor to receive any money under this contract."

Could there be a greater compliment paid to a man than this engineer pays to the contractor that tackles such a job?

Yes, the compliment to the engineer paid by the contractor when he signs that contract. A specification for a given piece of work has an underlying and fundamental meaning. It is a description of how to secure the construction with given materials of the best character of work obtainable and the relation which we bear to one another is largely by it. If the meaning be ambiguous and the requirements vague, it is very easy for the relations to degenerate into an effort to see how much each can get away with; a greater simplicity and a larger measure of fair dealing would seem to me to point to a great possible movement.

Limiting Arbitrary Power

While the unlimited authority given to the engineer to interpret and finally determine the meaning of the contract provisions is in practice nullified, first by enlarged estimates to meet the risk of an improper decision, and, secondly, by the enforced decisions of our courts holding that this power is really not conclusive, still some method should be devised which would not only limit this seeming arbitrary power of the engineer to make or break a contractor, but would also retain his authority to control and direct the progress of the work.

Public work in the United States is at present upon a high plane of accomplishment. Our great private work has been heretofore free from scandal and corruption, but curiously our organization (that is, the contract system, or the engineer, the inspector and the contractor), is in this particular I believe, to-day in greater danger from these causes upon private work for great corporations than upon public work. The work of the Panama Canal is an illustration, and the only great illustration on which our organization did not work together. My belief is that it only proves the rule as an exception and that the elimination of the contractor in that instance was proper and best. The twentieth century is just well started and looms big with opportunity, for we have done and are doing great work.

Factors Governing the Selection of a Road Surface or Pavement*

By L. R. Grabill†

THIS question has been so thoroughly considered by several eminent authorities, notably, among Americans, by Tillson, Byrne, Baker, and Frost, that little that is new is left to be said on the subject. The best that can be done is to consider these views from a slightly different angle, so as to show a somewhat different perspective.

The selection of a pavement or road surface is one of the most important of the duties of a highway engineer. The surface of the road or street, equally with the bridge truss or the retaining wall, should be neither over-designed nor under-designed as to the strength required to satisfy the conditions which it will be called upon to meet. In this particular the discrimination and care used must be similar to that of the architect in choosing the type of building suited to the case he has in hand, and to that of the bridge engineer in selecting the kind of bridge he will use. The road-builder or the pavement engineer must choose not only the type of surface which will be the easiest over which to pull a load, which will prove durable under the traffic that it will carry, and which will be adapted to the numerous local conditions; but he must, if his work is properly done, choose the surface that will produce these results with the minimum final cost both to the users of the road and to the community which pays for its construction and maintenance.

Nothing could be easier than to select a few types of road suitable to a few locations, and to adhere to these types, regardless of wide variations in the conditions; and this, it is feared, is too often done. It is very much on the safe side to assume that the character of pavement required for the most exacting purpose should be used for very different and lighter requirements; or to assume that the surface which costs the most will necessarily be the best; but it is not always possible to decide with such facility the question of what surface will prove the most satisfactory, under the special conditions involved, for the lowest total expenditure per ton carried over it. Yet this is the question to be solved in every new construction.

There is frequently the danger, too, that a lack of sufficient funds for the work proposed will cause the effort to be made to cheapen the first cost of construction beyond the limit necessary for durability; and it is not often that the road engineer finds enough funds available to build a better road than he wishes, if indeed he is able to build as well as his judgment dictates. In these cases, however, it is usually possible to limit the area covered, either in length or width, or both, so that a suitable character of surfacing may be employed.

It is assumed in this paper that all of the necessary requirements for the sub-grade have been met, such as those that relate to grade, drainage, and the preparation of the earth foundation for the pavement. These being the necessary and most permanent part of the road, should always be well done, in the best and most enduring manner that is practicable with the funds available, even at a sacrifice of the character of the surfacing, which will in time require renewal under any circumstances.

In considering the question from a purely academic standpoint, the availability of the funds necessary for constructing the kind of surface required for any given case may be also assumed, so that the question of cost presents itself only as a factor of the problem, and not as a limiting feature of the selection. This assumption is necessary, because if sufficient money cannot be obtained, the question becomes one of the selection not of the proper surface, but of the best one that can be paid for; forming a somewhat different problem, with greater limitations. In fact, the entire question may be said to cover two classes of cases, namely, those which are not limited by some special consideration, such as cost, grade, etc., and those which are so limited. The latter class is more frequently met with.

The word pavement is used, in this paper, for any class of hard surfacing of the road or street.

Mr. A. T. Byrne, in his work on Highway Construction, names the following as the essential qualities of a good pavement:—

1. It should be impervious.
2. It should afford a good foothold to horses.
3. It should be hard and durable.
4. It should be adapted to every grade.
5. It should suit every class of traffic.
6. It should offer the minimum resistance to traction.
7. It should be noiseless.
8. It should yield neither dust nor mud.
9. It should be easily cleaned.
10. It should be cheap.

Mr. G. W. Tillson, in the valuable chapter on "The Theory of Pavements" in his book on "Street Pavements and Paving Materials," appears to have originated the method of selection by assigning comparative values to the different qualities of surfaces upon a scale of 100, as follows:

Essential Qualities	Values
Cheapness	14
Durability	21
Ease of Cleaning	15
Light resistance to traffic	15
Non-slipperiness	7
Ease of Maintenance	10
Favorableness to travel	5
Sanitariness	13
	100

Mr. Tillson also gives, in his table number 51, a summary of the values of the various qualities which he assigns to different pavements, as compared with the full value in the ideal pavement. By combining the various values of the properties which are demanded to meet particular conditions this author shows how the selection of a pavement may be made. In speaking of the values as applied to various pavements, Mr. Tillson says: "It must be understood, of course, that the table is a general one; that much of it is based on the personal judgment of the author; and it will vary in different localities, even if the conclusions are agreed to."

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Mr. Ira O. Baker in "Roads and Pavements," divides the qualities of pavements, and gives the relative values as follows, in percentages of the value of an ideal pavement:

Economic Qualities	Values
Low first cost	15
Low cost of maintenance	20
Ease of traction	10
Good foothold	5
Ease of cleaning	10—60
Sanitary Qualities	
Noiselessness	15
Healthfulness	10—25
Acceptability	
Freedom from dust and mud	10
Comfortable to use	3
Non-obsorbent of heat	2—15
	100

Mr. Baker states: "The assignment of these numbers is wholly a matter judgment, and different individuals will differ greatly as to the relative values to be given to each quality. Different values should be assigned to the same quality according to the attendant conditions. The application of these principles is likely to be complicated by the personal interests of the residents or property holders."

An indication of the values of the qualities of different pavements is obtained from the average of the values as signed in ten replies by that number of paving engineers to an inquiry by the United States Forestry Service, which are tabulated as follows; using standard values which are apparently based on Mr. Tillson's but differ slightly, viz:—

Comparative Value of Different Pavements.

Qualities	Standard Percentage Value	Granite	Sand Stone	Asph. Sheet	Ashp. Block	Brick	Macadam	Creosoted Wood
Cheapness	14	4.0	4.0	6.5	6.5	7.0	14.0	4.5
Durability	20	20.0	17.5	10.0	14.0	12.5	6.0	14.0
Ease of Maintenance	10	9.5	10.0	7.5	8.0	8.5	4.5	9.5
Ease of Cleaning	14	10.0	11.0	14.0	14.0	12.5	6.0	14.0
Low traction resistance	14	8.5	9.5	14.0	13.5	12.5	8.0	14.0
Non-slipperiness	7	5.5	7.0	3.5	4.5	5.5	6.5	4.0
Favorableness to travel	4	2.5	3.5	4.0	3.5	3.0	3.0	3.5
*Acceptability	4	2.0	2.5	3.5	3.5	2.5	2.5	4.0
Sanitary Quality	13	9.0	8.5	13.0	12.0	10.5	4.5	12.5
	100	71.0	73.5	76.0	79.5	74.5	55.0	80.0

*Acceptability includes noise, reflection of light, radiation of heat and emission of odors, etc.

The prime factors which should determine the selection of a type of surface, when this selection is not limited by any necessity for giving undue preference to any factor, appear to be as follows:—

1. The volume and nature of the probable traffic over the pavement.

2. Conditions incident to the location of the pavement; including the character of the adjacent land and improvements; the character of the foundation; the kinds of adjoining pavements; the ruling gradients; the climatic conditions; and especially the availability and cost of different materials at the work.

3. The characteristics of the surface which will adequately meet physically, hygenically and esthetically the conditions expressed in the two factors first named. These characteristics are practically those named in the tables cited.

4. The quotient obtained by dividing the total estimated traffic to be carried per unit of width into the cost per unit of area of the pavement during its probable life; including first cost and interest on the same; special surface treatment for dust suppression or other purposes; and any necessary repair until replacement; but not including the cost of cleaning. For the best pavement this quotient will be the lowest. This ratio may be called the ultimate cost of the pavement per traffic unit carried.

(1) The volume and nature of the traffic—not the present traffic, if the road now exists, but the traffic after the improvement—is the most essential factor. This must necessarily be approximated, and due allowance should be made for increase during the life of the pavement. The effect of traffic upon the pavement should be expressed in units of a known value, to which all classes of traffic can be reduced.

The different effects produced on a surface by different kinds of traffic are elements which must be considered. A certain tonnage in heavy slow-moving vehicles with iron tires produces an entirely different effect from that produced by the same tonnage in lighter rapid-moving automobiles with rubber tires; and a still different effect will be produced by the same tonnage in heavier and slower motor trucks. It has been well suggested that a traffic unit should be adopted, which could be used to represent, as far as possible in the same denomination, the amount of wear caused by the passage of one ton over the road in each of the several ways. The width of space available for travelled way must be considered in connection with the amount of traffic. Traffic when confined to a single vehicle width is very damaging and widening a few feet only may easily double or triple the life of a pavement.

One solution of the character of the roadway, when pleasure traffic and commercial vehicles use the same highway, is to construct a surface adapted to each, separated by a short distance, making a double roadway. This is done to the great advantage of the road users of every class where the travel is sufficiently dense to require it. It is customary, for the reasons indicated, as well as from an esthetic standpoint, to prohibit heavy traffic on roads built especially for pleasure drives. This factor of traffic, which is one of the most essential, is sometimes given the least consideration, and we occasionally hear of a county or township bonding itself for a costly form of surface where a gravel road would answer the probable demands for some time. On the other hand, in the neighborhood of cities, where the travel is already heavy and sure to increase, roads or pavements are frequently laid which are inadequate for even present conditions.

The nature of the future traffic is quite as important as its volume; although owing to rapid changes in the weight and speed of freight-carrying trucks, and the increase of motor-driven vehicles, this is difficult to forsee, An estimate of traffic on a city street made for thirty years hence would probably almost ignore horse-drawn vehicles, and would provide for the heaviest class of motor-trucks instead. If the traffic is to be of one class only, such as motor vehicles driven for pleasure with a moderate limit of speed, the problem is much simplified, and it is the writer's experience that no class of traffic is more easily or cheaply provided for. If there is to be a mixed traffic of horse-drawn vehicles, motor trucks, and other automobiles, with a possibility of the steam-lorry and train of wagons in the future, this combination will require a very strong and durable pavement, and first cost should be given little consideration.

There is an approximate limit to the amount of tonnage which can pass over any width-unit of pavement in a given length of time; and any amount of traffic approaching this would demand the very highest type of surface practicable to be constructed. This limit is probably seldom reached for more than a few hours daily on the heaviest travelled streets.

(2) The nature of the surrounding conditions is a potent factor in determining the character of the surface. In a manufacturing or wholesale district where noiselessness is less essential a granite or brick block may well be used on account of its strength or durability; whereas in a residential section the less durable but more quiet asphalt or wood block is better. In a farming or country area, a macadam or gravel road harmonizes more perfectly with the surrounding fields and woods.

The value of the adjacent property has a large bearing in the case, for it is the basis of the revenue which usually must be raised to pay for the improvements. A closely built city block can fortunately afford a much higher priced pavement than a less closely built suburban section, on account of its larger taxable value.

The character of the foundation governs the construction in many cases. An especially soft sub-grade may require a base of cement concrete; while, with certain types of pavement, upon hard ground, this might be omitted at a considerable saving of cost. If the problem be that of surfacing an old water-bound macadam roadway, it may be solved by using a surface, for instance, of bituminous concrete, placed directly upon the old macadam; whereas, if no such foundation existed, an entirely different type of pavement might be required. A rigid surface, such as one of cement, should never be placed where there is danger of settlement.

The ruling gradients of the road must be considered, for the reason that some pavements do not afford sufficient foothold upon steep grades, and the climate must be taken into account, since pavements are differently adapted to warm or cold or wet or dry conditions. The character of adjoining pavements will have weight with the engineer, except in cases where the requirements are very exacting. Again the practical consideration as to the availability of contractors and suitable construction plants in the vicinity must have weight as entering into the price to be paid.

Among local conditions, the availability of material, either local or foreign, the use of which latter largely depends upon the cost of transportation, is probably the deciding factor in more cases than any other. A city in an area producing excellent paving brick would be unwise to import granite block from a distance at a heavy cost for freight; or even to pay too heavily for the transportation of asphalt, and a western county could by no means afford to pay the cost of transporting the trap-rock used so largely on roads in the East, but must find the solution of its problem in the use of a surface of cement concrete or other material produced nearby. The very possibility of the construction of any roadway whatever, in many cases where the funds are limited, is dependent upon making the best possible use of the local materials available.

(3) The characteristics of the surface to be constructed, which must satisfy the requirements of the traffic, the environment, the foundation, the gradients, and the climate, may be divided into three clases, viz.:

(a) Those which are purely physical;

(b) Those which are required for health;

(c) Those meeting requirements of a more or less esthetic nature.

(a) The physical requirements are those previously stated, viz.: Strength; durability, ease of traction; sufficient roughness when either dry or wet to prevent slipperiness; imperviousness to a greater or less degree; sufficient smoothness to render the surface easily cleaned and to prevent excessive jarring of vehicles passing over it at high speed, and facility of repair, both as to openings and as to wear of the surface.

(b) The requirements as to health include noiselessness, freedom from dust produced by the wear of the pavement, and heat-absorbing and heat-radiating quality in a minimum amount.

(c) The esthetic requirements are such as appeal more directly to the senses. These are harmony with surroundings, a pleasing appearance, extreme noiselessness, and almost absolute smoothness. These qualities in their highest degree are usually demanded only in connection with streets of the highest class, or with pleasure drives.

Examining these characteristics further, but without going into details as to the qualities of materials, we find as follows:

Imperviousness is a very important feature, both from a sanitary standpoint, and as a matter of increasing the durability. No very permeable surface can be considered a good one.

Smoothness is particularly demanded by motor-vehicles, especially where speed can be used. Non-slipperiness is produced by slight irregularities in the surface. It is necessary for good foothold and to prevent skidding of rubber tires when the surface is wet.

Facility of repair is essential; and for this reason the pavement should not be constructed of materials and by methods which will be difficult to duplicate after the completion of the original pavement, without at least providing for its repair. Block pavements lend themselves most easily to repair, since they require no large plant for that purpose.

The sanitary requirements are mostly for the benefit of the public living or working on the streets, and less for the road-user. A noisy pavement with much travel seriously affects the nerves of those near it; a dusty pavement permits fine grit to be carried into eyes and lungs and becomes a muddy pavement in wet weather. A heat-absorbing and heat-radiating pavement, such as sheet asphalt, if exposed to the sun, adds much to the temperature of the street and the surroundings in the hot weather, to the discomfort of all in its vicinity.

The esthetic requirements are such as add a touch of good taste, and perhaps of luxury, to the road and are increasingly in demand.

All of these requirements will have somewhat different weights in different cases. Some of them can be omitted in considering nearly every case, and must be omitted often. In view of this it seems best not to assign special values to these requirements; but in each case to give preference to such characteristics as the situation demands, and to use the surface combining these characteristics in the greatest degree.

(4) This combination must produce a pavement, usually, which will give the lowest ratio of total cost to the total traffic units to be carried. The surface thus chosen should be that which is best adapted to the purpose.

In instances in which a high first cost might be prohibitive, the pavement showing the lowest cost-tonnage ratio could not always be selected; and a less costly surface with a higher rate of maintenance would be necessary.

The process of selection will usually be one of elimination, thus, for a certain case of proposed construction several well-known classes of pavements, of nearly equal theoretical value, will be considered; say, granite block, vitrified brick, wood block, and sheet asphalt. If low cost is paramount, this element may eliminate the granite block and the wood block; and if noiselessness is desired, the vitrified brick will be eliminated; leaving the sheet asphalt, or a similar surface, to be adopted. If durability alone is considered, the granite block might be chosen where this material is convenient; whereas, if the case demanded noiselessness, smoothness and durability in a high degree, without especial reference to first cost, the wood block would probably receive the verdict.

A resident paving-engineer familiar with the local conditions and with pavements in general often need not tabulate or even assemble, otherwise than mentally, the reasons for his choice, and this mental way is very often the method of selection employed. In such cases, however, the same conditions should, and do, actually control as would be the case if the situation were being considered for the first time with the utmost pains.

In order to proceed with system in the matter of choice of a new pavement, or one in a new location, the engineer should have the necessary data as to traffic; as to cost of construction and maintenance of similar pavements in the vicinity, or under like conditions; as to the life of such pavements; as to climatic conditions, and, in fact, all available information on the subject. It is unfortunate that the supply of information on the subjects is not what it should be. This is a defect which every highway engineer can aid in correcting, by careful investigation and records in connection with his work. In the absence of the necessary data, the selection is merely an assumption based on judgment and experience, and sometimes on a desire to experiment, and this is the manner in which the choice is very often made.

On the whole, the selection of a pavement, like the tariff, is largely a local question, and in its final aspect, when under practical consideration, presents such a number of features, some of which are predominant at one time and some at another, that each case must usually be considered alone.

The matter is well summed up in this quotation from Mr. Tillson: "The official who decides on the material after the most careful investigation will often find that his decision is displeasing to many people. . . . . He must make his decision after taking all things into consideration, and stand by it, although it will not always prove satisfactory to all. . . . But if he meet the question successfully, and ultimately arrive at the true solution, his satisfaction is as great, perhaps, as in any other branch of his profession."

Water in Concrete Mixtures

THE occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid with adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement float in the water, filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the coarse aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroughly drenched. Following thorough mixing, water as needed is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.—Municipal Engineering.

Nineteen Thirteen a Record Railway Year

DURING the year 1913 the railways of Canada have had in hand, in one stage or another, fully six thousand miles of new construction. By June 30 last, when the year for railway statistics closed, between 1,800 and 2,000 miles had been taken into operation as finally completed, and since that date there has been immense activity. Including lines which have been surveyed, lines for which the contracts have been let, and lines for which the contracts have been completed, the total will run into the extraordinary figure quoted. At present the Canadian Pacific has well over 1,000 miles in hand, the Canadian Northern not far short of 2,000, and the Grand Trunk Pacific about 1,000, while there also is to be considered the 500 miles of the Hudson Bay Railway and the National Transcontinental, which now is nearing its completion. The present activity in construction work constitutes a record.

Pulleys with insufficient breadth of face do not give fullest transmission efficiency. Usually the diameter of a pulley is given correctly, in accordance with the work they are called upon to do, but the breadth of the face is overlooked and the width of the belt is correspondingly small. As the power transmitted by a belt not getting all the power the diameter of the pulley leads one to expect. A narrow belt is poor economy.

What is a Proper Allowance for Depreciation in a Sewerage System?

WITH all the discusion that has gone on in the last few years, regarding proper depreciation allowances in accounting, we recall little or nothing regarding the depreciation of sewerage systems, comments the Engineering News. This is doubtless because sewerage works are almost without exception built by municipalities themselves, and they are in a large part paid for by assessments on abutting property. Other portions of sewer systems such as the trunk sewers and disposal works, however, are usually paid for by money raised by bond issues.

It is a universally accepted principle of sound financiering that the terms of a bond issue to pay for a public improvement should never be longer than the life of the improvement itself. It is a pertinent inquiry, from this point of view at least, how long the sewerage systems now being built are likely to endure. Probably most engineers designing and constructing a sewerage system, would say offhand that their work ought to last at least for half a century. It is doubtful, however, if the results of experience with sewerage systems built twenty years or more ago, justify the expectation of any such long term of life.

Some weeks ago we published an account of a sewer failure which recently occurred in St. Louis, where a circular brick sewer, 5 ft. in diameter and 44 ft. below street level, collapsed and caused a cave-in extending clear to the surface of the street. While by good fortune no loss of life resulted, the property damage was large.

The most serious feature of all, and the feature of most interest to engineers, is the cause to which the collapse is assigned. The sewer was built in 1878, the bricks being laid in ordinary lime mortar, without cement. The mortar has been gradually disintegrating, and weakened the arch until collapse finally occurred. Similar causes have without doubt operated to cause great deterioration in all old brick sewers laid in lime mortar. Nor need we limit the damage to this class of work. The erosive effect of the flowing sewage, and the disintegrating effects of both the liquid and the sewer gases upon cement mortar as well have caused great deterioration, without doubt, in a large portion of the sewers laid upon cement mortar, which are more than a score of years old.

A large proportion of existing sewerage systems, too, have suffered more or less damage from other causes, such as unequal settlement during street excavation and the discharge of improper materials into the sewers. Of equal importance with physical alterations of the sewers themselves in increasing depreciation is the changing character of the population and the consequent demands upon sewer systems. If cities and towns were planned in advance on an intelligent system, it might be possible for a competent engineer to design a sewerage system which would be reasonably certain of fulfilling at all points the needs of a city of 40 years hence, as well as that of to-day. But our cities and towns have not been and are not being planned in advance of their growth. Centers of population and of manufacturing industry change in unforeseen directions. Cities are compelled all the time not merely to extend their sewerage systems with the growth of population, but also to revise the layout. Sanitary commissions and state legislation have compelled the outlay of many millions of dollars on long intercepting sewers, the need of which was hardly thought of thirty years ago.

When we come to works for ultimate disposal of sewage, a still shorter term of life must be assumed, if we would be on the safe side. The changing demands of the public and of state legislation and the courts, have rendered many sewage-disposal plants obsolete only a few years after they were constructed. We are building more wisely in these matters without doubt than did our predecessors a quarter of a century ago, but it is absurd to suppose that we have reached finality or to expect that the works now being constructed for sewage disposal may not be supplanted by something quite different within not more than 25 years.

The general public knows little of these matters but the engineer knows them or should know them, and should lend the strength of his opinion and influence, to the end that money borrowed for sewerage construction should be repaid in a short term of years.

Unit Price, Lump Sum and Percentage Work*

By H. C. Hill†

THE subject of this paper, Unit Price and Lump Sum and Percentage Work, readily divides itself into a consideration of Percentage vs. Contract Work and Unit Price vs. Lump Sum Contracts. None of these methods is perfect and while under certain conditions one may be better than another this paper will attempt to prove that in a great majority of cases contract work on a unit price basis is the correct method.

Percentage work is nothing more than day labor, as far as the cost of manual work is concerned, and differs in a total cost in that there is at the start an organization with a certain knowledge of how the work should be laid out and executed and a man or firm whose reputation for not doing work at an excessive cost is at stake.

Contract work has everything that percentage work has and something in addition, namely, an incentive, which constantly spurs every man, to a more or less degree, depending upon his nature, to do the work set before him in the most economical manner and with the least expenditure of energy. Some will say that this is too true and leads in a few cases to poor work. If this is so it is not the fault of the method but the fault of those doing the work, more particularly those having supervision, for it is possible and it has been done, to eliminate entirely those contractors who desire only to make as large a profit as possible irrespective of the class of work done.

An attempt has been made to instill "incentive" into percentage work by establishing a price on each unit of work and paying a bonus on a sliding scale if the work is done at a less cost than first agreed upon. This is a very delusive point and those familiar with the variable factor in cost data will readily see the futility of this. Furthermore it will not take much of a mathematician to figure that it is the percentage that gives the contractor his profit and not the bonus, unless the agreed price is considerably higher than the actual cost should be. It being true then that percentage work tends to increase the cost of the work there remains the question of under what method of payment shall contract work be done.

In comparing the advantages and disadvantages of lump sum and unit price contracts it is possible to consider them under two heads namely, the engineering feature and the moral aspect.

So much has been written and said on the former that nearly all of you are familiar with that phase of the question, so under this head only that point which has the greatest bearing will be considered; namely, the relative cost of the two methods. Let us then consider the engineering feature first and the moral aspect second as the latter is the one which needs more attention at the present time.

The point upon which the advocates of the lump sum method lay the greatest stress is that the cost of the work is reduced by having the engineering charges a minimum and those of this opinion are wont to tell how much cheaper work is done, basing their comparison on an average cost, as in highway construction the average cost per mile, instead of basing their comparison upon the actual amount of material moved or used. The truth or falsity of this statement is not subject to specific proof, for it is impossible to have the same piece of work done using both methods, but is subject to proof in a general way. However, a very close approximation might be obtained if desired by procuring bids for the same piece of work on each method, then after the work was completed comparing the average of all the lump sum proposals with the average total of all the unit price proposals, using however, as a basis for the latter, the actual unit quantities as shown by a final estimate, not the bidding schedule quantities. This is, perhaps, more theoretical than practical, but what in the writer's mind is a satisfactory proof that under lump sum contracts the work costs more is the following: No reliable experienced contractor will bid as low on a lump sum proposal as he will if the work is to be let on a unit price proposal. This is a definite statement but one which a majority of contractors will agree to, and for this reason contract work in any form contains certain factors, the exact nature of which it is impossible to determine definitely until after they are encountered, and every contract, except it be a percentage contract, must necessarily be more or less of a gamble. Therefore, no contractor overlooks this factor and you can rest assured the larger the risk the higher the bid. This element of risk is less on a unit price contract than on a lump sum for under the former should a certain class of work increase over the estimate the contractor gets a corresponding increase in pay and should less work be done he gets a corresponding decrease in pay. Under the lump sum method such changes have no effect upon the amount of money received by the contractor for doing the work.

In some cases under lump sum bids estimates for the various quantities are prepared but the general practice is for the bidder to ascertain for himself, either by his own engineer or by guess based upon general knowledge. Even in cases where careful estimates are prepared the final quantities are not the same as those upon which the bid was made out, therefore as far as payment is concerned under this method estimates are of no value. The fact, however, that there is a variance between the preliminary and final estimates is not the fault of the engineer, for it is impossible to determine accurately the exact quantities until the work is completed.

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* Paper read at the Tenth Annual Convention of The American Road Builders' Association, Philadelphia, Dec. 9-12, 1913.

† Engineer, Lane Construction Corporation, Meriden, Conn.

Theory of the Unit Price Method

The theory of the unit price method is a very simple and just one and expressed in a few words conveys this idea: the contractor is to be paid for just what work he does and to do what work be gets paid for. Nothing could be more equitable than this. However, like everything else, it has its imperfection, but not of a very serious nature. Its weakness lies not in itself, but in the hands of inexperienced men, incapable through ignorance of properly preparing unit quantities. This weakness causes what is known as unbalanced bidding and consists of bidding high on items, the estimates of quantities of which in a contractor's judgment is lower than will be used, or vice versa, and so regulating his bid on these items that he will lower his total bid on one hand and at the same time increase the aggregate amount he will receive for doing the work. This results some times in putting an engineer in an embarrassing position and has therefore caused some to condemn this method. Before taking this stand they should ask themselves if an unbalanced bid is any worse than an unbalanced bidding schedule prepared by engineers and if what criticism of unit price method there is, is not primarily due to those who make the estimates and not to the contractors. If engineers were as careful not to leave any loop-holes in preparing estimates for contractors to bid on as they are in making out specifications for them to do the work by unbalanced bidding would become almost an unknown quantity.

Another advantage of having work done by unit prices is that it enables changes to be made while the work is in progress with the least possible chance of any dispute and as a rule at a less cost than by lump sum method. Oftentimes such changes are to the disadvantage of the contractor but the majority of them realize that the changes are necessary for the proper execution of the work and so much more satisfactory to them are unit prices that they prefer to do the work by this method and willingly submit to additions or deductions as may be found necessary while the work is in progress. While of course under the lump sum method changes are possible, so much is involved that only as a last resort is any change made. This is unfortunate for I venture to say that no work was ever undertaken but what during its construction it was not possible to make some alteration that would not only improve the work but also in many cases save hundreds of dollars, even more than what the total engineering expense would amount to by having the work done on a unit price basis.

I have never been able to see but one object in lump sum contracts and that is, that some one is looking to catch a sucker and in most cases one is caught. However, this monetary advantage, for that is what it is, is only temporary, for sooner or later the fortunate one becomes the unfortunate.

Great as are the advantages of the unit price contracts viewed from the engineering standpoint, much greater are they when looked at from the moral standpoint, which cannot but have a beneficial effect upon the class of work done. There is no contractor earning a living by his work but whose principal object is to make money. The word principal is used to differentiate. His first object should be to do as good work as is intended by the specifications. Careful examination of the successful contractors and those who remain so year after year will show that good work is their first object, while as a rule it is not so of those who fail. Therefore it is the duty of those engineers in charge of work to assist in every way possible to have this thought uppermost in the contractor's mind. At first this might seem to indicate a weakness on the part of contractors but after careful consideration nobody should look at it in this light and for the reason: it is the nature of many people not to do the task set before them in as careful, thorough and complete manner as should be done. In this respect contractors, and more particularly their employees, are not unlike others; therefore, any method of payment that will remove the temptation not to do good work or make it an object to do work in a careful, thorough and complete manner will not only insure the doing of all work but also in a better manner. It needs only a superficial examination of a lump sum contract to see that not only is the incentive to do faithful work absent but there is also a premium for not doing it.

Contracting today is a business representing investments of millions of dollars, in which men of honesty, ability and training predominate, whose desires are to make a fair profit on their investment and to do good work, so that whenever work is to be done near where previously they had worked their return will be welcomed by the people of that community.

Engineering today is a profession which is fast receiving from the public that credit which it should have received so many years ago, and likewise consists of capable and honest men, desiring to give their employers the best there is in them. No better means of proving these statements exists than by means of the business in which the most of us are engaged, namely highway construction. The engineer is no more responsible to the public than is the contractor, for payment for the services of both comes from the same source. Therefore it should be the duty of engineers and contractors to work together to this end, and only by a unit price contract rather than a lump sum can the first step this direction be taken, for by the former, payment is made for just so much work as is done and no more and at the same time an incentive is always at hand to do faithful work, while under the latter, payment is not equitable nor is there the incentive to do faithful work.

Conserving macadam surfaces, the maintenance of which motor traffic was making prohibitive, is being effected in Allegheny County, Pennsylvania, by using them as the base for new brick or asphaltic-concrete roads. Mr. J. S. Gillespie, county road commissioner, in addressing the American Road Congress at Detroit, stated that for brick roads the macadam is first scarified and formed to a true cross-section, concrete curbs are built, the sand cushion is placed and the brick are laid, after which the surface is grouted with a mixture of equal parts of sand and cement. In the other class of construction, bituminous concrete is laid directly upon the scarified and levelled surface, of course, and both finished surfaces are rolled. The method is said to be economical and satisfactory.

Methods of Securing Terra Cotta to Steelwork in Modern Building

By S. H. Penlington, A. R. I. B. A.

TERRA cotta is being used today in such large quantities in buildings of all kinds, from the private house to the skyscraper (which latter is commonly sheathed with this material), that a short article descriptive of the methods of fixing it in position will doubtless be of interest. First of all, there are practical limits to the sizes of the pieces used, whilst the shape also must be considered. A good working limit of size is about 2 ft. 6 ins. x 2 ft. x 1 ft., but smaller pieces are preferable, as the material shrinks about one-half inch to the foot in burning, also large pieces would show the warping and twisting more than small pieces. It is good practice to keep all the pieces as regular in shape as possible—that is to say, to have no awkward projections sticking out. This will give better results in manufacture and there will be fewer breakages in transit and handling on the job. To minimise the possibility of accident this should be done, as the re-making of these pieces in case of mishap may lead to costly delay. The manufacturer usually makes duplicate pieces, particularly of rich or delicate parts, to ensure satisfaction to his customers. Architectural terra cotta weighs on the average 70 lbs. per cubic foot. The average thickness of the material in the web is 1¼ inches and the crushing weight about 7,000 lbs. per square inch.

From the above information it will be seen that it is unnecessary to fill terra cotta blocks to add to their strength. This is done to form a bed for the work that is above, or to keep the water from attacking any steel that may be supporting the blocks. It is easier to fix terra cotta in the building than it is to manufacture it, therefore the design of the individual parts is of the first importance, the parts being designed as simply as possible and in relation to the steelwork by which they are carried. The fixing of terra cotta in a large job is done by the structural engineer, who accommodates his steel beams to the jointing of the terra cotta, putting in all necessary angles, brackets, hooks and clips.

Column Construction

Manufacturers assert that a column shaft can be made 8 ft. long in one piece with a diameter of 15 ins. Larger columns can be made up of drums not exceeding 2 ft. in diameter and about 18 inches high, fluted, as shown in sketch 1a. Column drums 3 ft. in diameter can be made if the horizontal joint is concealed by the interposition of a rusticated drum with a plain drum, but the only feasible method of jointing classical column shafts over 2 ft. in diameter is as shown in sketch 1b. Here it will be seen that the column has vertical joints. To the left of the centre line—these are shown in the flutes and to the right in the fillets—either method can be used. This method of jointing allows the fixers to "true up" the columns more accurately than could be done with large pieces, owing to shrinkage in the material. The right and wrong way of jointing small attached columns is shown in the second sketch. These drums are made 18 inches high. It will be seen at once that a piece of terra cotta as at A would crack in burning. Where the col-

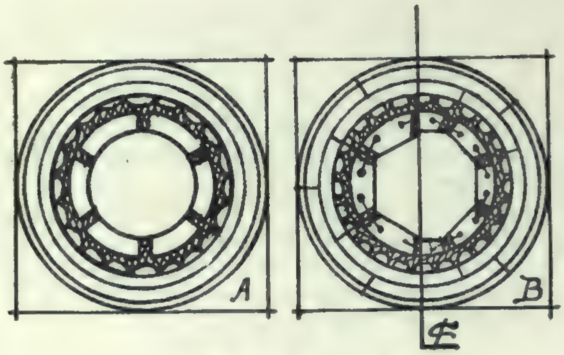


Fig. 1 (A and B).

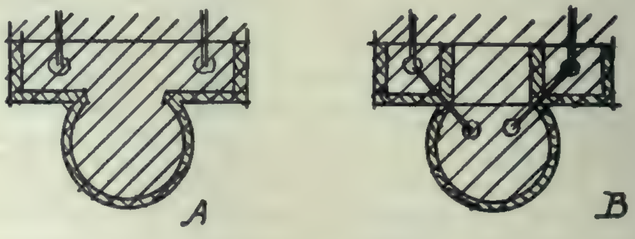


Fig. 2 (A and B).

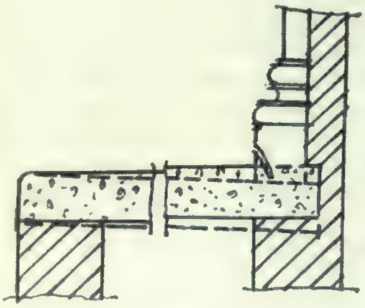


Fig. 3.

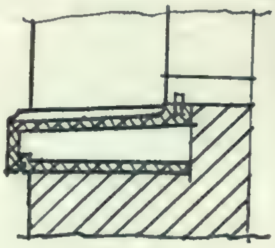


Fig. 4.

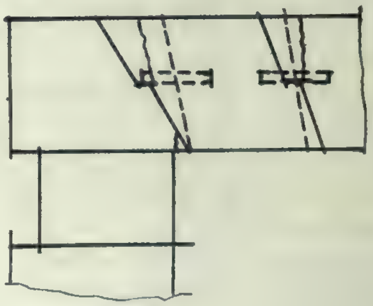


Fig. 5.

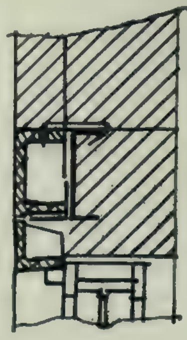


Fig. 6.

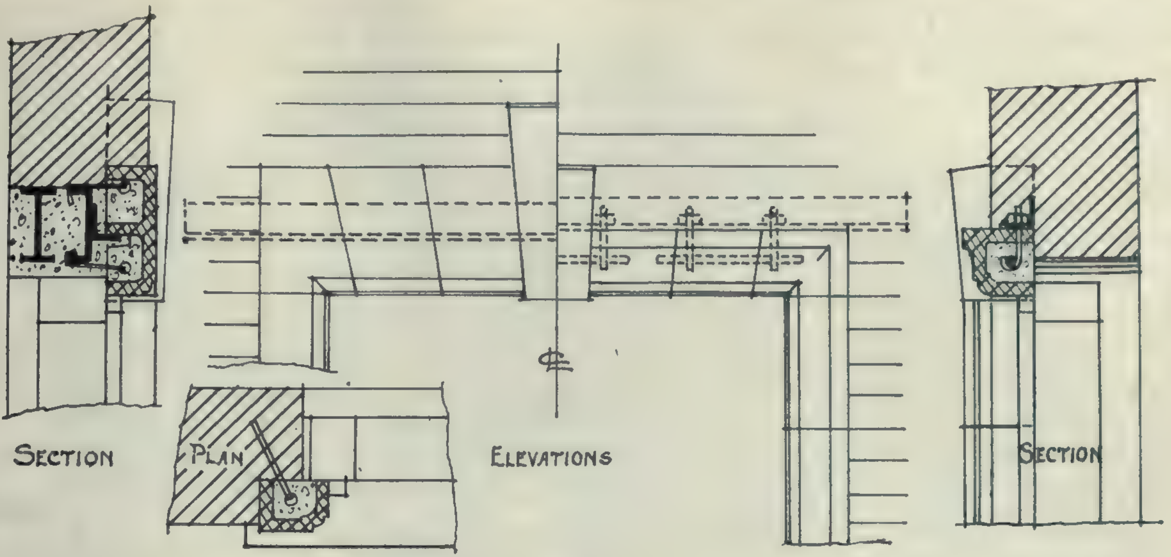


Fig. 7.

umn meets the wall face, the right method is to put a joint as at B. Sketch 3 shows the base of a pilaster resting on the sidewalk. The settlement of the building, which is bound to take place, will flash off the outer edge of the base, therefore the pilaster and the sidewalk should rest independently on the finished wall. The best method of making a window sill is shown in sketch 4. It drops away immediately from the wooden sill about 1 in. This allows the roll to cover the joint of the sill.

Sketch 5 shows a flat window head with joggle joints and the resultant cracks in the material owing to the acute angle formed in the blocks. The correct method of jointing and dowelling is shown by dotted lines.

In sketch 6 is shown a broken window head. This is caused by the shelf angle supporting the terra cotta having too much projection. The correct method is illustrated in sketch 7 and allows the terra cotta only a 2-in. bearing on the shelf angle. To the left of the centre line is another method of hanging a window head. Here the hook bolts and nuts allow a very fine adjustment of the blocks. Most suspended terra cotta is done in this way as will be seen by the following sketches. Although in this case the strength of the construction is unnecessary it is shown as an example of good work. A simple terra cotta head is frequently fixed by putting at 1½-inch pipe through the blocks. If the holes in the blocks are not in alignment they can be made so by means of a star drill. The

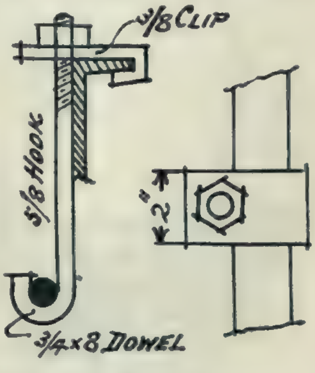


Fig. 8.

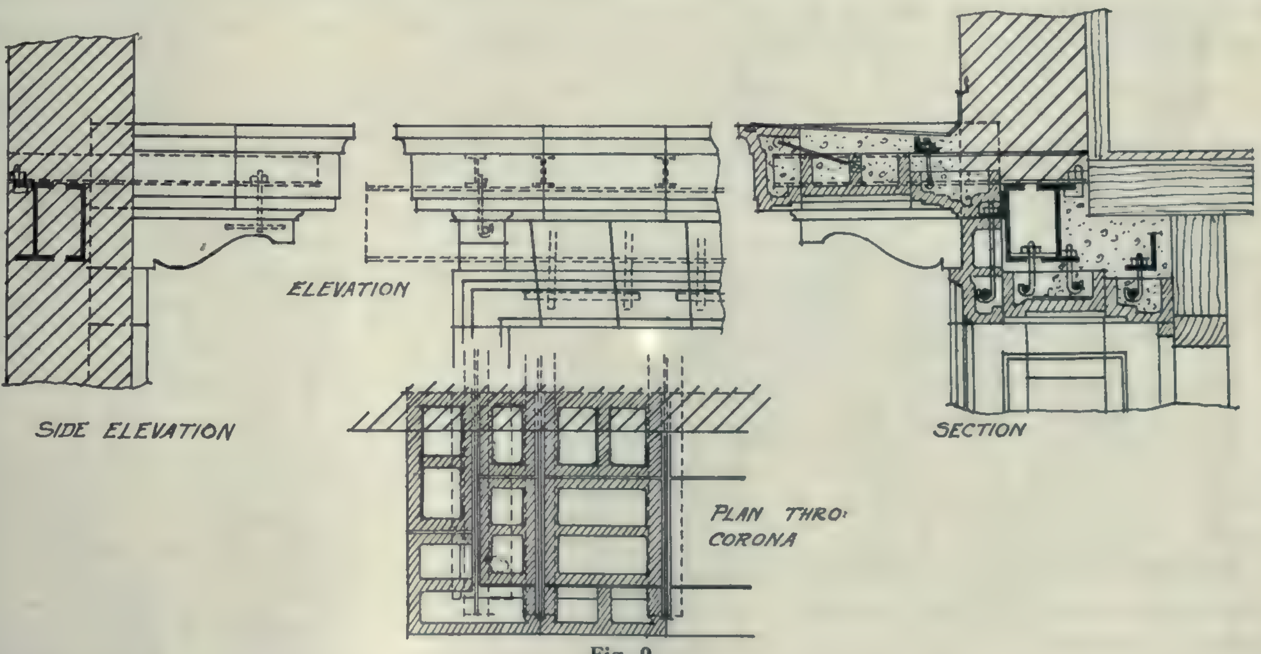


Fig. 9.

usual clip and hanger employed in suspended terra cotta is indicated in sketch 8.

Sketch 9 shows plan elevations and section of a projecting door head. The system of carrying terra cotta is capable of adjustment to suit the door head of much greater projection. The steel lookouts are so arranged as to come between the joints of the terra cotta and are tailed down to the wall beams by hook bolts. The advantage of the hook bolt here is that it may be fixed anywhere along the wall beam without drilling. The soffit panels will be lipped on to the lookouts, the bed mould hooked up to an angle across the lookouts. The members of the cornice will be hooked back to the steel as shown, and the blocks will be filled with concrete wherever possible in order to protect the steel from moisture.

Sketch 10 gives the details of construction of a cornice projecting about 2 ft. 9 ins. Here steel brackets are provided at each column or pier which carry an I-beam or channel along the front of the cornice. To this the cymatium and corona of the cornice are fixed. The modillions and panels between the piers are hooked up to angles spanning from the front beams to the wall beams. In cases where a lot of filling in the cornice will be too heavy, tees are used instead of angles to support a 2-in. tile floor on which the concrete gutter is laid, the gutter being lined with copper and let into a wraggle joint as shown. The proper method of fixing balusters and coping is shown in sketch 11. Each baluster is bolted through the channel, which latter is carried across the baluster. A small filler of terra cotta is placed between each baluster to protect the steel from the weather. The coping is then laid with a bed of stiff mortar over each baluster. The whole can be secured in line by secret clamps let into a groove provided at the joints of the coping and afterwards covered with cement.

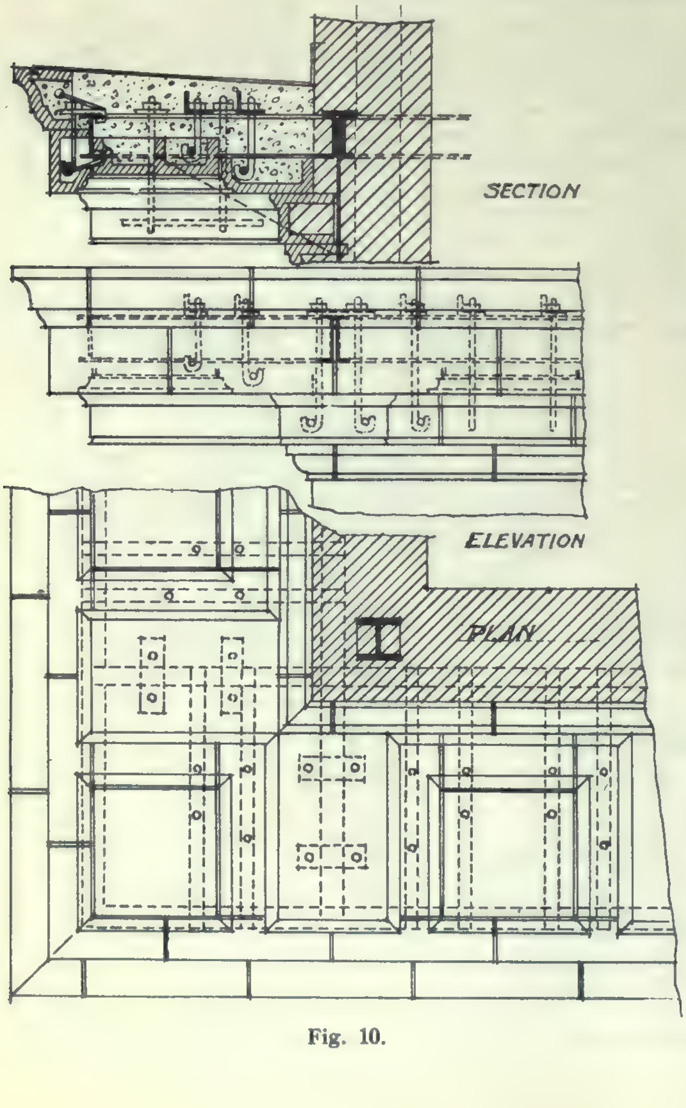


Fig. 10.

Sketch 12 shows a chimney cornice. The cornice is dropped down to allow the roll to cover the joint, the coping being carried over the flue lining in order to prevent the water from getting between it and the brickwork. A groove is made in the terra cotta and a secret clamp is let in with cement at each joint. It is very necessary to protect from water all steelwork in connection with terra cotta. To this end it is advisable particularly in suspended work to fill all the blocks with a weak mixture of fine concrete after the blocks have been fixed in position. The accumulation and subsequent freezing of the water would shatter the blocks, and the cost of replacing one piece would probably equal that of the entire concrete filling. There are places, however, where concrete could not be used; therefore, other precautions equally effective must be taken.

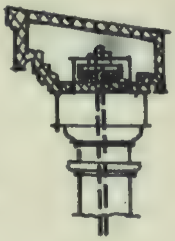


Fig. 11.

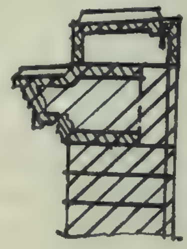


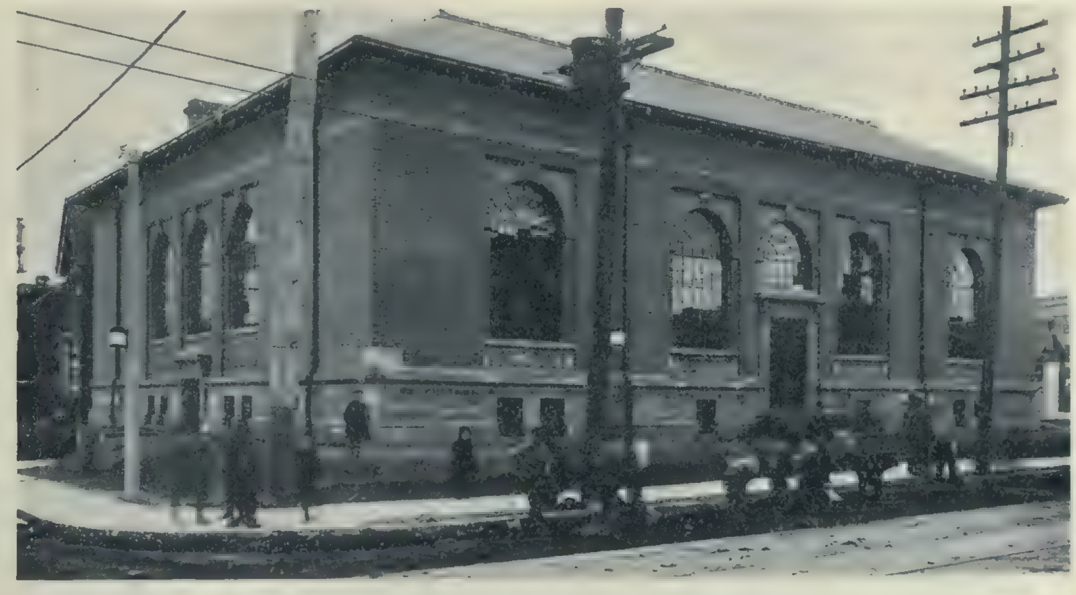
Fig. 12

In cornices of great projection the usual method is to lay a tile and concrete floor on top of the steelwork. This is done with small tees and 2-in. book tiles. The concrete is then laid above this to the necessary fall and covered with copper.

In the jointing and fixing of terra cotta a good deal of latitude should be allowed the manufacturer, who has had much more experience than any architect can possibly have acquired. The material as used to-day is quite modern, therefore any system of jointing that would prove superior to that at present in use should be adopted.

Blasting pole-holes in frozen ground has proved more economical than hand digging to the Marion Light & Heating Company, of Marion, Ind. Whenever the ground is frozen to a greater depth than 2 ft. this company digs the hole, exact size, about 15 in. deep only. With a long-handled auger a hole large enough to admit a stick of dynamite is bored about 30 in. deep. It has been found that three-quarters of a stick of dynamite will excavate a uniform hole to the desired depth of 5 ft. An average saving of 15 to 20 per cent. over the cost of manual digging has justified this method.

Nearly ninety million more face brick were produced in the United States during 1912 than in 1911, according to the annual report of the U. S. Geological Survey. The total production was 814,000,000, as against 725,000,000 for 1911. The value of the production, bulking face and "fancy or ornamental brick" was $10,707,978, which included $1,027,314 in enamelled brick, as against a value of $9,864,757 in 1911. The latter figure included $1,038,865 in enamelled brick.



The Dovercourt Branch of the Toronto Public Library.
Architects, Messrs. Chapman & McGiffin.

New Branch Library at Toronto

THE Dovercourt Branch of the Toronto Public Library is a handsome, and at the same time substantial, structure, the site on which it stands being admirably chosen for the purpose. The building, which is U-shaped, is of two storeys. The outside dimensions are 89 ft. 6 in. by 71 ft. The centre of the U is occupied by a court, 32 ft. by 30 ft., which will form a little garden and terrace, upon which the library reading room opens and through which the readers will pass to the garden and grounds at the west side of the building.

The exterior of the building is a simple treatment of a dark, red-flashed brick with buff terra cotta trimmings, depending upon the color and texture of the wall surfaces, together with the proportion of window openings, for its architectural effect. The terra cotta has been carefully chosen to harmonize well with the brickwork in color, and being a clay product it harmonizes well in character. Another advantage that is obtained in the use of terra cotta is the relatively small cost of repeating certain decorated members that are characteristic of the style in which the building is designed. This of course is an important factor when taken in relation to the use of terra cotta in structures of the kind. The style is a modern adaptation of the brick architecture used in Northern Italy at the time of the Italian Renaissance, and is exceedingly well suited to this kind of building. The lower floor, having its entrance on the east side at the level of the sidewalk, is used for the accommodation of the heating plant, the Librarian's rest-room, also kitchen and lavatory, the public lavatories, and a large room 68 ft. x 25 ft. This room has a high ceiling and is well lighted with windows on three sides. A touch of homeliness is added to the apartment by the introduction of a large fireplace at one end, a feature which will also assist in the ventilation. The object of this room is for the holding of meetings and lectures, as well as for special library work.

The main floor, which is entered from the north, about five feet above the grade level, is occupied by the entrance hall, the delivery and receiving room, and two large reading rooms, each 68 ft. x 25 ft., with a ceiling height of 22 ft. The three latter rooms, divided only by large arches and practically covering the whole area of the building, give the visitor the impression of one large open area, which is so arranged that it can be flooded with sunlight at any hour of the day. This is owing to the large windows and lofty ceilings.

The walls of the reading room are lined with bookcases, 7 ft. high, above which the stucco plaster is colored a soft, bluish green tone, up to the cornice and decorated ceiling which is vaulted and of a light ivory tone. At the end of each reading room there are large fireplaces which enlarge the comfort of the visitor and will also assist in the ventilation. The kitchen, attendance rooms, etc., are all fitted in modern style and everything that adds to convenience and comfort has been provided.

The buildings are fireproof, with the exception of the roof, and the window frames and sashes being of metal there will be a minimum amount of insurance, depreciation and consequent maintenance. The roof is covered with a non-fading green slate, the gutters, rain conductors, etc., being of copper.

The walls, which are exposed, are lined with No. 2 pressed brick, obtained from the Milton Pressed Brick Company. The falling brick was supplied by Mr. A. H. Wagstaffe, Toronto.

The library is steam heated throughout and the main floor is lighted by indirect lighting fixtures. The furniture and woodwork are of oak-stained fumed oak tone and the main floor is covered with cork matting, with the exception of the entrance halls and stairs, which are of marble.

Messrs. Chapman & McGiffin, 95 King Street East, Toronto, are the architects. The contractors for the work were:—masonry work and terra cotta, H. N. Dancy & Sons; carpenter work, Thos. Paynter & Son;

roofing, A. Matthews, Limited; plastering, Hoidge & Sons; painting, A. E. Phillips; plumbing and heating, Fred Armstrong & Company; electric wiring, Bennett & Wright; metal sashes, Henry Hope & Sons; furniture, G. E. Lindsay; cork carpeting, The T. Eaton Company.

World's Record on C.N.R. Tunnel

SHORTLY after seven o'clock on the morning of Wednesday, December 10, the two headings of the Mount Royal Tunnel of the Canadian Northern Railway were joined, and in the afternoon of the same day the first train was run through from the west portal to the Dorchester Street shaft.

The headings met at about 600 feet below the highest point of Mount Royal, the distance through the tunnel being 3 1-10 miles long. It is just over fifteen months since work was commenced, and the meeting of the headings constitutes a second record in work of this character. On June 5 last, a new record for hard rock tunnelling on the continent was made, 810 feet of heading being bored in the thirty-one working days previous. In the matter of actual number of feet of rock drilled and the amount excavated, the tunnel through Mount Royal is a world's record, while on the continent of North America a tunnel of this length has never before been built through a mountain in fifteen months. The heading is fifty per cent. larger than those of the Swiss tunnels, where the actual progress has consequently been greater.

The heading is about 8 x 12 feet and this has to be enlarged to the size of 22 x 30 feet. About one and a-half miles of this has been done, but no lining has yet been placed. The tunnel will be lined and will have a dividing wall through the centres, so that the trains running in each direction will be separated.

The work was carried on in four different directions, from the west portal towards Montreal, from a shaft at Maplewood Avenue in both directions, and from a shaft on Dorchester Street, Montreal, towards the mountain. On April 5 last, the heading starting from the west portal and that running westward from the Maplewood Avenue shaft were joined, and on December 10 the two remaining headings were completed.

The average progress was 420 feet per month in each of the two principal headings, while the gross progress since the date of the commence of the first heading was 1,100 feet per month. In No. 3 heading, running from the back of the mountain towards the city, for the six months prior to the installation of the muck handling drill carriage, the average progress was 350 feet per month, and for the six months after the installation of the carriage, 485 feet per month. Prior to the use of the drill carriage, the rock consisted of crystalline Trenton limestone, with many dykes of camptonite and nepheline syenite. Afterwards the rock was almost entirely essexite. For the past two months the progress in both headings was about 110 feet each week.

The chief engineer of the Canadian Northern Montreal Tunnel and Terminal Company is Mr. S. P. Brown; Mr. H. T. Fisher is tunnel engineer. On the eastern division the assistant engineer is Mr. J. L. Busfield, and on the western Mr. R. S. Bassett. The general superintendent of the eastern division is Mr. Edward Duffy and on the western Mr. R. Byers.

Medals have been struck to commemorate the joining of the headings.

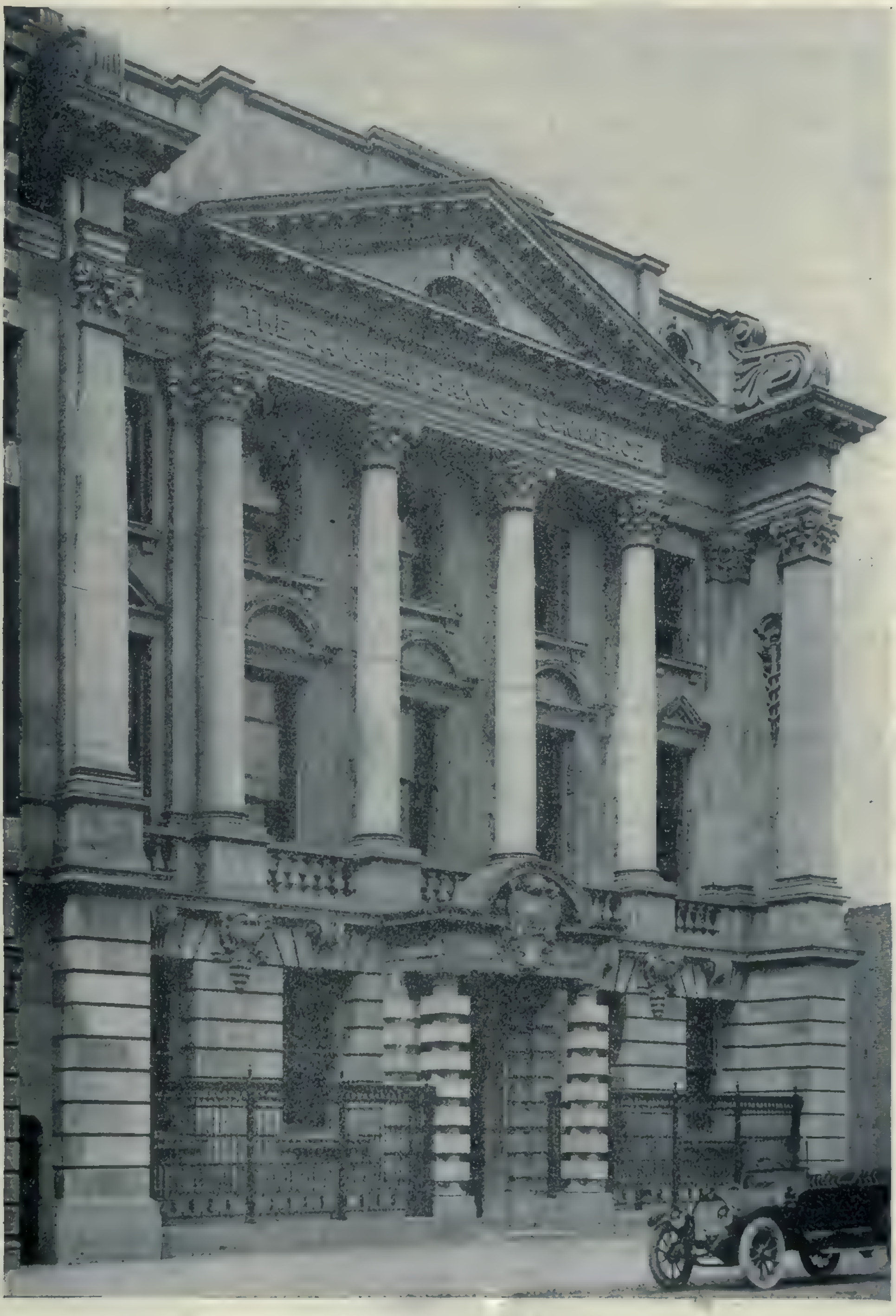
New Building of the Canadian Bank of Commerce at Regina

THE up-to-date bank building recently erected for the Canadian Bank of Commerce is a notable addition to the architectural achievements of Regina. The cut which appears on the opposite page is a striking illustration of the beauty of the building, passing reference to which was made in our issue of November 5. The massive and striking facade which now adorns Scarth Street, Regina, for many years performed the same function for the chief office of the Canadian Bank of Commerce in Winnipeg. Originally erected in 1900, being a portion of a building which in size and equipment far exceeded the need of that period, it was worthy of a prominent position in any city. The design has the quality and distinctiveness which do not go out of date, and in this respect at least the bank buildings of the Canadian Bank of Commerce may be said to be unique. The dimensions of the old Winnipeg building being no longer capable of serving the needs of that city's expanding business, much anxious consideration and careful planning were expended on the problem of preserving this structure before the happy solution was reached of re-erecting it further west where conditions of earlier development would ensure it a further term of usefulness. The new building at Regina, which is four-storeys high, is 52 ft. wide and 73 ft. deep. The banking hall is lofty and designed with more regard to dignity and simplicity than to elaboration. In size it is 46 ft. x 50 ft. The public portions are floored with marble and the counters and other finishings have been executed in mahogany with exceedingly attractive effect. In the manager's room, as elsewhere, the hardwood floor, the panelled walls and other finishings, are designed in a manner suited to the requirements of a capital city but at the same time with a careful regard to cost. The building is equipped with the ordinary steel-lined vault and in addition a treasure vault of exceptional strength has been erected. Another interesting feature of the banking hall is the quiet grey stencilled fretwork decoration on the walls, which gives a handsome touch to the general decorative effect of the interior.

The first floor of the building is arranged as rented offices and the two upper floors have staff apartments substantially furnished. Adequate provision has been made for the accommodation of the staff, bedrooms for twenty officers having been planned, as well as a sitting room 27 ft. long x 18 ft. wide. The staff has been amply provided with modern toilet accommodation, and the plumbing and sanitation have been looked after in the same manner. While the construction is steel frame internally, the solid brick enclosing walls carry their natural share of the weight. The footings are of wide spreading reinforced concrete design to distribute the weight equally over the soft subsoil.

The old Winnipeg front was originally designed by Messrs. Darling & Pearson, of Toronto, but the remainder of the structure is the work of Mr. V. D. Horsburgh, F.R.I.B.A., Toronto. The supervising architect was Mr. T. Chapman Clemesha, Regina, and the builders were Messrs. Lyall, Mitchell Company, Winnipeg.

Any sort of salt will produce a first class glaze on tile and sewer pipe, if the clay is in condition to take a glaze.



Regina Branch Canadian Bank of Commerce

Architects: Messrs. Darling & Pearson, Toronto.
Mr. V. D. Horsburg, F.R.I.B.A, Toronto.
Supervising Architect, Mr. T. Chapman Clemesha, Regina.

Contractors: Messrs. Lyall, Mitchell Company, Limited, Winnipeg.

Glossary of Terms Used in Road Construction

(Continued from issue of Nov. 26)

Patrol Maintenance.—A term used to designate the constant supervision and consequent repair of a road.

Pave.—To make a hard, level surface with bricks, stones or wood blocks (from pavio, to beat or ram).

Pavement.—The footway, and also used to describe the finished paving of a carriageway.

Paving.—The pavement so made, or the act of doing the work.

Paving Setts.—Stone blocks used for paving carriageways.

Pavior.—One who lays the pavement. The word is also used to designate the slab or brick used for paving.

Pebble.—A small stone worn and rounded by the action of water.

Pedestrian.—A foot passenger.

Pedometer.—A pocket instrument for measuring the distance walked.

Pegmatite.—Coming under the trade name of "Granite," as settled by the Engineering Standards Committee.

Penetration Method.—Sometimes used to describe the method of constructing roads under the more familiar term of "grouting." Also used to describe a method of testing bituminous materials suitable for road making.

Penetrometer.—A machine for determining the penetration of pitches and bituminous materials.

Percussion Test.—A test of pitch, etc., by dropping a small mankey from a fixed height.

Perfecta.—The trade name of an artificial flag or stone.

Permeable.—That which admits the passage of water or other fluids.

Pervious.—Capable of being penetrated by water or other fluids.

Petroleum Pitch.—The residuum from the distillation of petroleum oil.

Petrology.—The scientific study of rocks and stones.

Phenols.—A name given to a group of oils similar to carbolic acid.

Phillipin.—The trade name of a method of carriageway construction.

Phillite.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Pick.—Or Pickaxe. An instrument used for breaking up the surface of roads by hand labour.

Pinning.—Sometimes used to denote the act of making a road foundation with stones set by hand.

Pitch.—The residue of tar, etc., after heating to drive off all volatile matters.

Pitch.—Sometimes used to denote the crossfall or contour of a carriageway.

Pitch Grouting (Single).—A single layer of "macadam" grouted with a bituminous mixture.

Pitch Grouting (Double).—Two separate coats or layers of "macadam," each separately grouted with a bituminous mixture.

Pitching.—Sometimes used to designate the act of paving.

Pitchmac.—The trade name of a bituminous binder or filler.

Pit Flints.—Flints taken from pits.

Pix Process.—The trade name of a method of carriageway construction.

Plascom.—The trade name of a bituminous binder or filler.

Plastic.—Capable of being moulded.

Plate-shaped.—A term sometimes applied to flaky stones.

Pliable.—Easily bent without rupture.

Poachy.—Wet and soft; generally applied to a wet soil or a marsh.

Pockets.—Receptacles; the term is sometimes applied to depressions in the surface of a carriageway.

Pocky.—Pitted, or showing pustules on the surface.

Polygon.—A plane figure of more than four sides.

Pond.—A collection of water smaller than a lake.

Pool.—A collection of water smaller than a pond.

Porous.—Having pores or minute openings or interstices. The quality of easily passing air or water through the substance.

Porphyrite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Porphyry.—The trade name given to a group of road-making rocks, as settled by the Engineering Standards Committee.

Potholes.—Cup-like depressions in the surface of a carriageway.

Poudrette.—Very fine powdered material.

Powder Vehicle.—Or power van. A vehicle driven by mechanical means.

Pressure Distributor.—A term applied to a machine which distributes tar, etc., on a road, to distinguish it from a "gravity distributor."

Prise.—To force or open by means of a lever.

Producer Tar.—Obtained from certain types of gas-producer plant which yield tar; not very suitable for roadwork.

Profile.—An outline or contour of the face of anything.

Promenade.—"A walk for pleasure or show." Really a place for walking, but now generally applied to broad roads or avenues, and to walks or drives at seaside resorts.

Protection Coating.—A term sometimes used to designate the top-dressing or coat of the surface of the carriageway.

Puddle.—A small collection of dirty water; clay or earth tempered with water and thoroughly worked up into a plastic condition.

Pug-mill.—A machine for mixing clay, mortar, etc.

Pulvercide.—The trade name of a dust palliative.

Pulverise.—To reduce to a fine powder by beating or grinding.

Pun.—To ram or beat earth, etc., into place.

Punner.—A rammer or beater.

Put-log.—A short piece of timber used to carry the floor of a scaffold.

Pyktonon.—The trade name of a bituminous compound.

Quagmire.—Wet, boggy land that shakes under foot.

Quarry.—A small square paving flag or brick; a place or site whence stone is obtained.

Quarters.—A term sometimes applied to the haunches or sides of a carriageway.

Quartzite.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Quenast.—The name of a Belgian granite quarry.

Quicksand.—A mass of running sand freely mixed with water.

Quickset.—A live fence or hedge.

Quoin.—An external solid angle of a building.

Rabbet.—To cut a sloping edge so as to form a lapping joint.

Rack.—To fill in the joints between stone setts or wood blocks with fine, sharp gravel or chippings before grouting.

Raddle.—A short lath or strip of wood.

Rag Bolt.—An iron pin with barbs on its shank to keep it in place.

Rammer.—A tool for heating or ramming; also called a "punner" or "beater."

Ramp.—A slope.

Random Tooling.—Hewing the face of a stone with a broad chisel, which produces a series of waves at right angles.

Random Work.—Pavement or stones set of unequal size, and not in coursed work.

Ravel.—Or Ravelling. To become untwisted or disentangled. Applied to road work, it is used to indicate the loosening or fretting up of the surface of a carriageway by the traffic.

Ravine.—A deep, narrow gorge or valley.

Raze.—To pull down level with the ground.

Recoating.—Also called "resurfacing" and "resheeting." To redress the whole surface of a carriageway with metal or a bituminous mixture. When applied to macadam roads it is called "remetalling."

Refuge.—A paved oasis or islet on the centre of a street or carriageway for the protection of pedestrians; generally raised slightly above the level of the surface of the carriageway.

Render.—To plaster directly on a surface with mortar or cement.

Residuum.—Or residuals. That which is left after any process of separation or purification.

Resilience.—"The act of leaping or springing back." Rubber has a very marked resilience.

Resilient.—The property of resilience. Bituminous compounds for road construction should, if possible, have this property.

Resin.—An inflammable substance found in most vegetables, and largely in some trees. It is insoluble in water.

Retaining Wall.—A wall constructed to support the sides of roads in embankment, or the earth or soil when in cutting.

Revetment.—A retaining or breast wall.

Rhonven.—The trade name of a system of road construction.

Rhyolite.—Coming under the trade name of "Porphyry," as settled by the Engineering Standards Committee.

Riddle.—A sieve, generally constructed with wire meshes.

Ridge.—The line along which the ground slopes or descends on each side.

Rigid.—The reverse of flexible.

Rime.—Hoar-frost.

Rimer.—A boring tool.

Riparian.—Pertaining to the bank of a river. "Riparian rights" are the legal rights of landowners and others on the banks and stream of a river.

River Stone.—A term given to stones that come from the bed or the banks of a river.

Road.—"A public carriageway, with or without footpaths, but including ditches and fences"; "an open way or public passage"; "ground appropriated for travel, forming a line of communication between one city, town, or place and another for foot passengers, vehicles, cattle, etc." As a generic term the word includes highway, street, lane, etc.

Roadamant.—The trade name of a method of carriageway construction

Road-bed.—The bed or foundation on which the superstructure of the carriageway rests.

Road Crust.—The upper surface or wearing crust of a carriageway.

Road-edge.—A term sometimes employed to denote the verge or grass edge of a carriageway.

Road Metal.—See "Metal."

Roadoleum.—The trade name of a bituminous binder.

Road-stone.—A stone suitable for the construction or maintenance of a carriageway. See also "Metal."

Roadway.—See "Carriageway."

Robeson's Process.—The trade name of a system of road construction.

Rock Asphalte.—A term sometimes used to designate real asphalt.

Rock Drill.—A tool for piercing rock.

Rocky.—A term applied to a wood pavement when the blocks get loose.

Rocmac.—The trade name of a siliceous binder.

Rolley.—A truck or wagon used in mines. Hence "trolley."

Rolling.—The consolidation of a carriageway surface by rolling.

Rood.—Or rod, pole, or perch; 5½ lineal yards. A square rood equals 1,210 square yards, or a quarter of an acre.

Ropey.—Or "ropiness." The state or quality of being ropey; able to draw out without breaking, viscous and glutinous.

Rosin.—Or rubblestone. Stones of irregular shapes and dimensions.

Rubble Wall.—A wall built with rubble stones and without courses.

Runnel.—A rivulet or small brook. The word is sometimes used to designate the channel at the side of a carriageway.

Runners.—The planks placed vertically in the sides of a trench.

Running.—The act of grouting or pouring in any composition between joints, or to fill interstices.

Rut.—A term generally applied to the long depressions caused by the track of a wheel.

Rutting.—Sometimes used to designate the act of repairing ruts.

Saddle-back.—A name given to a hill when somewhat saddle-shaped, to differentiate it from a "hog's-back" hill.

Sand.—Fine particles of stone, particularly siliceous stone, in a loose state, but not reduced to powder or dust. There are pit sand, river sand, sea sand, desert sand, drift sand, etc.

Sand-blast.—A test sometimes applied to stones to test their wearing capacity.

Sandsize.—The trade name of a dust palliative.

Sandstone.—Coming under the trade name of "grit," as settled by the Engineering Standards Committee.

Saponaceous.—Of a soapy character.

Saturate.—To cause to be completely soaked or impregnated.

Scabble.—To dress a stone with a broad chisel or "boaster" after it has been "broached."

Scale.—To separate and come away in thin layers.

Scantling.—The dimensions of pieces of timber and stones in length, breadth, and thickness. Also used as a name for small pieces of timber cut into various sizes.

Scar.—A bare and broken place in the side of a hill or mountain.

Scarf.—To join two pieces of timber by a special joint.

Scarifier.—A machine for lifting or breaking up the surface of a carriageway.

Scarify.—To break up the surface of a carriageway. Also called "chequer," "lift," "hack," etc.

Scarp.—To cut away to a slope.

Scavenge.—To cleanse from filth by brushing or scraping.

Schist.—The trade name of a group of road-making rocks, as settled by the Engineering Standards Committee.

Score.—To mark with furrows or incisions.

Scores.—Faint ruts or marks on the surface of a carriageway.

Scoria.—Similar to slag or dross.

Scoring.—See "Chequering," "Scarifying," etc.

Scrap.—A term used to designate the throwing anything aside as useless. To throw on a useless rubbish heap.

Screed.—A strip of wood or metal used as a gauge.

Screen.—A riddle or sieve, generally placed nearly upright for the purpose of screening or sifting stones, gravel, etc.

Screenings.—The refuse matter left after screening.

Seal.—To close up or imprison. Used to describe the dressing of the surface of a carriageway with some bituminous mixture or compound.

Seal Coat.—A term used to designate the final or top coat or layer of a carriageway.

Sediment.—The matter which settles at the bottom of water or other liquid.

Seep.—"To flow through pores, to ooze gently."

Seepage.—A term now applied to designate the water that has oozed through the carriageway formation on to the surface.

Seepy.—The quality of oozing slowly.

Segregate.—To separate or set apart.

Segregation.—The quality or act of separating.

Sequacious.—Ductile, pliant, manageable.

Serrated.—Notched on the edge like a saw.

Sett.—The generic term for a stone block used for paving the surface of a carriageway, sometimes spelt "set."

Shale.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Shaping.—A term used to designate the trimming and preparing of any portion of carriageway construction.

Shard.—A broken piece of pottery. Sometimes called "potshard."

Sheaf.—A loose covering.

Shearing.—Coming apart, breaking by a cross thrust.

Shell.—The outer covering or casing.

Shingle.—Round, water-worn, and loose gravel and pebles.

Shoot.—Or Shute. See "Chute."

Shore.—A prop or strut.

Short.—A term applied to bituminous mixtures which have become brittle or dead.

Shoulder.—A term sometimes used to designate a haunch or side of a carriageway.

Side-cut.—A road or path breaking out of another road.

Side-edges.—Sometimes used to designate the verges of a carriageway.

Side-slope.—See "Camber."

Sidewalk.—See "Footpath."

Siding.—A term sometimes used to designate the act of keeping the sides or verges of a carriageway in repair. Used as a noun; it is sometimes employed to describe the material removed from the sides of the carriageway.

Sift.—To pass a material through a sieve or screen.

Siftings.—The residue after sifting.

Sign-post.—A direction-post at the side of a road.

Silica.—Silex or flint.

Silicious.—Sandy.

Silt.—A deposit of mud, or fine soil, or earthy sediment.

Sinuous.—Winding, or crooked, with many curves.

Skep.—A basket, sometimes called a "skip."

Skid-pan.—A shoe or drag used on wheels when descending hills.

Skin.—Sometimes applied to the top surface of a carriageway.

Slack.—Very small coal.

Slag.—The scoria from a smelting furnace; a vitreous mineral matter.

Slake.—To mix or cause to combine with water, so that a true chemical combination shall take place.

Slat.—A long, narrow piece of wood, called also a "batten."

Slate.—Coming under the trade name of "Schist," as settled by the Engineering Standards Committee.

Sledge-hammer.—The largest hand hammer used in a forge.

Slime.—Viscous mud of an adhesive character.

Slippery.—Not affording a firm foothold.

Slop-cart.—A scavenging cart.

Slopping.—A term sometimes used instead of "scavenging" to designate the act of cleansing the mud off the surface of a carriageway.

Slosh.—See "Slush."

Slough.—A place of deep mud or mire.

Sludge.—Mud, mire, dirt. Generally, however, applied to the deposit in sewage tanks after treatment or decomposition.

Sluice.—A vent for water or other liquid.

Slurry.—Very liquid mud.

Slush.—Soft mud or slush. Generally applied to half-melted snow on a road.

Soak.—To wet or drench thoroughly.

Soakway.—A term used to designate a gully pit not connected with any drain, and through which the water soaks into the surrounding soil.

Sod.—The surface of a ground filled with grass roots. A synonym for "turf."

Sodden.—Thoroughly soaked.

Softwood.—The antithesis of hardwood.

Soggy.—Thoroughly soaked. A synonym for "sodden."

(To be concluded)

Erratum.—Molten Asphalte: The definition "a thin term for 'mastic asphalte'" should read "another term for 'mastic asphalte.'"

It is learned in unofficial sources that the government contemplates an outlay of $500,000 in the near future on the harbor at Oshawa. An appropriation of $200,000 has already been made for this work. Over fifty acres of land has been purchased and in addition to the harbor basin of 100 feet square it has been determined to make a ship-turning basin of 600 feet square. The preliminary work has already been begun.

The docks at Nottaway, Hudson Bay, in connection with the Northern Railway line, will be built out a distance of a thousand feet where a forty-foot channel begins, and the basins between the piers will be dredged to the same depth as outside, the total docking room being estimated at five thousand feet.

An Ode to Everlasting Clay*

When Noah stood on Ararat,
His foot slipped on the slimy fat
Of Mother Earth, and I recall
Some words of his, although not all—
"The Rotten Stuff!"

He little thought that Clay met Clay,
As he went sliding on his way.
I was beneath his dignity
And got his old malignity—
"I Was the Stuff!"

Nor reck'd he that I bore the tree,
Whose branch proclaimed my victory,
O'er boundless waters of the flood:
Invited his assorted brood
"To Get the Stuff!"

His children's children, all, my cup
Have snatched and drained with bottom up;
And as they drank, unheeding they,
That maybe I was their own clay,
"Their Very Stuff."

How then, can man, whose end is mud,
Sit up and boast of his blue blood,
When all the ichor in his veins
Is but the liquor, with my brains,
"To Make the Stuff?"

I know not why, who bends the bow,
Or he who plodding wields the hoe,
Or he who rules with kingly power,
Should fill with brags his every hour—
"That He's the Stuff."

Why, I'm the feet of every man
Who treads on me, and e'en the ban
Of all his other mortal parts,
Save what eludes death's fatal darts,
"Immortal Stuff!"

Aye, there's the rub! I shape the bowl
With man's remains, but of his soul
I know naught, save it gives me mould;
I hold but dross, while it is gold
"And Priceless Stuff."

One thing I know, while round is round,
In this my own terrestrial bound,
That all of earth's own facts are mine,
And all the myriad suns will shine,
"Shine On My Stuff."

*A poem read at the Denver Session of the National Terra Cotta Society by W. E. Dennison, of San Francisco, Vice-President.

LETTERS

The Proposed Municipal Organization

Regina, Dec. 10, 1913.

Editor Contract Record:

With reference to your request for my views on the Canadian Society of Civil Engineers, I wish to state that by the correspondence I have had with municipal engineers in many parts of Canada, it would appear that a forward movement is desired.

It will be known to you that a few of us are advocating the formation of a Canadian Institution of Municipal Engineers and it is hoped to see it consummated early next year.

It must, however, be definitely borne in mind that the municipal engineers' institution will not in any way act in conflict with, but entirely supplementary to, the Canadian Society of Civil Engineers. We recognize that there must be a powerful parent organization embracing all sections of engineers and that it must be supported loyally by the engineering profession. It would be folly on our part to introduce any disintegrating forces into the Society. What we desire is to encourage it with all our power to act aggressively and decisively on our behalf.

Why then form another organization?

The Canadian Society of Civil Engineers if developed to its full power, and even now, cannot give adequate attention to municipal engineering problems. This is found to be the case in the United States, in Great Britain, in France and in Germany. Municipal engineering embraces a variety of problems and there are enough difficulties and questions arising in this single profession to keep any society fully occupied for all time. Why then hamper the Canadian Society of Civil Engineers? No other parent society has ever been able to afford time for the discussion of the multitude of municipal engineering matters without entrenching on the allied professions. Moreover, the formation of other societies has not been found to detract from the value of the parent association but rather to afford an incentive to more progress by encouraging a feeling of esprit de corps among engineers and promoting a healthy and generous competition in organization.

Canada is an immense country—a continent in size—and it must have a central government, which must be located somewhere. But throughout the British Empire whilst there are central governments there are also provincial or state governments having certain powers.

If this is necessary in civil government, can the principle be applied to engineering society organization? British Columbia engineers claim that it can. If it is possible in British Columbia, why not in other provinces?

Whilst this would mean some measure of decentralization, it would be feasible to provide for a general cohesion also.

Yours truly,

R. O. Wynne-Roberts.

Sewerage Board in the Limelight at Vancouver

Vancouver, December 5th, 1913.

Editor Contract Record:

We have read with interest your editorial and letters from contractors in regard to tendering for contracts for public works and also in regard to the treatment handed out to contractors by public boards.

A most glaring example is the manner in which the recently-appointed Board, i.e., the Burrard Peninsula Joint Sewerage Board, which was appointed to take charge of the work in connection with the sewerage for Greater Vancouver, has treated the contractors.

This Board recently called for tenders in connection with which each contractor had to fill in and return intact a priced schedule of quantities, completed in detail, and for alternative plans (comprising about two hundred items) put up cash or certified cheques, agree to put up bonds and also to forfeit his cash (not by way of penalty, but as damages) if he refused to sign the contract when called upon.

This Board turns down all tenders and to the local press gives the information that it will do the work by day labor which will be of more benefit to the unemployed of Vancouver this winter. How this will benefit the unemployed better than the work being done by contract, except by waste of public money, we fail to see. The board evidently regretted this statement, as on the following day it gave out to the press the reason "that the bids were not satisfactory."

The latter reason given is hard to comprehend, seeing that for weeks it had been stated publicly that the work was estimated to cost from $200,000 to $400,000 (a very large margin) and the tenders ran from $240,000 upwards at very close bidding. The Engineer to the Board stated that he had made no recommendation regarding the various tenders and so we fail to see how the conclusion was reached that the bids were not satisfactory.

That six firms of contractors should have their time wasted in giving out detailed prices at a cost of probably $2,000, putting up approximately $90,000 and arranging for bonds (which on the face of it looked like an attempt to get proper estimates for this work) is a gross injustice to any body of men and one of which none but a public board would be guilty.

We were not the lowest bidders and so we are not writing from any personal soreness but simply from the injustice of the whole business.

Yours truly,

"One of the Contractors."

Personal Mention

Mr. W. A. Clement, engineer of South Vancouver, has tendered his resignation to the Municipal Council.

Mr. E. A. James, C.E., Toronto, has been elected to membership in the American Society of Civil Engineers.

Mr. Patrick Welch, railway contractor, of the firm of Foley, Welch & Stewart, has been seriously ill in the Seattle Hospital recently.

Mr. W. E. Skinner, of Winnipeg, has been retained as consulting engineer for the town of Kenora, to report upon the cost of producing power at the municipality's hydro-electric plant.

Mr. John Taylor, superintendent and director, Ottawa Contractors, Limited, Ottawa, Ont., has been transferred from the class of Associate to full membership in the American Society of Civil Engineers.

Mr. John McPherson, formerly superintendent of the stores and works department in Edmonton, has been appointed secretary of the Edmonton Builders' Exchange, succeeding Mr. A. E. Wetmore, resigned. Mr. McPherson has had a wide experience in the building and allied trades, is a quantity surveyor by profession, and has acted as estimating and cost engineer on some large contracts.

Mr. A. D. Swan, formerly assistant engineer to the Montreal Harbour Commissioners, has been retained by the Federal Government to advise on the selection of a site on the eastern coast of New Brunswick, suitable for the establishment of a new port. Mr. Swan has already inspected two or three sites, and will report his findings to the government.

Mr. J. W. Porter, of the staff of the National Transcontinental Railway, has been appointed chief engineer of the Hudson Bay Railway, succeeding Mr. J. B. Armstrong, who has resigned to enter the contracting field.

Mr. W. A. Clement, Engineer to the Municipality of South Vancouver, whose resignation is announced.

Messrs. Palmer, Hornbostle & Jones, architects, of New York, have opened an office in New Birks Building, Montreal, with Mr. H. E. Prindle in charge. The firm have designed some of the largest buildings in the United States.

Messrs. George C. Diehl, of Buffalo, and Harold Parker, of Worcester, Mass., having completed their work as members of the advisory engineering board of New York State, Department of Highways, have resigned. The third member, Mr. W. de H. Washington, will continue in the service until he completes his report on his recent investigation of road conditions in Europe.

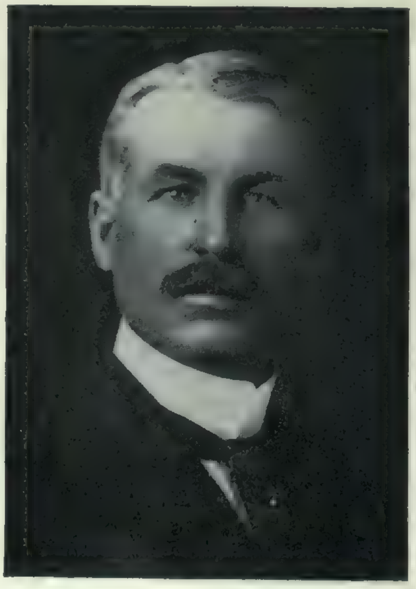
Mr. Philip H. Moore, lately mining engineer and manager of the mining, crushing and cement machinery department of the Canadian Allis-Chalmers Company, Limited, has accepted the position of general manager of the Rock and Power Machinery, Limited. The company's head office is in Toronto, with branches in Halifax, Montreal, Sudbury, Cobalt, Winnipeg, Calgary, and Vancouver.

Mr. Angus Smith has been appointed city engineer of Prince Albert to succeed Mr. Mason H. Baker who has resigned. Mr. Smith has had extended experience in the municipal field. He is a graduate of the School of Practical Science and was city engineer of Stratford, Ont., from 1900 to 1906. In the latter year he went to Regina as city engineer but resigned in March, 1910, in favor of the same office at Victoria.

Mr. H. C. Cooke, of the Geological Survey of Canada, has completed researches on Vancouver Island, and as a result of his investigations, which have been carried on since May of this year, he is able to state authoritatively that there are great prospects of copper development in certain sections, notably in the vicinity of Sooke and Ladysmith. It is anticipated that his report, while pregnant with valuable geological data, will attach particular significance to the copper-bearing regions of the Island he has come in contact with.

Mr. W. A. Clement, engineer to the municipality of South Vancouver, has tendered his resignation on the ground that the duties attached to the position are too light. The newspapers contend that this is the first instance on record where a public official has taken such a step for such a reason. Mr. Clement graduated from the University of Toronto in 1889 and was on the staff of the Toronto City Engineering Department from 1890 until 1905, when he resigned to become City Engineer of Vancouver, a post which he held for six years.

Mr. Georges Janin, who (as announced in our last issue) has made application to retire from his office of Chief Engineer to the city of Montreal.



Mr. Angus Smith, Prince Albert's new City Engineer, succeeding Mr. Mason H. Baker.

Mr. George T. Clark for the last five years City Engineer of Saskatoon, who has resigned.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For the eleven months of this year the city of Three Rivers, P.Q., issued building permits valued at $587,800, as compared with $372,800 in 1912.

The Dominion Railway Board has granted the application of the city of Toronto for the widening by twenty feet on the east side of the proposed Yonge Street subway.

The first stretch of concrete road built in Ontario under the provincial aid system has been completed in Welland County, which has spent $58,924 on its roads system this year.

For the month of November the Montreal building permits totalled $4,293,745, an increase of $1,309,759. For the eleven months the value was $25,723,867, a gain of $15,957,281.

Hon. Adam Beck recently addressed a meeting of the Kent county council on the question of good roads as a result of which an extensive scheme for road improvement is to be prepared.

The Ontario Railway and Municipal Board has rejected the city's plan for a diagonal road through the Upper Canada College property, approving the plan submitted bu the Suidan Realty Company, Limited.

The contract for the Ashdale Avenue section of the Midway district sewerage system, Toronto, has been awarded to Mr. J. A. Jarrow for $62,500 and for the Lamb Avenue district to the Engineer of Works for $90,000.

For the first half of the year the net earnings of the Steel Company of Canada were $1,108,233, the largest for any six months' period. The figures do not take into consideration any earnings yet to be received from the new mill recently completed.

The two schemes for underground subways submitted to the Montreal Controllers by the Tramways Company and the Canadian Autobus Company have been referred to the city engineers for report. When this is received a board of experts will be appointed.

The work of preparing the site for the new union station, Toronto, is proceeding without delay, and it is expected that the whole site for the station will be cleared before the new year. The city will pass a by-law closing parts of Simcoe, Lorne, Esplanade and Harbor streets, also the York street diversion south of Front.

Plans have been drawn up by the government for the improvement of the Prince Edward Island ferry so as to insure an all-year-round service. A nine hundred thousand dollar contract for the Island terminal and one for five hundred thousand for the New Brunswick terminal have been let, together with a-half million dollar ferry boat.

H. T. Hoag, Industrial Commissioner of the St. John Board of Trade, has been in communication with a firm in another province relative to the establishment of a brick and tile plant in the city next spring. Local capitalists announce that a site has been secured, and a new brick plant will be established by them near the city next year.

The Elbram Stone Company, of Sherbrooke, P.Q., are constructing a large building for the manufacture of their products. The stone is designed to take the place of marble in public and commercial buildings, and it is claimed that the stone can be made in large slabs and in various shapes at a very much lower cost than natural marble.

When the work is in full swing upwards of four hundred men will be employed by the contractors, Messrs. Roger Miller & Sons, of Toronto, on the building of the car ferry terminals at Carleton Head, Prince Edward Island. The plant has arrived at Shediac and it is expected the contract will take upwards of three years to complete.

Mr. J. W. Weller, chief engineer of the new Welland Canal, has been requested to consider the building of concrete retaining walls in the erection of the canal through Welland. It is pointed out that unless such walls are placed along each side the town would be divided almost through the centre as the new channel is over 400 feet wide.

The Canada Cement Company recently commenced operations in one of the largest individual mills in the world situated in the east end of Montreal. Its capacity is 12,000 barrels a day bringing the total capacity of the company's plant up to about 12,000,000 barrels a year. It is computed that several million dollars have been expended on the new mill.

A report is to be prepared by the City Architect's Department regarding the cost of the new roof of steel construction for Toronto city hall. The roof of the building has been leaking seriously for some time past during heavy rain and it has been thought feasible to add another storey to the building at the present time. There is some opposition to this latter proposal, however, and the matter will be left for the incoming council to deal with.

The Ottawa city council has passed the new eight-million dollar by-law for the Gatineau Lakes water scheme. This was rendered necessary by the quashing of a former by-law which prescribed for an expenditure of five millions only. The first reading has been given in the Quebec Legislature of a bill allowing the city of Ottawa to take a water supply from any lakes in the county of Carleton, Big Whitefish lake excepted.

Mr. E. H. Bennett, of Chicago, has been engaged by the Ottawa and Hull city planning commission to prepare a comprehensive plan for the enlargement and beautification of the capital. The plan which will take two or three years to prepare will include park schemes, arrangement of governmental and civic buildings, driveways, industrial sites, etc. Mr. E. T. Cousins, engineer of the Toronto Harbor Commission will be associated with Mr. Bennett in the work.

Work on the overhead bridge at Sunnyside, Toronto, is going ahead rapidly, the last of the girders, weighing over twenty-four tons, having been put in position. The bridge is 153 feet long and 60 feet wide, nine feet of which on each side is reserved for sidewalks. The central large girder weighs sixty-three tons and the two outer ones forty-five tons each. The street car tracks will be laid on each side of the central girders leaving a roadway on each side of twelve feet.

In opposition to the plans for underground subways submitted to the Montreal Council by the Montreal Tramways Company, the Canadian Autobus Company have made an offer to construct seven to eight miles of subways at an estimated cost of $20,000,000. It is suggested that the city should build the tunnels and the company supply the plant, tracks, cars, equipment, etc. A thirty years' franchise is asked for, the city to have the right to acquire the whole undertaking at the end of that term at its actual value plus 10 per cent.

Engineers of the Toronto Works Department are working on an alternative plan for the North Toronto sewerage scheme which is expected to bring to the city a saving of something like two million dollars. The original scheme was for six million dollars and it is understood the saving will be effected by means of a different form of construction in the great water courses than was originally planned. Expensive brick work may be replaced by concrete and the scheme for manufacturing fertilizer from the disposal works discharge may be cut down.

Under a Bill introduced into the Quebec Legislature by the Hon. L. A. Taschereau, Minister of Public Works, municipalities will be called upon to contribute to the maintenance of the steel and iron bridges which the Provincial Government are constructing in place of wooden bridges. In instances where bridges are situated between two municipalities practically nothing is done in the way of upkeep, and the Bill proposes to authorize the Public Utilities Commission to decide what municipalities shall provide for the maintenance of such bridges, and what amount.

The Toronto Exhibition Board has decided to erect a number of new buildings, the most important of which is a new live-stock arena at an estimated cost of $200,000, with a seating capacity of 8,000 to 10,000 persons. The arena of the building is to be 208 feet by 370 feet, with an inside floor space of 125 feet by 225 feet. A similar expenditure is to be incurred on a new machinery hall and the remainder of the total of $600,000 is to be distributed among several other buildings and extensions. A by-law to provide the necessary funds has been adopted by the City Council.

The value of the building permits issued in St. John, N.B., for eleven months ending November 30th was $2,367,710, compared with $547,700 for the corresponding period in 1912. Despite activity in building during the past year, the housing problem is still being discussed, and is to be taken up by the Board of Trade at a general meeting to be called for that purpose. Last winter a number of immigrants who desired to remain in St. John went farther west because they were unable to get satisfactory housing accommodation and the Board of Trade is seeking to discover the best method of making the number of new, comfortable and sanitary houses at moderate rental meet the increasing demand.

The plans for this year's work on St. Alban's Cathedral, Toronto, have been brought to a successful conclusion with the completion of the entire substructure up to a height of thirteen feet above ground, including the floor of reinforced concrete. This first stage of construction was not only the most expensive but also the most difficult, involving as it did the making of foundations for all the massive piers of the nave and the extensive substructure of reinforced concrete measuring twenty feet square, for the massive columns to support the great weight of the central tower. At the present rate of construction and provided no financial difficulties occur, next year should see the edifice well on the way to completion so far as the masonry work is concerned.

Members of the Montreal Builders' Exchange have again had under consideration the Quebec Lien Law, under which supply firms can only secure a lien on the materials supplied by giving notice of responsibility for the purchase to the proprietor. The notices are sent, as a rule, in cases where the contractor is in a small way of business, and it was suggested that notices be sent out regardless of the standing of the contracting firms. A resolution has been passed requesting that all branches of the building trade, especially the supply houses, consider the advisability of uniting in an agreement to send out notifications to all proprietors with every purchase of materials amounting to $200 or over. This sum was merely a suggestion, and may be altered. The matter is to be taken up later on a report from the parties concerned.

Construction work in connection with the Halifax terminal railways is making rapid progress. The first unit of the new terminals has been awarded to Messrs. Foley Bros., Welch, Stewart & Fauquier, the contract price being $5,208,743. The work contracted for consists of a concrete landing stage 2,000 feet long, a pier 1,200 feet long and a basin 300 feet wide—built outside extensive filling in from the landing. This will give a lineal distance for shipping purposes of 6,200 feet. The work is to be solid throughout and the piers and landing stage are to be unique in their solidity and massiveness. The pier foundations will consist of 2,500 cellular blocks, 20 ft. by 30 ft., each weighing sixty tons. The cellular apertures will be filled with cement and rubble, allowance being made for uniting the blocks. Steel rails also serve to strengthen the reinforcement. The floor will be of concrete, while the front of the interior space will be faced with granite blocks from low water to the floor of the pier and landing stage.

WESTERN CANADA

Mr. James Wilson, of Chicago, and his associates will build theatres in Edmonton and Calgary and probably Moose Jaw and Saskatoon next year.

Announcement is made that a Roman Catholic high school building will be erected in Edmonton next year, and work on the first unit will begin in March.

The Ladies' Orange Association of Edmonton has plans for a girls' school to be established in this city, and Mrs. William Hoig, is head of the committee in charge.

The Edmonton city council has approved the plans for the construction of a concrete arch over Saskatchewan Avenue on Eight Street to provide a direct thoroughfare to the main entrance of the Parliament buildings.

According to returns furnished this journal by Mr. H. L. Fitzsimmons, Building Inspector, Prince Albert's building expenditure for the year up to the end of November is $1,374,390, compared with $2,034,900 for 1912.

Mr. E. F. Hutchings, of Winnipeg, owner of the Great West Saddlery, who is also interested in several other companies, contemplates erecting a six-storey brick building on Jasper Avenue, Edmonton, work to begin early in 1914.

Edmonton library board has decided to call for plans and specifications for a library building, costing $200,000, to be erected on the College Avenue site next year. The new structure will be modern, a feature being a semi-open room overlooking the river.

Mr. J. J. Rutledge, managing director of the Northern Mercantile Company at Grouard, Alta., the most northerly organized town on the continent, reports that the store building destroyed by fire the night of November 22 will be rebuilt. The structure was erected last July.

Mr. W. D. Cromarty, architect, has completed plans for a three-storey brick and stone apartment house to be erected in Edmonton for Daniel Sewell. The dimensions are 52 ft. by 113 ft. There will be 19 suites of from three to five rooms, each suite having a private bath and lavatory.

Mr. M. Valquet of the Dominion Public Works Department recently arrived at Victoria, B.C., to undertake preliminary observations looking to the improvement of the local harbors. He expects to remain on the coast for some time as his work embraces not only Victoria but also all the other harbors on Vancouver Island as well as on the mainland.

Mr. John Kirby, of Indianapolis, international president of the United Brotherhood of Carpenters and Joiners, who was in Edmonton recently reports that while building operations throughout the west are quiet, there is every reason to believe that 1914 will be a record year.

Messrs. Olson and Johnson, of Edmonton and Missoula, Mont., have been awarded a contract to construct a city market building at Edmonton at a cost of $85,000, exclusive of electrical work, plumbing and heating. There were nine bidders, one being the city's construction department.

The Bitulithic & Contracting Company, Winnipeg, have been awarded the contract for the laying of seven and a-half miles of country road near Assiniboia, Man. The price to be paid is $2.80 and $2.90 a yard, the larger amount being for the more distant portion of the road for which hauling will be more expensive.

Archbishop Legal, of St. Albert, head of the Edmonton diocese, announces that a cathedral, costing about $300,000, and a residence will be erected here next year. It is also proposed to build thirteen churches in various parts of the city. The Norwood Presbyterian congregation are to erect a $30,000 church in North Edmonton.

Two hundred and fifty thousand dollars will be expended by Mr. George Brown upon a playhouse adjoining the Empire hotel, Edmonton, of which he is a director. The structure will be of steel and reinforced concrete and modern in every detail. Messrs. Anderson, architects, are preparing plans for a building 100 x 150 feet, with a seating capacity of 2,800. The new theatre, which is being financed with eastern capital, is to be started early in March.

Plans and specifications for a new market building, including a three-storey administration section in front, for the city of Edmonton, Alta., have been completed and the contract awarded to Ohlson & Johnson. The building will cost about $50,000. Work on the foundations will commence at once and it is expected that the structure will be completed early next summer. The exterior will be constructed of red pressed brick trimmed with stone.

Mr. McIvor, building inspector, has announced to the commissioners of Edmonton that building permits, involving a total expenditure of $10,243,567, were issued during the year ended October 31, 1913, as compared with $13,217,212 for the same period in 1912. The decrease is attributed to stringency in the money market. However, several large buildings are projected, and it is expected that the total of permits issued during 1913 will be fully $11,500,000.

Arrangements have been made between the city of Edmonton and Mr. J. D. McArthur, builder and president of the Edmonton, Dunvegan and British Columbia Railway, to extend the city's water to the railway yards off St. Albert Road by means of a ten-inch main pipe line which will be connected with the city's main to 115th Street and will extend to other thoroughfares, then westerly by a six-inch pipe to the shops of the railway.

For the month of November, 27 building permits covering a money value of $51,050, were issued in the city of Regina, as compared with permits of the value of $271,670 issued for the corresponding month in 1912. The total value of permits up to November 30th, 1913, was $3,989,435, against $5,837,634 for same period of the previous year. These figures are indicative of a rather unfavorable year in the building trade in Saskatchewan.

It is reported that difficulty has arisen over the selection of a suitable site for the new dry dock at Esquimault and the matter of selection has been left in the hands of Mr. Ulric Valequette, expert supervising engineer of the Public Works Department. The new docks will be 1,150 feet long so as to accommodate the largest ocen liners. Mr. A. F. Yarrow, head of the shipbuilding firm of Yarrow & Company on the Thamas, paid a visit to Esquimault recently and inspected the shipping possibilities of the place.

In Athabasca, Alta., 1913 promises to be a record year for building. The permits up to the present total $250,000, which includes two new hotels, each of three storeys, now in course of construction. They are of brick veneer, and will install their own electric lighting plants. Messrs. Revillon Freres have announced their intention of erecting a $40,000 store and warehouse building next spring, whilst the new four-roomed solid brick school will be completed in a few weeks. The town has practically completed the installation of its waterworks system, and a company is boring a new well for natural gas.

That the city of Saskatoon, Sask., is forging ahead at an unusual rate may be gathered from the statement circulated to the effect that the building programme for the coming year will probably mean the expenditure of about six million dollars. The principal structures to be erected are an interior terminal grain elevator estimated to cost $1,000,000; new post office, $400,000; new armoury, $300,000; university extensions, $500,000; dwelling houses, $500,000; other buildings, $400,000, and a reinforced concrete arch bridge to span the Saskatchewan river, cost $400,000, which promises to be the largest of its kind in the Dominion.

The Fort Garry hotel which was opened on December 10 at Winnipeg is said to be one of the world's finest hotels, embodying in its construction the most advanced scientific and architectural ideas. This latest hotel for the Grand Trunk Pacific Company is built of Canadian granite and buff lime stone in the style of the old French chateau of Normandy and Touraine. The hotel is fourteen storeys high, the central feature of the main floor being the circular tea room of Adam design unbroken by columns, lofty in height and finely lighted by broad windows and circular dome ceiling. The structure involved an outlay of a million and a-half dollars.

Winnipeg's first commercial artificial ice plant has been erected at Norwood, Man., and is now producing ice made from artesian well water at the rate of fifty tons a day, while its daily capacity can easily be increased to one hundred tons. The actual freezing process is accomplished in a series of receptacles five feet high, 22 inches wide and 11 inches thick. The shipping room has a capacity of several hundred tons, while the storage room adjoining is capable of storing one thousand tons. The plant has been built with Winnipeg capital and is being operated by the Consumers' Ice Company of Winnipeg.

Canadian Railroad Development

The Canadian Pacific Railway Company is to be asked to build a branch line between Cranbrook and the Kootenay Central railroad.

Mr. F. A. Knapp, of Prescott, Ont., promoter of the new Canadian Transcontinental Railway from Cape St. Charles in Labrador to Dean Inlet on the Pacific Coast, visited New York recently in connection with the financing of the undertaking. The company, it is stated, will be capitalized at one hundred million dollars, and arrangements are complete for incorporation at next session of parliament.

The contractors for the Hudson Bay Railway, acting for the government will, it is stated, build an over-land railway from the end of the present grade to Port Nelson, a distance of 160 miles. It will be along the line of the roads used in lumbering operations, the object being to facilitate the taking of supplies both for the railway itself and for the Harbor terminal works at Port Nelson.

A record for the continent in tunnel building has been achieved in the completion of the Canadian Northern tunnel which pierces Mount Royal at Montreal, and enables trains to run into the heart of the city. The average progress made since the headings were started last September has been 420 feet a month and the joining of the headings was celebrated on December 9 by the running of the first train through the tunnel.

The Pacific Great Eastern expects to complete its contracts within the schedule time limits, judging by the progress made in construction work during the last six months. The section between Point Atkinson and Newport promises to be one of the most costly pieces of construction on the entire line. It will involve an outlay of about $100,000 per mile. This will mean practically laying the road on a bed of solid rock.

A suit for $1,000,000 against the Grand Trunk Railway Company of Canada for alleged breach of contract in connection with the construction of a railway terminal at Toronto, has been filed in the United States district court by Westinghouse, Church, Kerr and Company, engineers and architects, of New York. The plaintiffs set forth that they lost $1,000,000 through the railroad's alleged breach of the contract with the New York company to erect the Toronto terminal at a cost of $9,000,000.

Association and Convention Notes

The Ottawa branch of the Canadian Society of Civil Engineers held its annual dinner and smoker recently under the presidency of Mr. G. A. Mountain, president of the branch. The gathering, which was numerous, embraced men of note in every branch of engineering in Canada.

An official call for the International Good Roads Congress, to be held at the Panama-Pacific Exposition in San Francisco, February 22-27, 1915, has been issued by the International Good Roads and Automobile Association and the National Good Roads Association, of which Arthur C. Jackson is president, Maude E. Jones, secretary, and Mrs. Edward L. Murfey, treasurer. The headquarters are at the Congress Hotel, Chicago.

The second annual convention of the British Columbia members of the Canadian Society of Civil Engineers was held at the Progress Club, Vancouver, December 12-13. On Friday, December 12, an illustrated address on the Coquitlam-Buntzen hydro-electric development of the Vancouver Power Company was given by Mr. G. R. G. Conway, Chief Engineer of the B. C. E. R. and Chairman of the Vancouver Branch of the Canadian Society of Civil Engineers. Various routine business was transacted on Saturday, December 13 This was followed by a number of interesting discussions covering the education and training of engineers, the professional status of the engineer in British Columbia, and the relation of the engineer to public affairs.

The sixty-first annual meeting of the American Society of Civil Engineers will be held Wednesday and Thursday, January 21 and 22, 1914, at the society house in New York City. Three special meetings will be held on the two days following the annual meeting. The topic for discussion will be "Road Construction and Maintenance." The first meeting at 10 a.m., January 23, will be devoted to a discussion of "Engineering Organizations for Highway Work." At 2 o'clock p.m. the second sub-topic will be discussed, "Factors Limiting the Selection of Materials and of Methods in Highway Construction." The third sub-division, "Equipment and Methods for Maintaining Bituminous Surfaces and Bituminous Pavements," will be discussed at 10 a.m., January 24.

Rust-Resisting Sheets

The question of securing increased durability from sheet metal products is highly important, and one that has caused the manufacturers of sheets to devote a vast amount of time and energy. The results, we are happy to say, have proven fruitful and most practical and important developments have been accomplished recently by the American Sheet and Tin Plate Company of Pittsburgh, Pa. The outcome is the placing on the market of their copper bearing steel sheets. After careful study on the part of metallurgists, chemists and practical rolling mill people, it has been demonstrated beyond question that manufactured steel when alloyed with a certain percentage of copper, possesses remarkable durability and will resist corrosion and the action of the elements to a much greater degree than ordinary steel without copper, or those products based on alleged "purity" of the materials. The working qualities of copper bearing steel are likewise important. This material is claimed to be softer and more ductile, and experience has proven it to be more satisfactorily worked when subjected to severe drawing or forming operations. It appears quite self-evident that these copper bearing steel sheets are destined to fill a long-felt want in the sheet metal trades, especially for the manufacture of roofing, siding, gutters, culverts, tanks, car roofs, and all exposed sheet metal work, where durability and resistance to the deteriorating influences of weather and soil are highly important factors. Being made in both black and galvanized steel, the word "Keystone" alone is used as a brand for black sheets, and "Apollo-Keystone" the brand for galvanized. Messrs. B. & S. H. Thompson & Co., Limited, of Montreal, Canadian representatives of the United States Products Company, will gladly supply any metal worker or distributor in Canada with explicit information regarding "Keystone" copper bearing steel, together with a booklet containing illustrations of tests which have been conducted. It is to the interest of the metal trade to secure complete information on this important subject, since the merits of this material are being widely recognized.

Terra-Cotta and Its Proper Use as a Decorative Medium

The author of the above article, which was published in our last issue (Brick and Clay Products Number) was Mr. Philip J. Turner, F.R.I.B.A., Lecturer in Building Construction and Materials in the Department of Architecture, McGill University, Montreal. The word "Architecture" was inadvertently rendered "Agriculture."

In the description of the Port Moody Sand & Gravel plant published in our issue of November 5 last it was omitted to state that the wood stave piping was supplied by the Pacific Coast Pipe Company, of Vancouver. The firm supplied some 3,500 feet of 16-inch wood pipe for the line from the pump to the gravel pit. Much of this was for a head of 400 feet. The pipe is laid under severe conditions in places, but so far it has shown every appearance of giving satisfaction.

Mr. Michael Sinott, a pioneer contractor of the Canadian West, died recently after a very short illness. Mr. Sinnott, who was born in Wexford, Ireland in 1823, came to Canada at the age of 24 years, and settled in Winnipeg in 1876, residing there for thirty-six years. He built the first block pavement in the city, on north Main street, in 1883.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brome, Que.
Ratepayers will be asked to vote on Dec. 15th on question of taking loan under the "Good Roads Act" for purpose of constructing 20 miles macadam roads in above twp. Brome Twp. Council. Mayor, M. E. Bullard.

Galt, Ont.
Railway Board has been petitioned to have the railways build a subway at the East River Road entrance to city. Town Clerk, Jos. McCartney.

Le Pas, Man.
Ratepayers will vote on Waterworks and Sewers by-laws Dec. 16th. Mayor, H. Finger. Sec.-Treas., H. H. Elliot.

London, Ont.
Paving of City Market, King St., at a cost of $20,000, is contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Engineer in charge, W. N. Ashplant, City Hall. 90,000 sq. yds. reinforced concrete or asphalt pavement.

Medicine Hat, Alta.
By-law re the extension and improvements to waterworks at a cost of $175,000, has been passed. H. Baker, Clerk to city council. Engineer, A. K. Grimmer.

Grading, cost $50,000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. By-law has been passed.

By-law re sewers, cost $50,000, has been passed. H. Baker, Clerk to City Council. Engineer, A. K. Grimmer.

Montreal, Que.
Maisonneuve. Town contemplates paving 1st and 2nd Ave., Leterneau and Lasalle Sts. in spring. Sec. Municipal Council, Mr. Ecrement. Engineer, M. Dufresne, Ontario St., Maisonneuve.

Ottawa, Ont.
Water supply system, cost $8,000,000, planned by City Council. Mayor, J. A. Ellis. Engineers in charge, Sir. Alex. Binnie, Son & Deacon, St. Stephens House, Westminster, London, Eng. Duplicate tenders endorsed "Tenders for Steel Pipe," one addressed to City Clerk, Ottawa, Can., and the other to Sir Alex. Binnie, Son & Deacon, London, Eng., will be received until 4 p.m. Feb. 3rd. 1914, for about 42 miles of welded steel pipe, 54 in. internal diameter, about 32 miles of welded steel pipe, 58 in. internal diameter, and about 11 miles of welded steel pipe, 51 in. internal diameter. Forms of tender and specifications may be obtained from Engineers, in London, Eng., or from City Engineer, Arch. Currie, Ottawa, on or after Dec. 15th.

Sussex, N.B.
Sewers and water mains contemplated by City Council. Mayor, Mr. Lamb. Engineer, Gilbert Murdock, C.E. Surveys being made. Report to be presented shortly.

Toronto, Ont.
Water mains contemplated by Twp. of Scarboro. Clerk, Thomas Crawford, Agincourt. Council to lay mains on Victoria, Blantyre, Chester and Lakeview Ave. City of Toronto will be asked to supply water.

50 miles of new roadway and 6 new bridges to be constructed in York, Markham and Scarboro Twps., by York County Council. Engineer, E. A. James, 57 Adelaide E.

Committee on Works recommends extension of Willcocks St., West to connect with Ulster and Ulster West to connect with Jersey Ave. Hepbourne to be extended west to Dufferin, with 24 ft. roadway and 4½ ft. walk. Board of Control.

Vancouver, B.C.
Recommendation made to City Council by City Engineer for paving Cornwall St. at an estimated cost of $19,911.

Sewerage system. As tenders received for the construction of the Canoe & China Creek Sections of the Greater Vancouver Sewerage System, were unsatisfactory the Burrard Peninsular Sewerage Commission has decided to do the work by day labor. Clerk, Wm. McQueen. Consulting Engineer, A. D. Creer, 119 Pender St. W.

Winnipeg, Man.
Tenders received by Board until Dec. 17th for laying of sewers in the following localities: Portage Ave. from Omand's Creek to W. City limits. Talbot Ave. from Cameron St. to City limits. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

The following concrete paving is contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Lane in block bounded by Fawcett and Alloway Aves., Maryland and Walnut Sts., $2,066, and on lane in block bounded by Kingsway and Harvard Ave., Harrow and Guelph Sts., $1,712.

Water main planned by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Water main in McPhillips St., from Selkirk Ave. to the subway. Plans, specifications at office of Engineer.

The following sewers are contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Sandford St., $2,457; Garwood Ave., $1,477; Doreen St., $1,143; Edith Ave., $623; Warsaw Ave., $148.

Granolithic sidewalks as follows are contemplated by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Levis St., $628; Pround Ave., $821; Edmonton St., $2,620; Ellice Ave., $411; Cumberland Ave., $861; Edmonton St., $704; Smith St., $1,147; Bell Ave., $953; Wilmot Place, $1,002; Bell Ave., $972; Wardlaw Ave., $1,265; Wellington Crescent, $2,608; Stadacona St., $550.

CONTRACTS AWARDED

Ottawa, Ont.
Chlorination buildings, at Lemieux Island, cost $7,000, planned by City Council. Engineer, Arch. Currie, C.E. General contractors, Alexander & Campbell, 587 Lisgar St. Electrical, W. R. McCallum, 498 Gladstone. Additional contract awarded.

South Vancouver, B.C.
Paving, cost $438,494.93, planned by Municipal Council. Clerk, Mr. Springford, Fraser and Wilson Road. General contractors, Dominion Creosoting Co., Ltd., 198 Hastings St., W. Vancouver. Creosoted wood block pavement from 16th Ave. to River Road.

Toronto, Ont.
Sewers planned by Board of Control. General contractors, National Contracting Co., 6 Garnock Ave.—Annette St., $8,688; Edgewood Ave., $3,268. M. H. Murphy, 84 Dominion St.—Chandas Ave., $722; Elmwood, $679; Glenholme, $2,755. J. F. Connolly, 606 Avenue Rd.—Clendennan, $2,155. Grant Contracting Co., 50 Front St. E.—Dundas, $390. Routly & Summers, 47 Benlamond Ave.—Lander, $1,253. J. H. McKnight Constr. Co., 88 St. David St.—Eastern, $547.

Pavement, cost $8,348, planned by Board of Control. General contractors, Constructing & Paving Co., Confed. Life Bldg. Asphalt pavement on Rushton Rd., St. Clair to Tyrrell, transferred from Commr. of Works.

Asphalt pavements planned by Board of Control. General contractors, Constructing & Paving Co., Confed. Life Bldg., Browns Ave., $3,855; Melgund Rd., $5,489. Godson Contracting Co., Manning Chmbrs.—Curzon St., $3,360; Rose Ave., $7,791. Commr. of Works, Homewood Place and Janet Ave. Done by day labor.

Winnipeg, Man.
Paving, St. Charles, cost $246,256.30, planned by Rural Municipality of Assiniboia. Clerk, Frank Ness, Kirkfield Pork P.O. General contractors, Bitulithic & Construction Co., Empress Bldg.

Sewers, St. Charles, planned by Rural Municipality of Assiniboia. Sec.-treas., Frank Ness, Kirkfield Park P.O. Contract awarded to Dominion Constr. Co., 209 Selkirk St. Woodlawn St. and lane off Portage Ave., $8,579.35. Galbraith Co., 601 McArthur Bldg., Belvidere, Overdale, Winchester and Lindwood, $19,814.80.

Railroads, Bridges and Wharves

Beloeil, Que.
Wharf planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa, who will receive tenders until 4

p.m. Jan. 5th. Plans, etc., at offices of Dist. Engineers at Post Office, Montreal, Postmaster, Beloeil, and at Dept., Ottawa.

Carleton Point, P.E.I.
Work has been started on the spur line for use of contractors working on car ferry terminal of Prince Edward Island Rly. Supt., H. McEwen. Railway engineer, Mr. Fripp. Work done by day labor under supervision of Engineer.

French River, Ont.
South Channel dam planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until 4 p.m. Dec. 29th. Plans, etc., at offices of the Dist. Engineers, Confed. Life Bldg., Toronto, Post Office Bldg., Montreal, Postmaster, North Bay, Ont., and at Dept., Ottawa. Work: placing of 3 gate sills and construction of 2 piers and abutments of concrete and steel reinforcing. This tender does not include 3 steel gates and operating machinery and steel superstructure on top of piers. These will be let by Dept. later.

Humberstone, Ont.
Tenders received by Reeve, Wm. Kramer, until Dec. 13th, for 224 ft. concrete retaining wall. Engineer in charge, Geo. Ross, Welland.

London East, Ont.
Paving of Dundas St. is contemplated by City Council. Mayor, C. M. R. Graham. Clerk, S. Baker. Engineer in charge, W. N. AsAhplant, City Hall. Market place in east end of city to be paved, 30,000 sq. yds. concrete or asphalt.

Ottawa, Ont.
Bank St. pontoon bridge planned by City Council. Mayor, J. A. Ellis. Engineer, Arch. Currie. Tenders received by Chairman, Board of Control, until December 18th.

St. Catharines, Ont.
Tenders to be called for Sec. No. 8 of Welland Canal. Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Plans are about ready.

Sussex, N.B.
Station planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, British American Constr. Co., Ltd., St. John, N.B. Roofing part of station, walls up one end and foundation for the main building just completed.

Toronto, Ont.
Mimico. G. T. Rly. Co. propose building a brick station 18 x 51 on Manchester Street.

City Council have asked the Commr. of Works to report the estimated cost of a station or shelter at or near the Dufferin St. entrance ot the Exhibition Grounds.

Gerrard St. Bridge planned by Board of Control. Commissioner of Works, R. C. Harris, recommends that contract be awarded to lowest tenderer, Hamilton Bridge Co., Hamilton, Ont. Supply and erection of structural steel, $81,000.

The Dawes Road bridge is to be temporarily repaired and a new bridge constructed next year. York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E.

Vancouver, B.C.
Retaining wall and two concrete piers, each 150 ft. long by 100 ft. wide, at False Creek. Engineer, F. L. Fellowes.

West Vancouver, B.C.
Wharf additions being planned by The West Vancouver Ferry Co. Engineers, Cartwright, Matheson & Co., Rogers Bldg. Considerable dredging required.

CONTRACTS AWARDED

Glace Bay, N.S.
Dredging, cost $5,945, required by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Coastal Dredging & Construction Co.

Prov. of Nova Scotia
Bridges planned by Dom. Govt. Dept. of Public Works at Barney's River, French River and West River. Sec., R. C. Desrochers, Ottawa. General contractors, Canadian Allis-Chalmers Co., Ltd., 23 Sparks St., Ottawa.

Prov. of Ontario
Four bridges, cost $90,469, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, Canadian Bridge Co., Ltd., Walkerville, Ont. Bridges on the eastern part of the Transcontinental Rly. in the Abitibi Dist., east of Cochrane.

Ottawa, Ont.
Improvements to lock No. 20, Cornwall Canal, cost $15,491, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. General contractors, Kennedy Constr. Co., 136 St. James St., Montreal.

Prov. of Quebec
Bridges over Becancour River, Riviere du Sud, Riviere du Loup, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Dominion Bridge Co., Lachine, Que.

Bridge, over St. Charles River, planned by Municipal Council of Varennes. Sec.-Treas., Aime Langlois, N.P. Engineer-in-charge, L. A. Valle, 80 St. Cyrille St., Que. General contractor, Jos. Trudeau, Varennes. One span, 20 x 16.

St. Jean Port Joli, Que.
Wharf improvements, cost $7,800, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, E. Carson, L'Islet, Que. 100 x 38 x 31 ft. high.

Washago, Ont.
Dams and deepening of channel planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jas. Roddick, 40 Wellesley St., Toronto, $8,925.

Public Buildings, Churches, Schools, etc.

Avonlea, Sask.
School planned by School Board. Sec.-Treas., T. H. Clay. Architects, Storey & Van Egmond, 1 Credit Foncier Bldg., Regina. General contractor, W. H. Richardson. Foundations in.

Dartmouth, N.S.
Plans and specifications for proposed new school have been submitted to Board, but site is not yet purchased. Chairman, Mr. Stevens. Architect, C. R. Tohrne.

Edmonton, Alta.
School, cost $150,000, planned by Public School Board. Sec.-Treas., Mr. Brady, Mortlake Blk. Supt., Mr. Richardson, Mortlake Blk. General contractors, Read, MacDonald & Brewster, Tegler Block. Trimming interior.

South Edmonton, Alta.
Church for German Lutheran Congregation. Architect, J. P. Springer, 216 Ross St. Plans, specifications, etc., at office of Architect, who will receive tenders until Dec. 20th.

Ethel, Ont.
School, at a cost of $15,000 the School Board contemplate erecting. Sec., A. H. McDonald. White brick construction, concrete and stone foundation, maple floors, plumbing, lime and sand plastering, seating.

Fredericton, N.B.
New high school building recommended by Supt. Matter to be discussed further at next Board meeting. Board of Education. Chief Supt. of Education, Dr. Carter.

Guelph, Ont.
Collegiate institute. Board of Education. Chairman, J. M. Duff. The Board will receive plans and specifications until Jan. 15th, 1914. Three stys., structural steel and stone construction, stone and cement foundation, salte roofing, electric lighting, steam heating, maple and pine floors, plumbing, metal ceilings.

Hamilton, Ont.
School, cost $40,000, planned by Separate School Board. Sec.-Treas. Com., Father Leyes, 260 Herkimer St. Architect, Robt. Clohecy, 226 John St. S. Two storeys, 94 x 74. Plastering.

Hull, Que.
Hull French School Trustees are contemplating erecting a school.

Kingston, Ont.
Major R. W. Leonard has donated site, 850 x 350, for a residence for the students at Queens University.

London, Ont.
County Council intend purchasing electrical fittings and seating for Court House. Further information from Engineer, C. Tabot, or County Clerk ,T. Robson.

Labor temple, cost $8,000, for The Arbeiter Ring. President, Jacob Wolfe, 258 Dundas St. Architects, McBride & Gilbert, Edge Block. Plans will be ready to call for new tenders in about 2 weeks.

Montreal, Que.
The Board of Commrs. contemplate building a number of lavatories in different parts of the city. Sec., L. N. Senecal.

Mount Laurier, Que.
School, cost $30,000 for Congregation of Mt. Laurier. Priest, Father Chenier. Architect, S. J. Bigonesse, 92 Notre Dame E., Montreal. Plans about ready, tenders will be called from Mt. Laurier. 2½-storeys, 63 x 83, solid brick construction, concrete foundation, waterproofed, felt and gravel roofing, steam heating, hardwood floors, lime and sand plastering, fire escapes, architectural iron railings and stairs, seating.

Newcastle, N.B.
Court house, cost $30,000, planned by County Council. Architect, Leslie R. Fairn, Aylesford, N.S.

New Glasgow, N.S.

Town hall, fire hall and market building are contemplated by Municipal Council. Clerk, Jas. Roy.

Armoury, cost $8,000, is contemplated by Dom. Govt. Dept. of Militia and Defence. Sec., E. F. Jarvis, Ottawa.

Ottawa, Ont.

Ladies college, cost $130,000, Lyon. Architect, Allan Keefer, 220 Sparks St. Trimming interior.

Swift Current, Sask.

High school (eight rooms), planned by Board. Sec.-Treas., Arthur Webber, Box 502. Dawson, Reilly & Dawson are the architects.

St. Agathe Des Monts, Que.

Post office planned by Dom. Govt Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Architects, Finley & Gagnon, New Birks Bldg., Montreal. Tenders will be called about Dec. 15th.

St. Catharines, Ont.

Four-room addition to Alexandra School. Public School Board. Secretary, C. T. McBride. Architect, T. H. Wiley, 128 St. Paul St. Tenders received by Secretary until Dec. 29th. Plans, etc., at office of architect.

Toronto, Ont.

Addition to club building for Granite Club, 513 Church St. Architects, Curry & Sparling, 105 Bond St., who will receive tenders until Dec. 18th for all trades.

Work started on new lodge hall for Diau L.O.L. No. 2054. Sec. Bldg. Com., J. L. Bolton, 146 Hiawatha Rd. General contractors, Robinson & Morris, 226 Rhodes Ave.

Commercial H.S., cost $200,000, planned by Board of Education. Sec., W. C. Wilkinson. The Advisory Industrial Committee have approved of the draft plans. Working plans to be prepared immediately. The committee recommends that no gymnasium be erected at first. Small automatic elevator to be installed.

Vernon, B.C.

Armoury, cost $16,811, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, T. E. Crowell, Vernon. Work to be completed as soon as possible. One storey, 140 x 60.

Wallaceburg, Ont.

Sunday school, cost $13,00, for Presbyterian Church Congregation. Chairman Com., Mr. John Scott. Architect, R. W. Fawcett, 152 Essex St., Sarnia. Brick construction and foundation, new heating plant, seating, gallery. Plans are in progress.

Waterford, N.S.

School (14 rooms), Town Council. Clerk, Jas. L. McKinnon. Tenders received by Clerk until 5 o'clock Dec. 12. Plans, etc., at office of Clerk or Ronald Gillis, Sydney.

Welland, Ont.

Plans have been submitted for addition to registry office, cost $15,000, for Welland County. Clerk, Robert Cooper. Chairman, W. W. Brookfield. Architect, A. E. Nicholson, St. Catharines. Additional one storey and basement, 60 x 30, pressed brick construction, stone trimmings, fan system of ventilation.

High school, cost $60,000. Sec., W. H. Lowe. Chairman, A. J. J. Brennan. Bulk and separate tenders received by Sec. until 6 p.m. January 10th for masonry, brick, carpentry, plumbing, plastering, painting, glazing, heating, ventilating, iron stairs, galvanized iron, hollow tile and reinforced concrete, electric wiring. Plans and specifications at office of Architect, D. F. Forbes, Temple Bldg.

Winnipeg, Man.

Church of St. Michaels and All Angels. Pastor, Rev. G. H. Broughall, 611 Mulvey Ave. Present structure will be moved on to new site and plans prepared for a new church to be built later. Architect not yet chosen.

School, cost $100,000, plans are being prepared by Prov. Govt. of Manitoba. (Dept. Education). Architect, E. D. Tuttle, 701 McArthur Bldg. Two storeys, 102 x 230, stone and brick foundation, reinforced concrete and pressed brick construction, electric lighting, steam heating.

CONTRACTS AWARDED

Edmonton, Alta.

Market building, cost $110,960, planned by City Council. City Architect, A. Jeffers. Market Supt., Mr. Robertson. General contractors, Olson, Johnson Co., McLeod Bldg., at $85,00. Contract does not include plumbing, heating or electrical.

Sarnia, Ont.

Council house at the Indian reserve, cost $4,153, planned by Dom. Govt. Dept. of Indian Affairs. Deputy Supt. Gen., D. C. Scott, Ottawa. General contractor, Jos. Shank. One storey and basement, 50 x 30, concrete and brick construction.

Tecumseh, Ont.

Alterations to St. Anns' Church, cost $2,000. Pastor, Fr. Langlois. Architects, G. Jacques & Co., Windsor. General contractor, Adam Jacques, Walkerville. One storey, 16 x 20, brick and stone construction.

Toronto, Ont.

School, Kimberley St. Board of Education. Sec., W. C. Wilkinson. Heating and ventilating, Callis, Sheppard & Abbott, 279 Brunswick Ave., $690. Plumbing, Fred Armstrong & Co., Queen W., $255.

School, Shirley St. Board of Education. Sec., W. C. Wilkinson. Heating and ventilating, Fred Armstrong Co., Queen W., $8,995. Plumbing, Fred Armstrong Co., Queen St. W., $6,200. Electric wiring, Fred Armstrong Co., Queen W., $650. Heat control, National Regulator Co., 407 Lumsden Bldg., $800.

Business Buildings and Industrial Plants

Belleville, Ont.

Creamery is contemplated by Mr. M. Robinson, Guelph. The Quinte Laundry building will be altered to suit requirements. Operations to start about Jan. 1.

Digby, N.S.

Plans are in progress for the remodelling of Bank of Nova Scotia. Architect, F. Neil Brodie, 42 Princess St., St. John, who will call for tenders in a few weeks.

Ft. William, Ont.

Representatives of Plymouth Cordage Co., 55 Colborne St., Toronto, have been in Fort William looking over several sites suitable for erection of warehouse.

Ingersoll, Ont.

Theatre, $15,000, for owner and architect, Reg. Bloor. Two storeys, white brick construction, concrete and stone foundation, electric lighting, maple, pine and concrete floors, plumbing, seating. Plans drawn.

London, Ont.

Stores and apartments, cost $25,000, Central Ave and Richmond St., for H. M. Douglas, 206 Central Ave. Three stys., 74 x 40, tapestry brick construction. Architects, Wall & Blackwell, Bank of Toronto Bldg., who will receive tenders until Dec. 17th.

S. F. Lawrason & Co., Adelaide and Nelson Sts., will be making alterations to and installing new machinery in their soap factory at an estimated cost of $25,000.

Ottawa, Ont.

H. N. Bate, et al, 109 Sparks St., proposes using half a city block to build large stables. Matter to come before Board of Control.

Residence, cost $5,000, Echo and Cedar, is contemplated by T. Ballantyne, 145 Echo Drive. Work to start in spring.

Factory, cost $27,000, Nelson, projected by Crown Lithographing Co., Wellington St., has been abandoned.

Store house is contemplated by Grey & Harvey, 115 Rideau St. Iron clad brick construction, concrete foundation, corrugated iron roofing, electric lighting, pine floors.

Factory, Hintonburg, cost $125,000, for National Drug Co. of Canada, Ltd. President, J. J. Allan, c/o Allan & Cochrane, 37-39 Sparks St. Council has passed fixed assessment.

Rapid City, Man.

Plant and warehouse contemplated by Rapid City Milling Co. Vote on by-law to be taken shortly. Exemptions, etc., from taxation for 10 years.

Sherbrooke, Que.

Factory for Elbram Stone Co., is about completed. General contractors, Simoneau & Dion.

Stratford, Ont.

Factory, cost $100,000. Wood Mosaic Co., Inc., New Albany, Ind., state that nothing will be done in regard to the projected factory until spring.

Sussex, N.B.

Alterations and addition to Bank of Nova Scotia. Architect, F. Neil Brodie, 42 Princess St., St. John, who will receive tenders.

Toronto, Ont.

Plans drawn for stable for Lake Simcoe Ice Co., King and George Streets. No contracts awarded. Work may be done by day labor or contract. Two storeys, 30 x 32, frame construction, shingle roofing, electric lighting.

Garages are contemplated by the following: Mr. G. Tamblyn, 381 Adelaide W., at Queen and Lee Ave. W. W. Hiltz, 735 Broadview Ave., at 731 Broadview Ave. The Pedlar People Ltd., College and Markham Sts., at rear 679 Euclid Ave. Geo. F. James, 15 High Park Gardens.

Garage and office, cost $10,000. Owners and general contractors, Morris & VanDusen, 147 Victoria St. Constructed by day labor. Two storeys, 50 x 144, brick construction and foundation, felt and gravel roofing, gas and electric lighting, birch and concrete floors, freight elevator, galvanized iron skylights. Plans drawn.

Vancouver, B.C.
Ex. Alderman McNeill, 80 Pender St. E., contemplates the erection of a wharf and warehouse at False Creek at an estimated cost of $250,000. Work will probably start in spring.

Five stores, picture theatre and apartments, Main and Broadway, for C. M. Bowman, c/o Architect, Wm. E. Gardiner, 347 Pender St. W., who will call tenders for General Contractor about Dec. 10th. Two storeys and part basement, 100 x 100, brick facing, Monarch art stone trimmings, 5,000 sq. ft. tile and terrazzo, hot water heating.

Vernon, B.C.
Tile plant is contemplated by V. C. Morrison, Franklin, Ind. Owner may start factory for manufacture of Drain and Hollow Building Tile and Fire Roofing.

Victoria, B.C.
Site purchased, 60 ft. frontage, by McCutcheon Bros., 1309 Douglas St., who contemplate erecting stores and offices.

Windsor, Ont.
Factory, cost $7,000, factory District, is contemplated by Dowsley Spring Axle Co. Architect not chosen. Work to start in spring. One storey, 60 x 150, concrete construction, cement foundation.

Alterations to store, $8,000, for Simon Meretsky. Architects, Atchison & Adams. Tenders received by architects from Dec. 16th until Dec. 25th. Three storeys, 60 x 42, brick construction, electric lighting, steam heating, maple floors, hard wall plastering, plate glass, one freight elevator, store fronts, vaults.

Bank and offices, $150,000, for Canadian Bank of Commerce. Manager, A. E. Taylor. Architects, Darling & Pearson, 2 Leader Lane, Toronto, Ont. Brick foundation and construction. Sketches in progress.

CONTRACTS AWARDED

Brantford, Ont.
Liquor warehouse, store and office, cost $12,000, Dalhousie, for J. S. Hamilton & Co., 91-95 Dalhousie St. Architect, W. S. Jago, c/o Jago & Cole, 66 St. Paul Ave. General contractor, mason, carpenter, plastering, painting, heating, plumbing and electrical, Hugh R. Thompson, 16 Terrace Hill. Steel Hamilton Bridge Works Co., Hamilton. All brick supplied by Owners. Work to be completed June 1st, 1914. Three storeys, 12 x 33½, stone sills and brick construction, concrete foundation, felt and gravel roofing, maple, pine spruce and concrete floors, lime and sand plastering, wood lath, plate and prismatic glass, 1 freight elevator, 1 vault, plumbing.

Dundas, Ont.
Branch of Royal Bank of Canada, H. O. Montreal. Architect, J. Walker c/o Owner. General contractors, Harris & Harris, Confed. Life Bldg., Toronto. Brick and concrete construction.

Montreal, Que.
Factory alterations, Fortification and St. George, cost $30,000, for Royal Trust (for Montreal Star), St. James St. Architects, Ross & MacDonald, 1 Belmont St. General contractor, Jas. Shearer, 225 St.

Alterations to store, 330 St. Catherine W., cost $7,000. Owner, Estate G. W. Stephens, Merchants Bank Bldg. Architect, H. C. Stone, 84 St. Francois Xavier St. General contractor, Jno. Wighton, 19 Sussex Ave. Plastering, MacIntyre Plastering Co., 55 Latour St. Three storeys, 20 x 85. Subcontract awarded. Patrick. Roofing, Richardson Simard & Co., 745 Clarke St. Sub contract awarded.

Stores, Peel and St. Catherine St., cost $6,000, for Crown Trust Co., 145 St. James St. Architect, K. G. Rea, 54a Beaver Hall Hill. General contractor, C. E. Deakin, 41 Mayor.

New Westminster, B.C.
"Holbrook" Hotel addition. Agents for owners, Northwest Trust Co., 550 Columbia St. Architects, Gardiner & Mercer, Westminster Trust Block. General contractors, Jones-Cornell Constr. Co., New Westminster.

Ottawa, Ont.
Stables, etc, St. Andrew, cost $10,000, for A. E. Rae Co., Ltd., Rideau St. General contractors, Doran & Delvin, Rae Bldg. Electrical, Marchand & Donnelly, 128½ Suarks St. Additional contract awarded.

Alterations to offices, cost $5,000, for James Hill, 76 Isabella. Architects, Richards & Abra, 218-220 Booth Building. General contractor, R. A. Kemp, 149 1st Ave.

Port Coquitlam, B.C.
Hotel for H. C. Thornton, care Architects, MacKenzie & Day, Vancouver Building, Vancouver. General contractor, W. H. Mueller, 407 Hastings St. W., Vancouver, $52,000. General contractor is receiving tenders for plastering, roofing and sheet metal work. Separate tenders in for plumbing and heating, to be let later by architect.

St. Catharines, Ont.
Offices for Baldry, Yerburgh & Hutchinson. General contractor, Thos. Irvine. Steam heating plant.

Toronto, Ont.
Factory, Carlaw and Wilton Ave., cost $40,000, for Roden Bros., 99 King St. W. Heating, Nobis Engineering Co., 329 King W. Heat Control, Thermo Grade Valve System, 07 Lumsden Bldg. Subcontracts awarded.

Vancouver, B.C.
Two stores and moving picture theatre, cost $40,000, for Rex Amusement Co. President, W. P. Dewees. Architect, Phillip M. Jullien, Arts & Crafts Bldg. General contractors, Campbell & Wilkie, Crown Bldg. Alterations to building for theatre. New concrete front, ventilating system, electric lighting, theatre equipment.

Victoria, B.C.
Addition to hotel, cost $10,500, for Punnett & Williams, "Manitoba Bar," 614 Yates St. General contractors, Waddington & White, 113 Pemberton Bldg. Two storey addition, concrete constr.

Windsor, Ont.
Store and flats, cost $8,000, for Chas. Rogin. Architects, Atchison & Adams. General contractors, Bersch & Appleman. Two storeys, 70 x 34, brick veneer construction, brick foundation, felt and gravel roofing, electric lighting, stove heating, tile, oak and maple floors, septic tanks, hard wall plastering, wood and metal lath, plate glass, galvanized iron, store fronts and fixtures.

Woodstock, Ont.
Factory, cost $12,000, for Wayne Oil Tank & Pump Co., Fort Wayne, Ind., and 154 Sorauren Ave., Toronto. General manager, Mr. Diserens. Co.'s Engineer, Mr. McGuire. General contractors, McKinney Lumber Co., Ingersoll Ave. One storey, 150 x 80, cement foundation, brick construction, asbestos roofing, steel sash.

Residences

Edmonton, Alta.
Apartment house, Stoney Plain Road and 27th Street. Owner and general contractor, Daniel Sewell, Stoney Plain Rd. and Park St. Architect, W. D. Cromarty, 21 Dominion Block. Three stys., 113 x 52, 19 suites, brick and stone construction, steam heating, electric lighting. Plans drawn.

Halifax, N.S.
Apartment house, cost $5,000, for Mrs. Henry L. Warr. Builder and general contractor, G. J. Hilchey, 287½ North St. 2½ storeys, 27 x 54, cement foundation, frame construction, shingle roofing, electric lighting.

Hamilton, Ont.
Alterations to apartment house, cost $8,000, Victoria Ave. S., for C. B. Webber, 3 Stinson St. Architects, Watt & Blackwell, Lister Chambers. Three storeys, brick construction, stone and concrete foundation, gas and electric lighting, pine floors, plumbing, lime and sand plastering. Plans in progress.

London, Ont.
Residence, cost $6,000, contemplated by Mrs. E. S. Prentiss, 534 Dundas St. Two storeys, red pressed brick construction, concrete and stone foundation, slate roofing, gas and electric lighting, steam or hot water heating, oak, maple and concrete floors, plumbing, lime and sand plastering, plate glass.

Montreal, Que.
Residence, cost $8,000, for J. W. Brown, 65 Summerhill Ave. General contractors, Archambault & Conway, 332 Bleury. Elec., Elec. Repair & Construction Co., 317 Craig W. Two stys., 25 x 50. Additional contract awarded.

Residence, cost $24,000, Outremont (Bloomfield). Owner and general contractor, T. Forest, 131 de L'Epee Ave. Architect, J. E. Branchaud, 218 Chatham St. Mason and brick, Mr. Dominique, 360 St. Antoine. Carpenter, Mr. Lagauchetiere, care general contractor. Additional contract awarded.

Residence, cost $23,000, Westmount (Carleton). Owner, J. E. Dalrymple, 4684 Western Ave. Architect, R. E. Bostrom, 211 McGill St. Roofing, Richardson Simard & Co., 745 Clarke. Elec. McDonald & Wilson, 99 Drummond St. Architect still open to receive tenders for plastering.

Ten residences, cost $25,000, Lachine (Summerlea Ward), for Marcil Trust Co., 180 St. James St., Montreal. Architect, Mr. Harris, care owner. Tenders will be called about January 1st for general contract. Concrete foundation, frame construction, shingle roofing, hot water heating, hardwood floors, lime and sand plaster. Plans in progress.

Fifty cottages, cost $150,000, Notre Dame de Grace (West Hill Ave.). Owner and general contractor, Henry Gaffney, 204 St. James St., who wishes tenders on carpentry work at once, also electrical, plumbing, heating, painting and plastering.

Ottawa, Ont.
Residence, cost $5,000, contemplated by T. Ballantyne, 145 Echo Drive. Work to start in spring.

Residence, cost $5,000, for T. J. Lyntel, 43 Melgund. General contractor, R. A. Kemp, 149 First Ave. 2½ storeys, 28 x 32, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot water heating, birch and pine floors, water heaters, lime and sand plastering, built-in fireplaces.

Residence, cost $7,000, Goulbourne, for L. Petergorsky and J. S. Wilson, 256 Kent. Plumbing, Goldrey & Chapman, 358 Rideau St. Additional contract awarded.

Toronto, Ont.
R. Dale, 16 St. Andrews Gardens, has just purchased a site for the erection of a residence.

S. H. Taylor, Runnymede and Henrietta St., who is building 10 pair residences, will receive tenders for carpentry work, labor and material.

Lake Simcoe Ice Co., 178 King St. E., will build apartments on top of present office building. Plans, etc., on view at 78 Dupont St. Tenders to be sent to 178 King St. E.

Seven pair residences, cost $32,000, Pendrith. Owner and general contractor, J. M. Walkey, 326 Shaw St., who will superintend. Two storeys, 33 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Two detached residences, cost $6,000, Gothic Ave. Owner and general contractor, S. B. Green, Weston, Ont., who will superintend construction. 2½ stys., 20 x 40, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two detached residences, cost $5,000. Owner and general contractor, C. S. Townsend, 149 Redpath Ave. Two storeys, 20 x 40, brick construction and foundation, shingle roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,000. Owner and general contractor, W. J. Spence, 118 Symington Ave., who superintends construction. Two storeys, 33 x 42, brick construction, concrete foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak & spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Two pair residences, cost $8,000, Laughton Ave. Owner and general contractor, A. A. Larkin, 112 Laughton Ave. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

One pair residences, cost $5,000. Owner and general contractor, W. J. O'Reilly, 52 Colborne St., who will superintend. Two storeys, 34 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

Winnipeg, Man.
Isaiah C. Craig, 165 Lipton St. will erect 20 to 40 houses on 900 acres of land in Blocks 42, 43 44 St. Francis. Land to be divided in small market gardens complete with buildings. Owner desires to get in touch with contractors who are willing to build these houses. Work to start in spring.

CONTRACTS AWARDED

Windsor, Ont.
Residence, cost $6,000, for Dr. A. E. Bowman. Architects, Leybourne & Whitney. Mason, John Ferguson. Carpentry and roofing, Elmer Gignac. Plastering, Lockwood & Troup. Heating and plumbing, Windsor Hardware Co. Electrical, A. H. Cook. Two storeys, 31 x 33, brick construction.

Power Plants, Electricity and Telephones

Aurora, Ont.
As hydro-electric lighting is being installed in town, many of the house will require wiring. Address all inquiries to Mayor, W. J. Baldwin.

Galt, Ont.
Town council, Clerk, Jos. McCartney, contemplates erecting ornamental lights on Water St. north and south.

Le Pas, Man.
Ratepayers will vote on Electric Lighting by-law Dec. 16th. Mayor, H. Finger. Sec.-Treas., H. H. Elliott.

London, Ont.
London & Port Stanley Railway Board are purchasing equipment for line between London and Port Stanley, cars, rails, machinery, wire, etc. Engineer in charge, S. B. Storer, care Hydro-Elec. Commission, Toronto.

Medicine Hat, Alta.
Extension to power and electric lighting, $150,000, planned by City Council. Clerk, H. Baker. Engineer, A. K. Grimmer. By-law has been passed.

Newcastle, N.B.
Wireless station for Universal Radio Syndicate. General contractors, Galbraith & Cate, 179 St. James St., Montreal, Que. 450 x 55, 105 x 35, is nearing completion. Power house also about completed. Concrete and steel construction.

Ottawa, Ont.
Boiler and engine house, cost $12,000, Middle St., for Ottawa Electric Railway Co., 248 Albert St. Steel for roof, P. J. Powers Co., Ltd., 224 Bridge St. Boilers, generators, etc., Canadian Westinghouse Co., Hamilton, Ont. 90 x 71, solid brick construction. Walls going up.

Preston, Ont.
Ratepayers will be asked to vote on by-law January 5th, to grant renewal franchise to Galt, Preston & Hespeler Street Railway Co., Ltd., for term of 25 years. Company to make extension to present system.

South Vancouver, B.C.
The Board of Works has authorized the installation of the Gamewell Fire Alarm System at a cost of $10,375. Clerk, Mr. Springford, Fraser and Wilson Rd. Electric Engineer, Mr. Rawder.

Toronto, Ont.
Ontario Hydro Elec. Power Commission are preparing plans for new line from Niagara Falls to Dundas, $500,000, To be built in private right of way, new towers and cables. Chief Engineer, F. A. Gaby, Continental Life Building.

Welland, Ont.
Fire alarm system, cost $5,000, is contemplated by Town Council. Clerk, C. M. Webber. By-law to be voted on next month.

Winnipeg, Man.
Switching apparatus required by Bd. of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King Street. General contractors, Northern Electric & Mfg. Co., 599 Henry St., at $9,550.

Telephone System. Manitoba Government Telephone Commission will receive tenders until noon, Dec. 12th, for supply of telephone instruments for delivery in the year 1914. Full information at office of chief engineer, Charlotte Street.

CONTRACTS AWARDED

Collingwood, Ont.
Electrical equipment for Imperial Steel & Wire Co. General contractors, Canadian Westinghouse Co., Hamilton, Ont. Motors, transformers and equipment.

Hamilton, Ont.
Sub-station, $19,088, Dundurn Street, planned by City Council (Hydro-Elec. Dept.). Mayor, John Allen. Consulting Engineer, E. I. Sifton, City Hall. Architects, Watt & Blackwell, 125 Lister Chambers. Elec. machinery and equipment, Canadian Westinghouse Co., Ltd. Two storeys, steel and brick construction, concrete foundation. Additional contract awarded.

Victoria, B.C.
Telephone line, cost $10,650, for City Council. Water Commissioner, C. H. Rust, City Hall. General contractor, Thomas Watson. Line required in connection with Sooke Lake waterworks extensions.

Miscellaneous

Guelph, Ont.
City Council require two chemical tanks. Mayor, S. Carter. Clerk, T. J.

(Continued on page 73)

Tenders and For Sale Department

TENDERS
FOR
A Complete Mechanical Filtration Plant, Boilers, Steam Turbo-Generator Plant, and all Appurtenances

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, January 20th, 1914**, for the installation of a complete Mechanical Filtration Plant, Boilers, Steam Turbo-generator Plant, and all appurtenances at Toronto Island.

Specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
November 25th, 1913. 49-51

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dam on French River, South Channel, Ont.," will be received at this office until 4.00 p.m. on **Monday, December 29, 1913**, for the construction of a Dam across the South Channel of the French River, at head of Big Chaudiere Falls.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont.; Post Office Building, Montreal, and on application to the Postmaster at North Bay, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, December 5, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51842. 51-52

Tenders Wanted

Lump sum and separate tenders for the following trades: Mason and Bricklayer, Carpenter, Plumber, Plasterer, Painter and Glazier, Heating and Ventilation, Iron Stairs, Galvanized Iron, Hollow Tile, and Reinforced Concrete, Electric Wiring; for the erection of a new High School, will be received by the High School Board, Welland, up to 6 p.m., **January 10th, 1914**.

Address all tenders to Mr. Wm. H. Lowe, Secretary.

The lowest or any tender not necessarily accepted.

Plans and specifications may be received upon application to the Architect, D. F. Forbes, 43 Temple Building, Welland.

51-52

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m. on **Thursday, the 15th of January, 1914**, for 10 knots of gutta-percha cable with 4 conductors and 14 knots of gutta-percha cable with 2 conductors, to be delivered at Halifax, N.S., or St. John, N.B., by the 1st of May.

Specification. and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, December 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51974. 51-52

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

TENDERS
FOR
Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 16th, 1913.**

1. Asphalt (Refined).
2. Paving Blocks (Vitrified).
3. Granite or Stone Setts.
4. Treated Wood Blocks.
5. House Numbers.
6. Iron and Steel.

Specifications and tender form for any of the foregoing, may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders, the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, Dec. 1, 1913. 50-51

FOR SALE

Steam Driven Air Compressors
thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.
One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company
SHERBROOKE, QUE.
Montreal Office, - - - - - E. T. Bank Building
50-53

Extension of Time

Notice is hereby given that the time for the reception of tenders for the construction of wharfs at Victoria Harbour, B.C., is extended to **Thursday, January 8, 1914.**

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 9, 1913. 51

Canadian Pacific Railway Company

North Toronto Grade Separation

Notice to Contractors

Sealed proposals will be received by the undersigned up to 12 o'clock noon on **Saturday, December 27th,** for furnishing labor and material in connection with the waterproofing of eight subways at North Toronto.

Plans and specifications may be seen at the office of the Engineer of Grade Separation at No. 262 Avenue Road, Toronto, where proposal forms may also be obtained.

The lowest or any tender not necessarily accepted.

B. RIPLEY,
Engineer of Grade Separation.

Toronto, Dec. 4th, 1913. F

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on **Tuesday, the 3rd day of February, 1914,** for about forty-two miles of welded steel pipe, fifty-four inches internal diameter, about thirty-two miles of welded steel pipe fifty-eight inches internal diameter, and about eleven miles of welded steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.

Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharfs and Dredging at Rimouski, Que.," will be received at this office until 4 p.m., on **Monday, December 22, 1913,** for the construction of a line of Wharfs and Dredging Tidal Basin at Rimouski, County of Rimouski, Que.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Rimouski, Que.; Post Office Building, Quebec; Post Office, St. James St., Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—43493. F

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Engineering Salesmen

Good future offered to a few clean-cut Engineering Salesmen, technical graduates preferred, to act as outside representatives for an established Consulting, Engineering and Construction Corporation, based on co-operative plan. Offices in Cleveland, Detroit, Buffalo and New York City. Highest references and financial interest required. Contract with salary, commission and expenses guaranteed. Answer Box 922, Contract Record, Toronto. 51

Miscellaneous

(Continued from page 71)

Moore. Chairman Fire and Light Com., H. O'Connor.

Guelph, Ont.

Fire escapes to be purchased for three schools. Chairman Board of Education, J. M. Duff, Oxford St. Sec., Wm. Tytler, Paisley St.

Hamilton, Ont.

Crushed stone required by Board of Control. One year's supply of broken stone awarded to Canada Crushed Stone Corporation, Ltd. 1, 2 and 3 in., at $1 per ton, 2-in. crushed run at 90c per ton, screenings at 60c per ton.

Harrow, Ont.

Council has ordered gasoline fire engine from the West Lorne Fire Engine

CASTINGS
Gardner & Saxby
Engineers' Patternmakers, etc.
346 5th Ave. W., Vancouver, B.C.

The
Laurentian Granite Co.
Limited
Manufacturers of
Building Granite, Granite Setts, Curbing, Crushed Granite
Samples Furnished and Prices Quoted on Application
Rose and Pink Granite Quarries at Staynerville, P. Que., Co. Argenteuil, on C.P.R.
Bank of Ottawa Bld'g, 224 St. James St. Montreal
Bell Tel. M. 4354

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

Canada Lumberman
& Wood Worker
Toronto, Canada

Co., and contemplates purchasing 2½-in. hose and other equipment.

Lindsay, Ont.
Slab-slasher and lath machines being installed at The John Carew Lumber Co., Ltd., sawmill, William St., and boilers may be required.

London, Ont.
Board of Education, Sec., R. M. McElheran, contemplating steam heating plant, cost $20,000. Further information from secretary or A. M. Hunt, care Western Fair Board, Dom. Savings Bldg., and E. R. Dennis, care Dennis Wire & Iron Works Co., Ltd., 22-26 Dundas St. Isolated steam heating plant and fittings for 30-room college building, new ventilating system.

Midland, Ont.
Chew Bros. will replace their present equipment of 5 boilers with new ones. General repairs to be made to plant.

Montreal, Que.
Motor fire apparatus required by Board of Commrs. Sec., L. N. Senecal. Fire Chief, J. Tremblay, 20 Craig St. W. Tenders received were unsatisfactory. New tenders may be called.

Ottawa, Ont.
Submarine cable required. Dom. Government, Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received until January 15th, 1914, for 10 knots of gutta percha cable with 4 conductors and 14 knots with 2 conductors, to be delivered at Halifax by May 1st. Specifications at office of General Superintendent of Government Telegraph Service, Ottawa.

Quebec, Que.
Heating and ventilating in post office required by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa, who will receive tenders until January 8th, 1914, Plans, etc., at offices of Chas. Chapais, Dist. Engineer, Quebec; R. L. Deschamps, Overseer Public Buildings, Post Office, Montreal, and at Department, Ottawa.

Seaforth, Ont.
Creamery equipment required by Johnson & Barber. Building has been purchased; owners contemplate installing creamery equipment; also equipment for the manufacture of cheese and ice cream.

Toronto, Ont.
Tenders received until Dec. 16th. Specifications, etc., at Room 12, Purchasing Dept. Annual supplies. six iron and steel, seven special castings. Board of Control. Mayor, H. C. Hocken.

Wallaceburg, Ont.
Wallaceburg Brass & Iron Mfg. Co., Ltd., Wallace St. Manager, D. A. Gordon. Machinery and equipment required for the manufacture of electric irons, etc.

CONTRACTS AWARDED

Montreal, Que.
Motor fire apparatus required by Bd. of Commrs. Sec., L. N. Senecal. Fire Chief, J. Tremblay, 20 Craig St. West. General contractor, W. E. Seagrave, Walkerville, Ont. Hose wagon and ladder truck, $21,650. General contractor, A. Jennings & Co., Wellington Street, Montreal, salvage wagon, $7,000.

Water tank for Maisonneuve Municipal Council. Secretary, Mr. Ecrement, Town Hall. Engineer, Marquis Dufresne. General contractor, T. Belair, 1835 Ontario E. To supply water tank for public market.

Business Notes

Amherst, N.S.
Factory of Canadian Beverage Co., Ltd., Spring St., destroyed by fire. Damage to building and equipment, $20,000. Frame construction, stone foundation.

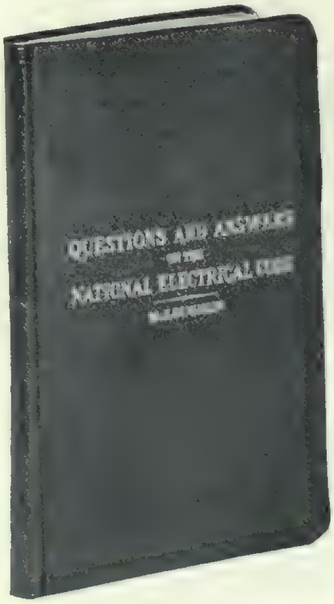
Premises of H. G. Hagen, destroyed by fire, insurance $3,500. Loss covered. Occupants, F. D. Stanton, restaurant, insurance $2,200, loss covered. Rae G. Barker pool room, equipment all destroyed, insurance $2,200, loss covered.

Bedford, Que.
Plant of Bedford Mfg. Co., Bridge St. Manager, F. D. Walsh. Forge room, tempering shop, finishing and machine shop, coal sheds and stables destroyed by fire, also machinery. Loss about $75,000, insurance $25,000.

Brantford, Ont.
Fire at Bow Park Farm, property of Dominion Canners, Ltd. Manager, Otto Herrold, Bow Park Farm P. O. Barn destroyed, 250 x 50, also impliments. Loss $50,000; insurance $154,000. Will probably rebuild.

Kingston, Ont.
Liquor store of James McParland, 341 King St., destroyed by fire. Damage estimated at $10,000.

You Can Interpret the Code Instantly with McLoughlin's



Questions and Answers
on the
National Electrical Code

It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.
The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 net, prepaid.

For Sale by
Contract Record, - 220 King Street West, Toronto

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work ...	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving..	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 “	4 60	6 75
41 to 50 “	5 10	7 50
51 to 60 “	5 35	8 50
61 to 70 “	5 75	9 75
71 to 80 “	6 25	11 00
81 to 85 “	7 00	12 50
86 to 90 “		15 00
91 to 95 “		17 50
96 to 100 “		20 50
101 to 105 “		24 00
106 to 110 “		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

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Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ “	2.16	⅜ “	3.06
½ “	2.72	½ “	3.57
¾ “	3.11	¾ “	4.26
1 “	4.59	1 “	6.29
1¼ “	6.21	1¼ “	8.51
1½ “	7.43	1½ “	10.15
2 “	9.99	2 “	13.19
2½ “	16.38	2½ “	22.23
3 “	21.43	3 “	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

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Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

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Grey coursing stone, delivered, $2.50 to $2.75 per yard.

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Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

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Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

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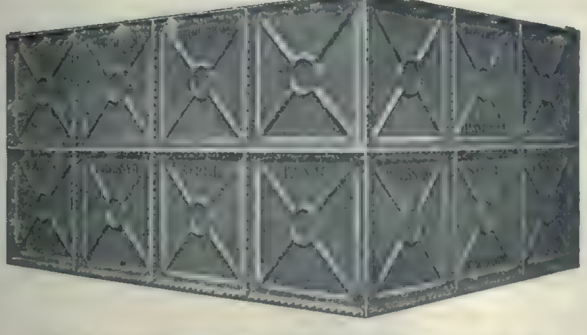
Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.



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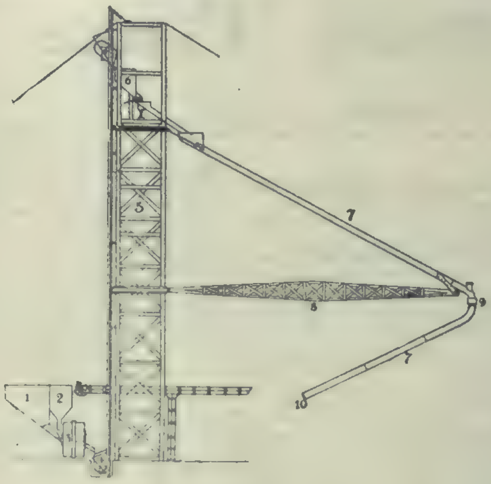

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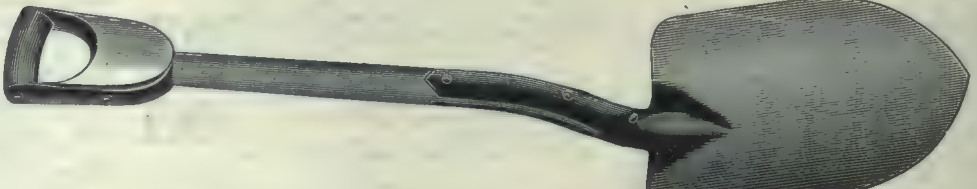

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For Canada asphalt must not only be pure (nearly 100 per cent bitumen) but the bitumen must retain its tenacity at all temperatures. In this regard Aztec excels. It is impervious to water, stays malleable even when buried under snow or ice for long periods, does not soften noticeably in summer and has great coherence, resisting wave tendencies.

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Page 16

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Should Fees be Charged for the Use of Plans by Contractors Estimating on Work?

JUST at a time when contractors in the Canadian field have reached the conclusion that conditions under which they are tendering are far more strenuous, nine times out of ten, than occasion calls for, it is somewhat startling to happen across an article published under the above heading in a recent issue of the Engineering News. Our contemporary discusses the action of the Executive Committee of the General Contractors' Association of New York City in advising its members, by a resolution adopted, to discontinue the practice of paying for the privilege of estimating, whether under the guise of a deposit or otherwise.

It appears that certain architectural and engineering firms on the other side of the border have instituted the practice of charging a fee for the use of plans for estimating and that where insufficient plans have been prepared contractors have been charged for additional sets necessary for the completion of their contracts. In view of the recent editorial articles and discussions bearing upon this subject which have appeared in this journal, the observations of our contemporary are interesting.

The point of view from which an engineer should view the question raised, says The Engineering News, is the point of view of his client's interest. Is it or is it not for the interest of the client to charge a fee for the set of plans necessary for a contractor to use in order to prepare a close and careful estimate of the work on which he desires to bid? In public work, the letting of which is governed by statute, it is the general practice to furnish sets of plans free to any bona fide bidder. Where fees are charged, they are as a rule made nominal, merely to shut out those who desire to secure sets of plans for other purposes than bidding; or it is often the practice to make the fee merely a deposit, to be returned when a bona fide bid is filed.

The sound and valid reason for this practice on public work is that the work must be open to free competition, and that the charging of a fee for plans tends to discourage the submission of bids. The practice of requiring a certified check to accompany a bid is, of course, to prevent deposit of bids by irresponsible parties. This is not necessary, however, in the letting of private contracts where the principal or his engineer in letting a contract knows or can ascertain whether the bids submitted are bona fide, by responsible firms, and can discard bids from an irresponsible firm without any formality. To require every bidder to submit a certified check with his bid on a private contract, means the tying up of the banking funds of perhaps a dozen or a score of contracting firms for a period of perhaps a week or even a month while the bids are being considered and the award made. Further, misuse of such certified checks by the private parties receiving bids is always a possibility. We see, therefore, no good reason why such deposits should be required.

As for charging a fee for the use of plans required by bona fide bidders for estimating, it seems to us that there are few cases where the charging of such a fee will work in the long run to the interest of the party letting the contract. A good way to meet the situation where the detail plans involved in the work are exceedingly elaborate and expensive is to open the plans to inspection and study by contractors and their engineers in the office of the engineer in charge of the work. This can well be supplemented by preparing general specifications and general plans which can be cheaply reproduced in quantities by the phototype process and furnished free to any contractor who desires to look over the work in a preliminary way to decide whether he wishes to submit a bid.

We believe a little careful study of this matter by engineers will enable them to solve this problem to the advantage of both their clients and the contracting fraternity. It is no doubt true that a large expense is often incurred in making numerous sets of large blueprints for the supply of a large number of bidders on contract work. To charge a fee for these prints, however, simply distributes this burden to a number of contractors, only one of whom receives any return from the expenditure.

An Interesting Judgment Affecting Municipal Improvements

FROM Victoria, B.C., comes the report of an interesting judgment rendered by Judge Lampman in an appeal against a ruling of the Civic Court of Revision. Thanks to this judgment the owners on a number of streets on which underground conduits were laid, and against the assessments for which the owners complained, will not have to pay the levy made by the City.

The judgment held that as the work was carried out and completed early in 1912, but the customary advertisements indicating that the work was to be done were not published until October of the same year—thus preventing the owners to be assessed from objecting to the work if they so desired—the work was not done according to the provisions of the by-laws and the legal formalities were not carried out. An appeal was brought against the ruling of the Court of Re-

1913 27(Se)

vision, which, when the by-laws were being revised, refused to relieve the owners of the assessments.

In all there were thirteen by-laws before the recent Court of Revision. All of these provided for the assessment of owners for underground telephone conduits. The cost of the work was approximately $30,000 and doubtless there are other by-laws under which the work was carried out in similar manner. By the judgment of the court this cost must be borne by the city of Victoria. This phase of the question was considered by the Court of Revision, but the members thereof decided that if the owners objected to paying the assessments they could take legal action.

If the city pays the assessments levied against the owners—and in view of the recent decision there does not appear any other way out of the matter—the amount must be taken from general revenue. This will mean that next year's council at Victoria will be saddled with a tidy expenditure to come out of the revenue available for civic purposes in 1914.

Public Works—for Service or the Builder's Profit?

THE reasons for desiring the building of public works are of two kinds—first, a desire for the advantages that will grow out of the completed works, and, second, a desire for the advantages and profits of construction.

By common consent, only reasons of the first kind are officially and publicly urged in support of any given project, and it is well that this is so; but no one actively engaged in public work can be blind to the fact that reasons of the second kind are often—in fact much too often—more potent in securing actual results.

Both kinds of reasons may be legitimate. The contractor expects a profit and has the full right to look for what will yield it, and within reason to do what he can to advertise and promote the kind of works that he can build. The engineer and the architect, also, have a similar interest in the commissions that may come to them; and all those who may be employed, either by a public authority or by engineers and architects, or by contractors, have their interest in seeing matters move forward. Those who have land to sell, those who furnish all of the thousand kinds of supplies used in construction, and even the bankers who make a commission by the sale of bonds—all have an interest in seeing the expenditure of public moneys go forward.

Financial rewards are by no means the only ones that need be considered. The experience, the honor, the prestige, and the political power that come from carrying out works, especially when they meet with popular approval, are often potent in securing the cooperation of those who would not be influenced by financial considerations.

Up to a certain point all this is well and tends to progress and civilization. The danger lies in the chance that when the forces of construction that are necessary for progress are organized and developed they will come to have a dominating influence in the transaction of public business, and will secure the construction of public works that could not be justified from the standpoint of the results to be obtained from the finished works, and will do this for the sole, or principal, purpose of yielding the profits that grow out of construction. When a government reaches this stage it ceases to be a government for the people and becomes a kind of piracy in which the taxpayers are plundered.

There is need at this time as never before, in view of the slackness of private enterprise, of engineers and other citizens with breadth of view to rightly appraise the need for public works and with the honesty and courage to speak fearlessly concerning them.—Engineering Record.

Errors in Specifications

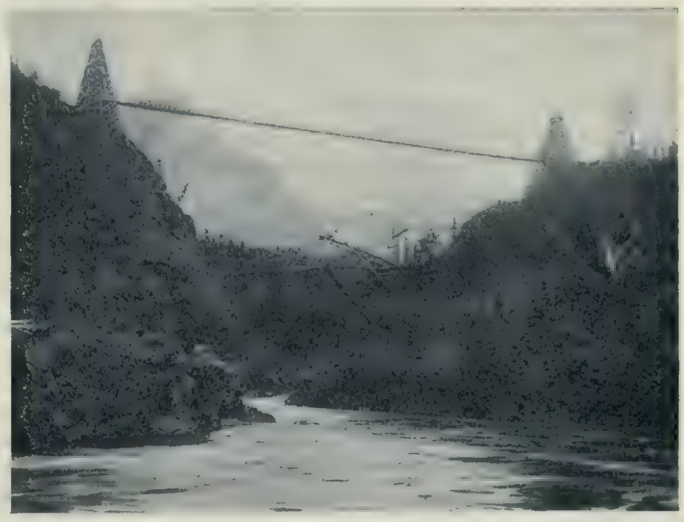
CARELESS proofreading is responsible for many inaccuracies in specifications, comments Engineering and Contracting. While most of these mistakes are unimportant yet there is a possibility that some of them might lead to serious results. In one specification that came to our attention two different dates were given on which the bids were to be opened. In the same document there was a mistake in the approximate quantities on which a comparison of the bids was to be based. The work included, among other items, about 300,000 cu. yds. of earth excavation. This amount, however, through error, was stated in the specifications as being 30,000 cu. yds. A mistake like this would be easily detected, but should it not be observed it might make some change in the standing of the bidders. With two contractors bidding 25 cts. and 24 cts. respectively on 30,000 cu. yds. there would be a difference of only $300 in their totals. But on 300,000 cu. yds. the difference would be 10 times as great, and this might be more than enough to offset the possible higher prices bid by the 24-ct. man on the other items of the contract. Mistakes through careless proofreading often occur in the papers for the preliminary steps for a public improvement. A few months ago a western contractor was "saved" from securing a $175,000 street paving contract by the discovery of his attorney that the council ordinance for the work called for the 'parking" of the street instead of the paving. The intention was plain, but the error got by the council committee, the city attorney, the city engineer, and the contractors, and was discovered only when the low bidder before signing the contract submitted the papers to his lawyer. In this case the whole proceeding had to be started all over again. The city council passed a new ordinance, the work was readvertised, and of course, this time, some other contractor got the contract.

A new "skyscraper" is to be erected in New York which will reach the colossal height of 901 ft., and is to form the permanent exhibition centre for the combined republics of America. The first floor will be an enormous hall, 200 ft. square and 30 ft. in height, which will always be used for purposes of exhibition of machinery. The second floor will be set apart for weekly exhibitions of local manufacturers, and the industries of north, south, east and west will be assigned a separate floor for their products. Four floors are to be set apart for the Latin-American Republics, the larger having each of them an entire floor, while the smaller will be grouped together two or three on a floor. Above these seven floors will be devoted to offices to be let to exporters, merchants, attorneys, and others whose business is connected with the Latin-American peoples. There will be a library devoted to books referring to Latin-American countries, and a floor will be given up to statistics and reports on American commerce, while space is to be provided for dining-rooms, conference rooms and lecture halls.

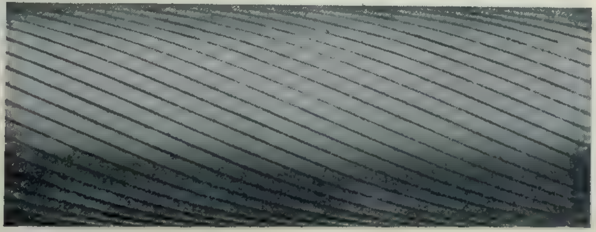
Large Single Span Suspension Bridge at New Hazelton, B. C.

THE new high level bridge which has recently been built across the Bulkley River Gorge at New Hazelton, B.C., by Geo. Cradock & Company, of Wakefield, England, and Vancouver, B.C., is one of the biggest single span suspension bridges in the world. It is also among the highest suspension bridges in Canada, being erected at a height of 250 feet above water. The bridge is one of Cradock's special stiffened structures, and is the first of its kind to be hung from catenaries of locked coil cables which do not rotate nor lengthen. The contract was awarded in the latter part of 1912, but owing to the severity of the northern winter it was impossible to undertake the work of excavating and erecting the foundations until the following spring.

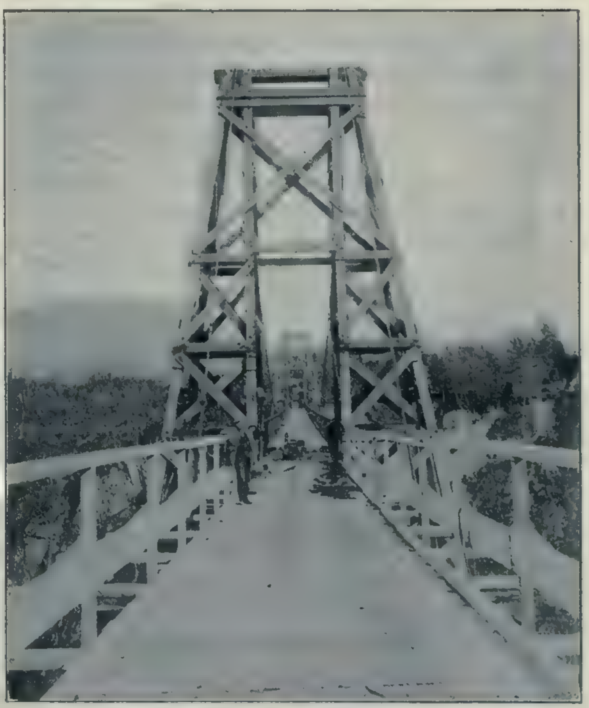
On account of the delay in making a start on the excavation it was considered advisable for Mr. Percy Cradock, one of the directors of the contracting firm, to come out from England and give the matter his personal attention. Mr. William Spencer, the company's chief engineer, also journeyed to British Columbia and acted as superintendent of the work until its completion last September. The length of time required in actual construction was only about two months, no difficulties whatever being encountered after the foundations had been completed. All the steel parts were sent out from England and fitted together perfectly, no undue strain being put upon the structure on this account.


Suspension bridge across Bulkley River, New Hazelton, B. C., showing old cantilever bridge, formerly occupying the site, built by Indians.

The bridge is the first to be erected in any part of the world in which Cradock's locked coil cable has been used. As already mentioned, it is at an elevation of 250 feet above water-level of the Bulkley River, spanning the river at a point where it is confined between the walls of a rugged canyon. The length of the single span is 451 feet, but with the approaches the total length of the structure is 600 feet. The bridge is suspended from timber towers, one of which is erected on a concrete pier, while the other is on solid rock. The cable used in construction is Cradock's locked coil steel wire rope, 2½ inches in diameter, and the bridge is cap- sides with four 3-in. steel bolts, two to each cable, and buried in blocks of concrete measuring 15 by 21 feet and weighing 150 tons approximately. The sides of the bridge are supported by stiffening steel girders of able of carrying a movable load of 18,000 pounds. At each end of the bridge the cables are anchored on both

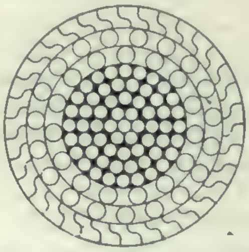

Locked coil cable used in construction of suspension bridge across Bulkley River

Suspension bridge across Bulkley River.


Roadway of suspension bridge across Bulkley River at New Hazelton, B. C.

lattice type, extending from the hand rails to the floor. The suspension rods are three-quarters of an inch with the screw bottoms thickened to seven-eighths of an inch, and are fastened to the suspension cables by clamps. These rods are placed four feet apart on either side, and at their lower extremities carry the bearers of the bridge, which are also of steel placed four feet apart and diagonally braced with steel angle iron. Fifty tons of steel have been used altogether in the construction. The towers are sixty-five feet six inches high, and the bridge is nine feet wide in the clear. The locked coil cable used in construction has a breaking strain of 350 tons. The floor of the bridge consists of 3 x 4-inch plank, laid on stringers 4 x 7 inches, resting on the steel bearers. All timber is of the best Coast fir. The accompanying cuts illustrate the work under construction, side and end views of the completed bridge, and in the side view is to be seen the cantilever bridge built by the Indians, which has withstood the winter snows, storms and traffic of many years. This old Indian bridge is one of the world's curiosities in engineering among primitive people, and the manner of its testing was as peculiar as the bridge itself. When it was completed the native builders placed a number of squaws on it to ascertain whether it would carry the load, and it was then passed for traffic.

The contract for the new bridge was carried out for the New Hazelton Bridge & Power Company, organized in Vancouver to protect the interests of New Hazelton. The structure fills a long-felt want in providing transportation in the Bulkley Valley. Erected in practically an undeveloped section of the province, amidst magnificent scenery, it suggests a useful type for bridges for crossings under similar conditions in British Columbia, Alaska and the Yukon.



Section of locked coil cable used in bridge across Bulkley River.

The work was completed before the government wagon road crossing the bridge had been surveyed, but as a result of petitions being sent to Victoria, road building operations were inaugurated without delay and the bridge is now available for traffic.

The new passenger station of the New York Central & Hudson River Railroad at Rochester is a large steel frame building occupying a triangular site one block east of the old station. The most important structural feature is the 122 x 156-ft. roof over the main waiting room. This is carried on four pairs of three-hinger steel arch trusses of 90 ft. 8-in. span supported in an unusual manner by long vertical and inclined posts engaging their skewback pins. The building contains 910 tons of structural steelwork, including 250 tons in the roof, all of which was fabricated and erected by the Buffalo Structural Steel Company. The roof trusses weigh 22 tons each, and each semi-truss was shop riveted in two sections. The station was designed and erected under the joint direction of Mr. Claude Bragdon, of Rochester, the associate architects of the railroad engineering department, and Mr. G. W. Kittredge, chief engineer, and Mr. J. W. Pfau, engineer of construction, of the New York Central & Hudson River Railroad. Mr. F. E. Paradis, district engineer of the Western district, was in charge of all construction and Mr. J. B. Reinhardt was resident engineer. The steelwork was designed by Mr. J. L. Miller, assistant engineer.

Observations on Bridge Expansion

THE question of bridge expansion has a number of doubtful points: (1) Some engineers regard expansion provision as a more or less unnecessary refinement and believe that bridges and similar structures of steel do not change in length perceptibly under varying temperature conditions. (2) While it is known that a straight bar of steel will expand or contract under temperature changes uniformly at the rate of 0.0000067 per degree F., there are no recorded observations to show that the same expansion-coefficient applies to a complex structure like a bridge, which contains joints, etc.

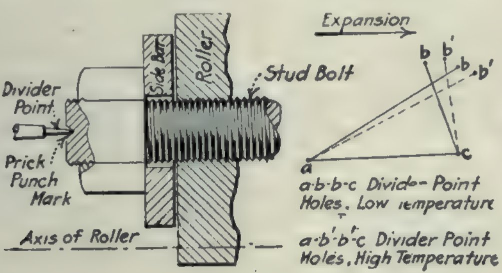
Three years ago the writer made a series of observations of steel railway bridges erected on various lines of the New York, New Haven & Hartford R.R., to determine the action of the expansion bearings. The bridges on which the observations were made are all relatively new, having been erected during the past ten years. In all, forty-five observations were made, on as many different bridges. Of these 16 were pin-connected trusses, varying in length from 182 to 217 ft.; 11 were riveted through trusses, 70 to 145 ft. in span; and 18 were deck plate-girder bridges, 70 to 111½ ft. in span. The winter temperatures during which observations were made (1910-11) ranged from + 15 to + 56 deg. F., and the summer temperatures (the following summer) ranged from 45 to 86 deg. F. The variation from high to low temperature during a single set of observations ranged from 18 deg. change as a minimum to 54 deg. change as a maximum.

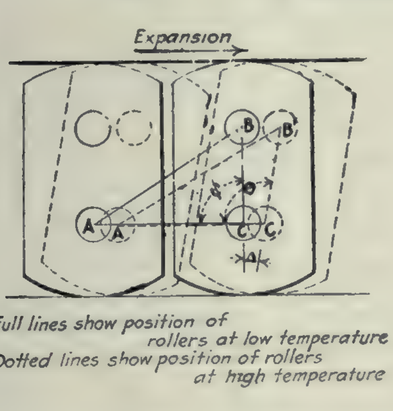
In all the through bridges observed upon, the floors were of the standard floorbeam-and-stringer construction; the deck plate-girder spans had the roadbed supported directly on the girders. The roller nests were in all cases made up of 6-in. segmental rollers connected by pairs of parallel side bars attached to the rollers with studs; the bearing surfaces of the shoes were planed.

The method of obtaining reliable measurements of the small expansion movements is illustrated by the adjoining sketch. Prick-punch marks were made in the centres of three studs in two adjacent rollers, and the distances between the marks were measured by a pair of dividers. The divider measurements were not read off on a scale, however, but were transferred directly to the pages of a notebook by pressing the divider points into the page. The second reading was recorded in this way on the same page on which the first reading (at lower or higher temperatures as the case might be) had been recorded. It was an easy matter to compute or work out graphically the angular movement of the rollers as represented by the two measurements and therefrom determine the expansion or contraction as a linear measurement.

To compute the coefficient of expansion, it was necessary to know the temperature of the bridge at each observation. It might be thought that very precise temperature readings would be necessary, but the following observation indicated that this was not the case: a 217-ft. pin-connected truss span was watched while the atmospheric temperature was rapidly rising under the warm rays of the morning sun. It was noted that a movement occurred at the roller bearing for every 3 to 5 deg. F. rise in temperature, and whenever such a movement occurred there was a loud noise. The bridge and its bearings were in good condition. It is concluded from the observation that, even under nearly ideal conditions of free movement, the expansion movement of a bridge does not take place smoothly and continuously. If this is true, great precision in the temperature readings is an unnecessary refinement, adding nothing to the accuracy of the final results. The noise accompanying the successive expansion movements suggests that there was an accumulation of expansion stress in the bridge prior to a movement.

The temperature readings were therefore confined to readings of the air temperature. In a few cases the bulb of the thermometer was in actual contact with the steel, but the readings then were practically the same as the readings taken with the thermometer bulb free from the bridge. It may be true, perhaps, that the actual temperature of the steel is somewhat lower an hour after sunrise than the temperature of the surrounding air (or similarly, higher than air temperature an hour after sunset); but the observations were all taken between 10 a.m. and 5 p.m., and during this part of the day it is believed that the internal temperature of the steel and the temperature of the surrounding air are very closely the same, in view of the large exposed surface of bridge members and the rapid transmission of heat through iron. Moreover, any attempt at accuracy in measuring the temperature of the steel would be nullified by the fact that at any time of the day some parts of a bridge are shaded while others are exposed to the direct rays of the sun, which makes it a question at what point of the bridge the temperature of the steel is to be determined.


Expansion
Side Bar
Roller
Stud Bolt
Divider Point
Prick Punch Mark
Axis of Roller
b
b'
b
b'
a
c
a-b-b-c Divider Point Holes. Low temperature
a-b'-b'-c Divider Point Holes, High Temperature


Expansion
B
B
A
A
C
C
O
Δ
Full lines show position of rollers at low temperature
Dotted lines show position of rollers at high temperature

The following table gives the results as regards coefficient of expansion obtained from the three classes of bridge observed upon. These three values, while differing somewhat among themselves, are closely enough in agreement with the generally accepted coefficient of expansion of steel to warrant the conclusion that a bridge expands just like a solid bar. Whether the lower value obtained for the pin-connected trusses is due to play in the joints may be a matter of opinion.

Conclusions

(1) The coefficient of expansion for an assembled bridge structure is practically the same as the laboratory coefficient of a specimen of the same material.

(2) Expansion bearings of steel segmental rollers 5 to 7 in. in diameter properly connected by parallel side-bars and rolling between planed steel surfaces are effective and will take care of all expansion and contraction with at best a very slight amount of secondary stress in the members of the bridge. From other observations, however, it is concluded at the same time that rollers less than 2½ in. in diameter under light steel highway bridges are not effective for any length of time.

EXPANSION COEFFICIENT OF STEEL RAILWAY BRIDGES

Number of observations	Type of bridge	Average variation in temperature	Observed coefficient of expansion
16	Pin-connected	39° F.	0.0000053
11	Riveted	30° F.	0.0000064
18	Plate-girder	44° F.	0.0000063

(3) A steel cog or other mechanical device to connect the rollers with the bearing plates in such a way as to compel them to turn is unnecessary. The observations showed that rollers without this device acted with just as much freedom as those having it. In neither case was there any sliding.

Improper Placing of Rollers in Erection

During the observations described above, the roller bearing of one bridge (not included in the series reported above) was found with the rollers in such tight contact that it was difficult to detect any parting line between them. This was observed at a temperature of 27 deg. F., and the axes of the segmental rollers were inclined away from the middle of the bridge, so that it was quite out of the question for the bearing to accommodate a further increase in truss length. This bridge was 160 ft. in span, a heavy double-track bridge erected about five years ago. The rollers were 6 in. in diameter. The position of the rollers was doubtless due to carelessness on the part of the erector when setting the rollers. It is easy to imagine that when the temperature rises to 100 deg. F. this bridge will be compelled to slide on its bearing plates.

Erectors should be cautioned to give the setting of the rollers careful attention, and to set the rollers according to the temperature at the time of erection, so that the maximum elongation and contraction counted upon can actually be accommodated.

Roller nests under trusses are machines—a combination of moving parts—to perform certain work. They should have the same attention and consideration as any other machine exposed to the weather. Owing to the fact that the position of rollers makes them practically inaccessible after erection they receive little or no attention during the life of a bridge. In winter they are surrounded by snow and ice which thaws and keeps them moist. Usually there is little provision for drainage and the conditions for corrosion are ideal. Sometimes sticks and stones get into the roller nest and help to prevent movement. Bearings should be designed so that these conditions will be avoided. Maintenance cannot be depended upon to keep roller nests in perfect condition.—H. A. Loser in The Engineering News.

Bituminous Surface Treatment and Dust Preventive*

By William H. Connell

BITUMINOUS surface treatments and dust preventives should be divided into two main divisions, each with a sub-division, and for convenience they will be classified as follows:

1.—Bituminous surface treatment designed to waterproof and act as a wearing surface on waterbound macadam, gravel, shell, slag, and dirt roads.

1a.—Dust preventives for waterbound macadam, gravel, shell, slag, and dirt roads.

2.—Bituminous surface treatments designed to waterproof and rejuvenate old bituminous pavements, sheet asphalt, asphalt block, and wood block pavements, and to be used as a wearing surface on concrete and old brick pavements.

2a.—Dust preventives for standard types of pavements; commonly used in municipalities, such as ordinary water sprinkling, washing with squeegees, and flushing. (For convenience in this paper bituminous pavements will refer to pavements consisting of stone, or stone and sand mixed with a bituminous binder, built by penetration or mixing method.)

The first classification applies more generally to country roads and the second to town and city pavements. There is so much overlapping, however, in the handling of these respective classes of highway work, that a highway engineer should be familiar with all branches of highway work in connection with both roads and pavements, and it is therefore desirable to take this subject up as a whole rather than confine it to country roads.

Materials and Conditions

The use of bituminous surface treatments and dust preventives on country roads has now become so general that there is no longer the mystery attached to the respective merits of the bituminous materials and dust preventives in general use that has existed in the past; in fact, we have reached the point where there are more or less standard methods of treatment for the different types of roads and, by making a careful study of its condition, it is not difficult to determine upon the best available treatment suited to the road in question, based upon former treatments of similar roads under like conditions. Therefore, as far as the materials in general use are concerned, we can get a more or less satisfactory treatment for all classes of macadam, gravel, dirt, and shell roads, but we have by no means reached the point where we have an ideal treatment for such roads. We have, however, reached the point where there is no necessity for extravagant waste in connection with our surface treatments, and going on the theory that an ounce of prevention is worth a pound of cure, it is far better to employ expert advice in connection with work of this character than to have inexcusable and disastrous failures due to the use of bituminous materials not adapted to the conditions, or the conditions not being satisfactory for bituminous surface treatment. The principal cause of the numerous failures is that there is too little attention paid to this phase of the situation and, as a matter of fact, it is just as necessary to employ expert advice in connection with this work as in any other branch of engineering work.

New materials and methods of treatment resulting from laboratory experiments and research work should be developed through experiments on sections of roadway of sufficient length, rather than through wholesale use, which may or may not result in a failure, and in fact, more often does result in a failure on first trial. There have been numerous papers and discussions on the subject of bituminous surface treatments and dust preventives in the past five years and while there were wide differences of opinion concerning the respective merits of the available bituminous materials and dust preventives, and the proper methods of treatment in the early papers on the subject, a review of the papers written by recognized authorities within the past two years shows that insofar as the treatment of country roads is concerned there is little if any difference of opinion concerning the underlying principles that should govern the selection of materials and the preparation of the road for surface treatment. This being the case, a great deal of repetition can be avoided and a better understanding reached by formulating standards relating to the elementary principles of the selection and the use of bituminous surface treatments and dust preventives for country roads. This will result in stimulating scientific research, and the development of new thought in the other phases of this all important subject, namely—the bituminous materials which are shrouded in so much mystery, due in part to trade conditions, and in which the advance has not been commensurate with the possibilities in the past two years. We are face to face with this problem and our progress within the next few years depends upon bettering the bituminous materials and dust preventives now in use. As it is assumed you are familiar with or have read articles by recognized authorities covering the underlying principles relating to the selection and application of bituminous materials and dust preventives on different types of country roads, this phase of the subject will close with the following summary of work of this character done in Philadelphia during the past year.

During the year 1913 the Bureau of Highways treated 415,000 square yards of waterbound macadam with various tars and asphalt cut-backs, at a cost of .049c to .10c per square yard. The high cost for some of this work was due to several reasons; first, the work was widely scattered throughout the entire city and in a large number of cases only consisted of one or two blocks, making it very expensive to move the gangs and equipment from place to place. Second, lack of experienced men to handle the work, and third, on account of the high cost of suitable top dressing available in this locality. The material used was a Torpedo sand passing a ¾-in. screen with not over 10 per cent. passing a No. 20 sieve, which cost from $2.50 to $2.75 per ton delivered on the road. This is also the standard price for clean trap rock chips in this locality. The labor cost for sweeping and chipping ran from .007c to .036c per square yard, and chips and gravel from .018c to .048c per square yard, bituminous material from .013c to .045c per square yard applied. The cost of the bituminous material was as follows: Tarvia A .085c, Tarvia B .07c, Ugite 1-C .07c, and Ugite No. 3 .08c; asphalt cut-back, .12c per gallon applied.

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*Paper presented at the tenth annual convention of the American Road Builders' Association, Philadelphia. December 9-12, 1913.

Realizing the importance of cleaning the macadam thoroughly before applying the bituminous material, both hand and machine brooms, as well as scrapers were used, care being taken to remove all dust and dirt so that the stone was absolutely bare, after which the bituminous material was applied in quantities of from 1/3 to ½ gallon per square yard. Wherever possible the road was blocked off and the material allowed to penetrate for a matter of twenty-four hours before chipping. If traffic conditions would not permit blocking the road for this period of time, it was chipped before stopping work for the day. The quantity of chips applied averaged from 13 to 14 lbs. per square yard, depending upon the amount and character of the bituminous material used. Every effort was made to avoid creating a pad on the macadam surface, especially on heavy grades. Where the bituminous material was applied during the cold weather very little, if any, penetration was secured, which resulted in a thin pad. Several old tar penetration sections were treated with a light application of about one-quarter gallon per square yard of tar and then chipped, which in most cases has put the road in good condition and will undoubtedly lengthen its life for a period of a couple of years.

The asphalt cut-back consisted of 65 per cent. of asphalt with a penetration of 140 to 160 at 77 deg. F., cut back with 35 per cent. of commercial naphtha with a gravity of 53 to 55 Beaume. This was applied in quantities of from 1/3 to ½ gallon per square yard. The naphtha acted as a carrying agent and in most cases a penetration of about ¾ in. was obtained, depending upon the temperature. The material was applied cold and in some cases it was fired immediately after the application, burning out the naphtha, which resulted in an immediate set in the asphalt and up to the present time the results have been very satisfactory. The results obtained from the various tars used have been very satisfactory with the exception of a few sections which were applied late in the Fall and which we believed contained too large a percentage of asphalt in the tar, causing a very mucky condition after each rain.

Avoid a Pad

The primary consideration pertaining to the application, all other conditions being satisfactory, was to avoid a pad, the object being to waterproof the surface of the roadway and use just enough material for this purpose, so that the surface would wear off uniformly and be in condition for a new application when necessary, instead of having it creep and pit in spots, which is often the case with a bituminous pad and which is very difficult to satisfactorily repair. The selection of the bituminous materials used in each case was governed by the fundamental or underlying principles covering this phase of the subject.

The tar treatments were applied hot and cold under pressure, depending upon the material used. In the case of the material applied cold about one-third to one-half gallon per square yard was used, while in the case of the hot application from one-quarter to one-third gallon was used. The cost of the cold application of tar averaged .067c per square yard, while the hot application averaged .087c per square yard. These costs are high, notwithstanding the high cost of top dressing in this locality, due to this class of work being new to the organization performing the work. Other materials used were Gluterin, which was diluted by adding 50 per cent. of water and applied at the rate of one-half gallon to the square yard, and calcium chloride and asphaltic oil, of about 18 to 21 Beaume gravity, applied at the rate of one-quarter gallon to the square yard. These two latter materials were used simply as dust layers.

With regard to the vast field coming under the head of the second division, that covering the more permanent types of pavement, little progress has been made in treatments designed to waterproof and rejuvenate old sheet asphalt and such types of pavements, except possibly in St. Louis, Mo. It is far from exaggeration to say, however, that large sums of money (resulting from prolonging the life of, particularly sheet asphalt and asphalt block pavements) can be saved by suitable surface treatment on old pavements of this type requiring such attention. The same can also be said of old bituminous pavements built either by the penetration or mixing methods, and a great deal of work of this character has been done in Philadelphia this year. Considerable experimentative and research work, however, has been carried on in connection with bituminous surface treatments on concrete throughout the country without entirely satisfactory results. The following experimental bituminous surface treatments on concrete have been laid on the Service Test Road (Byberry and Bensalem Turnpike) this year.

Section 3, Station 47-00 to 50-00: One-half gallon per square yard of Pioneer Road Surface Asphalt was applied at a temperature of 350 degrees, covered with clean trap rock chips passing a ⅜-in. screen and rolled with a 6-ton tandem roller.

From Station 52-50 to 54-58, a bituminous top of Ugite was applied. After sweeping the surface of the concrete, 1/6 gallon per square yard of Ugite A was applied by hand and ⅜ gallon per square yard of Ugite No. 3 was then applied, at a temperature of 280 degrees, by a pressure distributor. A coating of ¾-in. dry trap rock chips followed. Another application of ¼ gallon per square yard of Ugite No. 3 was then applied, at a temperature of 280 degrees, by a pressure distributor, which in turn was covered with Torpedo sand and rolled with a 12-ton three wheel roller.

From Station 54-58 to 57-17, a bituminous top of Tarvia was applied. After sweeping the surface of the concrete, ¼ gallon per square yard of Tarvia B was applied cold, after which ⅜ gallon per square yard of Tarvia A was then applied, at a temperature of 250 degrees, with a pressure distributor and covered with Torpedo sand.

From Station 57-17 to 59-50, a bituminous top of Texaco asphalt was applied. After sweeping the surface of the concrete, ⅛ gallon per square yard of Texaco asphalt cut-back with naphtha was applied by hand, after which 6/10 gallon per square yard of Texaco asphalt, 55 penetration, was applied by hand at a temperature of 450 degrees and covered with clean trap rock chips passing a ¾-in. screen and rolled with a 12-ton three wheel roller.

From Station 87-50 to 92-00, a bituminous top was laid. From Station 87-50 to 90-00, 4/10 gallon per square yard of Dolarway bitumen was applied at a temperature of 207 degrees and covered with Torpedo sand.

From Station 90-00 to 90-70, ⅛ gallon per square yard of Bicomac was spread on the surface of the concrete pavement. A mixture of trap rock chips, trap rock dust and Bicomac was then applied and rolled with a hand roller. One-half of this surface was covered with trap rock dust and rolled lightly. The other half was covered with trap rock chips and rolled lightly.

From Station 90-70 to 91-35, 4/10 gallon per square yard of asphalt cut-back with naphtha was spread upon the surface of the concrete pavement and the naphtha burned out. Trap rock chips were then spread and rolled into this asphalt coating with a hand roller.

From Station 91-35 to 92-00, ⅛ gallon per square yard of Bicomac was spread upon the surface of the concrete pavement, after which 4/10 gallon per square yard of asphalt was applied at a temperature of 400 degrees and covered with clean trap rock chips.

Section 14, Station 112-50 to 118-00; One-quarter gallon per square yard of Ugite No. 3 was applied here, at a temperature of 250 degrees, by a pressure distributor, which was covered with clean trap rock chips passing a ½-in. screen and rolled with a 6-ton tandem roller, after which ¼ gallon per square yard of an asphaltic cement was applied, at a temperature of 425 degrees, by a pressure distributor and covered with clean trap rock chips passing a ½-in. screen and rolled.

The methods used to do away with the dust nuisance on the more permanent types of pavements are thorough cleaning, preferably washing with squeegees, flushing with pressure flushing machines or a hose. The field for the class of work coming under the subject of this paper and covered by the second division has been only lightly touched upon in this paper, and, as a matter of fact, has not, generally speaking, been given the attention throughout the country that it deserves, excepting bituminous surface treatments on concrete.

In conclusion it might be well to add, that after all is said and done we only too often have to cut our cloth according to our pockets and cannot always use the type of bituminous surface treatment and dust preventive we prefer, but, even so, there is such a thing as doing the best we can under these conditions and if whatever may be done is the result of careful consideration, embodied with personal knowledge on the subject or advice from some recognized authority, conditions can always be bettered.

Moving Loads on Steel Bridges

Consideration of Stresses Produced by Train Crossing Truss and Girder Spans

INVESTIGATIONS of the stresses produced in steel railroad spans by locomotives and trains moving across them, at different speeds, have been in progress at Washington University since 1906, and a review of them recently published by Mr. E. O. Sweetser, assistant professor of civil engineering, does not warrant final conclusions, but indicates that impact stresses increase with the speed of the locomotive, but do not appear to have any fixed relation to it for short spans.

In 1906 records were made by students on stresses in a 150-ft. pin-connected single track Pratt truss span built in 1883 with suspended floorbeams and light lateral and floor systems. The investigators concluded that "the present formulae seem to be extravagantly generous in the allowance for impact." In the light of subsequent investigation Professor Sweetser believed this to indicate something radically wrong in the assumptions made as to the distribution of static stress.

Additional experiments on the same bridge in 1907 lead to the conclusions that for "speeds up to 15 miles per hour there is no increase of stress; for speeds up to 36 miles per hour there is an increase of 25 per cent., and for speeds up to 45 miles per hour there is an increase of 30 per cent. in stress."

In 1910 and 1911 tests were made on three bridges under the direction of Professor Sweetser. The records were made both under regular traffic and under special trains consisting of a freight locomotive followed by four or five heavy cars run across the bridge at different speeds. The stresses were indicated by special extensometers recording the elongation in a measured distance of 50 in. These two instruments magnified elongations about 56.5 and 59.5 times and recorded the amounts by a pencil moving on paper transverse to the direction in which the paper was moved automatically by clockwork. The speed of trains was determined by timing them with a stop watch over measured distances of 500 ft. for high speed and from 100 to 200 ft. for low speeds.

About 300 records were made of the effects of trains passing over three 153 ft. 1½-in. riveted through-truss single-track spans of bridge 18.2 of the St. Louis & San Francisco Railway at speeds varying from 2½ to 50 miles per hour. This bridge replaced the one previously tested, and had heavy members capable of resisting both compression and tension stresses. Most of the records were made on the center span. The lower chords, main diagonals, one suspender, top chords, secondary verticals, and end posts were tested.

About 50 records were taken of train loads on the single track deck-plate girders, 69 in. deep, in a two span bridge for the Missouri Pacific Railway. The extensometer was placed on the tension flange of the girder at the center of the span. The speed of the trains varied from 7 to 51 miles per hour.

About 200 records were made of train loads on the 36-in. plate girders for a 33-ft. deck single-track span of the St. Louis & San Francisco Railroad, the extensometers being placed on both inner and outer flanges.

About 300 records were made of trains on two spans of 52-ft. deck plate girders 69 in. deep with a track curved 2 deg.

The analysis of the results of the tests and the curves from them indicate that the distribution of stress in plate girder flanges is not at all uniform and that considerable impact often exists for short spans at speeds of 10 miles per hour, and that such a speed does not necessarily give a static stress.—Engineering Record.

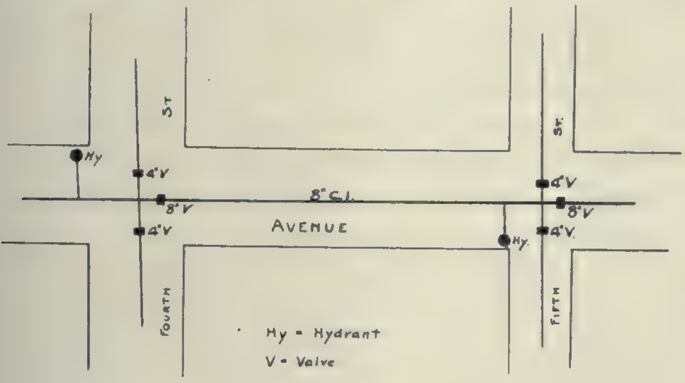
Large drain tile show blisters even before they go into the kiln. This is due quite often to the presence of mica in the clay. Mica is greasy and slippery and fails to unite properly with the clay. Blisters form at these places. While burning they open up. An extension on the tile press, between the clay cylinder and the die, permits the clay to travel further, giving it the time to unite before issuing from the die. This, as a rule, overcomes blister trouble.

Nanaimo Water Supply

THE City of Nanaimo is frequently called the industrial and distributing centre of Vancouver Island. It is also the centre of the coal mining industry and its resources in this respect are said to be practically unlimited; so, too, fortunately, is its water supply.

The continued steady growth of the city can be readily ascertained from the increased numbers in the "tappings" of the water mains, these have been so persistently increasing that an additional pipe line has had to be laid from No. 1 dam to the city. The water supplied to Nanaimo collects on the snow-capped mountains at the source of the Nanaimo River, some twenty miles away, consequently even on the hottest day of summer the drinking water is cold, pure, sparkling and abundant.

A corporation water works loan by-law sanctioned the expenditure of $50,000 on the construction of an 18-in. wooden water main and the general improvement of the distribution system of the district. Before any construction work took place the following important details were decided by the Water-Works Commission: (1) That the plan of the proposed unproved distribution system be adopted, and the work carried out according to the scheme laid down. (2) That the water mains on all principal residential streets be not less than six-inch diameter with four-inch diameter laterals on less important streets. (3) That all mains should be under separate control for each block (see tracing) and that no "dead" ends be allowed, but all pipes to be in circuit, and hydrants placed at the corner of each block.



The total length of 18-in. diameter pipe laid from No. 1 dam to the city was 10,800 feet, the pipe being supplied by the Dominion Wood Pipe Company, Limited, New Westminster. The whole of the excavating and filling was done by the city workmen. Unfortunately at about two thousand feet from the dam a large amount of conglomerate rock was met with in what to all appearance was simply an alluvial soil. This conglomerate is perhaps the most difficult rock to deal with from an excavator's point of view. It is simply Nature's concrete of first-class composition. Blasting has little effect on the rock except to form pop holes and it is a matter of slogging and "burning" out the conglomerate. At the outlet from the dam a reinforced concrete chamber, approximately 8 ft. x 6 ft. x 6 ft., was built. The top was formed of reinforced concrete with a cast-iron cover which is secured with gunmetal bolts. This chamber holds the screens and also acts as a flush chamber when so required. The line of pipe was practically straight, with one or two sharp angle turns. One of these was made in wooden pipes of short lengths (see sketch) and the other by a special casting.

Nanaimo water supply—showing dense bush through which the pipe was taken.

To provide for further extensions of the distribution system, five cast-iron crosses, 18 in. x 18 in., were put in. This obviates the necessity of tapping the wooden main at any time. Valves have been placed at each branch and these can be taken through the sub-divisions as the population increases.

One of the great drawbacks to the cities in the Far West is that of obtaining, a quick delivery of supplies and the firm of iron founders who have the intention to lay in a stock of standard supplies for water main and fittings on this side of the continent will readily find a good demand.

"Brick is the best kind of pavement that our experience has been able to develop, on account of its moderate first cost, its smoothness, wearing, qualities, light maintenance expense, and the ease with which it can be cleaned. I regard our 600 miles of brick pavement in the city and 400 miles of rural brick highways in the country as a distinct commercial asset worth many times what it cost."—Newton D. Baker, Mayor of Cleveland.

Method of carrying pipes to trenches, Nanaimo, B. C

Methods of Heating Various Types of Buildings

Contributed by Harry H. Angus, Consulting Engineer, Toronto

HEATING and ventilation may be accomplished by the use of hot air, hot water or steam, as the medium for carrying the heat. The question of deciding upon the best medium to use depends largely on the type and size of building in which the heating plant is installed. Generally speaking each system has its special field, although this is not always the case.

In general, buildings may be divided into four main divisions as follows:—(1) residences; (2) schools and public buildings, in which ventilation as well as heat is required; (2) buildings, such as factories, warehouses, etc., in which no ventilation is required; (4) buildings in which the ceilings are very high, such as boiler shops, foundries, and some large churches.

Taking these buildings in this order, we have residences as the first division. These are almost always heated either by hot air furnaces or by the hot water gravity system.

The main points in favor of the furnace system are: (1) low cost of installation; (2) heating combined with ventilation; (3) the rapidity with which the system responds to light service. In case of dwelling houses a furnace can be installed for about one-third the cost of any other system. It is also quite evident that ventilation may be very easily obtained with this system. In order to do this, it is only necessary that the furnace draw its supply of cold air from outside. The amount of fresh air entering may be easily varied by adjusting the size of the inlet through which the outside air must enter. The rest of the air to be heated is drawn from the floors of the heated rooms. The owner, with a system of this kind, is thus free to secure the quality of ventilation he desires up to a certain point. Of course, the cost of operation rises rapidly as the quality of ventilation increases, as it requires much more fuel to heat a cubic foot of outside air up to the temperature required than to heat a cubic foot of air from the floor of the room when the room is kept at ordinary temperature.

The main disadvantages of the hot air furnace are: (1) the difficulty of heating the windward side of the house; (2) the contamination of the air supply by the fuel gases leaking through the joints in the furnace; (3) the cost of operation when outside air is circulated.

There can be no doubt that the natural draft from the hot air furnace is very weak and any difference in pressure will tend to force the air along the line of least resistance. If, however, this system is well designed, and both a heat flue and a vent flue are supplied in each room, the trouble is not so serious as with the usual system installed, in which the vents are only taken from one or two rooms. The contamination of the air supply, by the fuel gases leaking through the joints, can be avoided by proper construction of the furnace, and by keeping it in good repair.

In connection with the inlet and vent pipes, probably one of the worst troubles is that due to dust and dirt accumulating in the flues and being later blown out into the room by the velocity of the air. The flue gases in many cases do sooner or later get into the rooms, due to leaky joints which are not usually repaired.

The cost of operation, as before stated, depends largely on the amount of fresh air entering the furnace. If the outside air is entirely closed off, there should be no great variation between the cost of operation of the hot air system and that of any other system. The hot air furnace consists essentially of two shells, one inside the other, the fire being placed in the inner shell, and the air to be heated circulating in the outer shell. In the case of some of the larger furnaces, however, the outer casing is omitted, and the furnace is enclosed by walls usually of brick, and the air to be heated passes through this chamber. In order to get over the dryness of the air when heated to a high temperature, furnaces are usually supplied with water pans which keep the air saturated.

In the case of large furnaces where ducts are long and nearly horizontal, a fan is sometimes used to force the air along the ducts, the fan being located between the fresh air inlet and the furnaces, so as to keep a slight pressure on the furnace and thus prevent the escape of the fuel gases as much as possible.

The other method of heating residences is by the use of hot water which is circulated by radiators, and there can be no doubt that, for the better and larger residences, this is the most popular system. The main advantages with the hot water system are that it does away with openings in walls or floors, which are dust collectors and to a certain extent unsightly; also that the circulation of hot water is independent of air currents, and it is just as easy to get the hot water to flow to one part of the house as another. The hot water radiators also are usually placed under the windows where they are most effective.

Hot water also retains its heat, and, therefore, it is easier to keep a house at an even temperature than with hot air. Also the hot water system is free from the leakage of fuel gases into the different parts of the house, as sometimes happens with the hot air system. There are a number of other advantages of the hot water system in residence work, but it is believed that these are the main ones. Its great disadvantage, of course, is that there is no ventilation of the rooms, and this must be effected by opening windows and doors, causing drafts.

Heating School and Other Public Buildings

We come next to the class of buildings such as schools and other buildings where a large number of people are congregated into a comparatively small space. In these buildings the question of ventilation is an important one. Such buildings were at one time heated by hot air furnaces, but their use has been practically discontinued and the usual practice now is to use a certain amount of radiation in each room, and also to supply a certain amount of air to each room, the air being heated usually slightly higher than the temperature of the room. The direct radiation, which is usually steam in the larger buildings and hot water in the smaller ones, supplies the main part of the heat; the air, which is taken from outside and heated, usually by passing over steam or hot water coils, and then forced into the room by means of a fan, supplies the ventilation. The main reason for use of the two systems is that the ventilation is only required while the rooms are occupied, and as soon as the occupants are out of the rooms, the fan is shut down.

Unless some heat were supplied of course the rooms would then rapidly cool off, and it is partly to provide against this that direct radiation is installed. It can be readily seen, of course, that it costs considerable to operate the ventilating apparatus, as the cold air is drawn in from outside, heated, blown into the room, and exhausted at the room temperature, which means that a great deal of the heat in the air is wasted. When it is remembered, that in buildings of this class, the air is usually changed about six times per hour, the cost of operation is readily understood.

With a system of this kind, the amount of direct radiation required is, of course, less than if the ventilating system were not used, as the hot air coming in at a slightly higher temperature than the room, and also being forced in under a slight pressure, prevents the cold air from leaking in as the air in the room is under a slight pressure.

The use of both a heating and ventilating system, of course, costs considerably more to install and operate than if the building were heated by either system by itself. Occasionally buildings are heated by forced hot air altogether, but as stated before this usually results in considerable waste of fuel, as the air is taken from outside. If the air instead of being taken from outside, is re-circulated in the building, it is still necessary to run the fan, which not only takes considerable power but requires a regular attendant on the job all of the time. If the fan is shut down over night in such a system, the rooms get chilled before morning, and it takes some time to get them warm again.

Warehouses and Office Buildings

Coming to those buildings which are heated and not ventilated, we have such buildings as warehouses, office buildings, etc. A great many buildings, of course, which have no ventilation should have it, but it is omitted on account of the cost. There is no doubt that every building, where the number of occupants is large compared with floor space, should be ventilated. There are, however, a number of buildings such as warehouses, storages, etc., where the results would not warrant the additional cost. These buildings are usually heated by either steam or hot water. Gravity hot water system is of course limited to smaller buildings, as the force circulating the water is not sufficient to guarantee circulation in a building where the friction losses are great or the runs long. In such cases forced hot water is used, that is, the hot water is forced through the building by means of pumps. The main advantages of this system are: (1) economy of operation, due to fact that water may be circulated at any temperature or any speed, thus giving the man in the engine room practically control of the heating. This may be readily seen from the fact that steam must be 212 deg. F. or more so that on a mild day the rooms are too warm, and the occupants must open and close the radiators. With the hot water system the temperature of the water may be varied to suit the outside temperature.

Other advantages of hot water over steam are; mains may be run to suit contour of building, no drips being necessary as with steam; large storage capacity, which means ease in keeping uniform temperature. Where steam is used it may be either circulated under slight prssure or by some vacuum system. The question of deciding between steam and forced hot water heating, depends largely on the use to which the building is to be put. Where there are groups of buildings to be heated by a control plant, there is no doubt that the forced hot water system is the most popular, and most efficient, and the simplest since its economy of operation is not dependent on the adjustment of delicate parts, such as thermostats, and the same temperature is maintained year after year. The main limitation to the use of forced hot water is the height of the building and where this height exceeds one hundred feet, the pressure becomes so great on the radiators and connections that there is liable to be considerable leakage.

Foundries and Machine Shops

The other class of buildings are those with high ceilings and large window areas, such as, foundries, machine shops, etc., and these buildings are usually heated by the forced blast apparatus, although pipe coils are sometimes used. For such buildings the cost of installation is probably not much different, but the cost of operation of the fan blast system is usually slightly less than with direct radiation. There are, however, other advantages which point to the fan system as the best one for this work.

In buildings of this kind, there is difficulty on account of the heated air rising to the roof, and passing out through the ventilators. This acts like a chimney, and draws in cold air through every opening around the windows and doors at the floor level, causing bad drafts, and also wasting a great deal of heat. The fan system, by delivering air at a slight pressure, does away with this leakage, as the pressure in the building is slightly higher than that outside.

Then, if direct radiation is to be used it is difficult to get a suitable place to locate the coils except around the outside walls, but with the fan system the pipes are usually run overhead, and openings can be left at suitable places, and the air is forced through and so can be more evenly distributed. Also with direct radiation on account of the coils being close to the walls a good deal of the heat is radiated through the walls without affecting the temperature of the building, while the fan system heats the air itself. Fan systems also heat the air up much more rapidly in the morning, as if the cold air inlets are closed the fan rotates the air of the shop through the coils heating it up slightly every time it passes through. It is comparatively easy, with the fan system, to remove smoke, steam and dust, through the monitor. A fan system should have its inlet so arranged that it can draw its air either entirely or partly from outside or from the shop.

Another disadvantage of the pipe coils is that they are liable to be broken or damaged, and there is also a long run of pipe around the building which must be kept in repair. The fan system having one central location, and merely air pipes running around the shop, is free from trouble of this kind.

The usual method is to run the hot air pipes about fifteen or twenty feet above the floor, but, sometimes, the air ducts are run underground, and in some cases the air is carried up in the posts of the building, which are made hollow for this purpose. The usual apparatus consists of a power driven fan which draws the air through steam heated coils, and forces it through ducts to different parts of the building. Sometimes the air is only partly heated before entering the fan which blows it into a chamber, and from here the air passes through heating coils at the bottom ducts, where it is finally heated and passed into the room.

Some Points Concerning Our Present Knowledge of Paints for Structural Steel and Recent Improvements Made in Paints

THERE are a number of paints on the market which are claimed to be efficient in preventing the corrosion of structural steel. Although the subject of paint making has for years been given great attention by experts, and notwithstanding the progress made in recent years, there is still considerable room for improvement. As all engineers realize the importance of securing a paint which will prevent corrosion, any discussion looking toward a solution of this problem will prove of interest. The following article, which has been taken from a paper, "Painting Structural Steel: The Present Situation," by A. H. Sabin, in Vol. XXXIX, Proceedings, Am. Soc. C. E., p. 2061, discusses paints for structural steel and gives the present status of paint making:

Attempts to Classify Pigments

Much has been written and much has been done relative to the protection of steel; but improvement has been slow, progress being made step by step. Some years ago, Mr. G. W. Thompson attempted to classify pigments, as to their relation with iron, by suspending them in water and immersing pieces of iron or steel in these mixtures. The results were somewhat surprising; some of the pigments seemed to increase corrosion in this condition, and others, known to be useless in protective paints, seemed to be much better for preventing it. Lampblack, for instance, was the worst in provoking corrosion, and white zinc or pulverized chalk prevented it. This was probably due to the fact that lampblack contains, condensed on the surface of its particles, considerable carbonic acid, which is the most generally active agent in the corrosion of iron, while white zinc and chalk are basic substances by which iron is not rusted; however, the carbonic acid in lampblack is displaced by grinding in oil, and the well-known lack of durability in paints made of white zinc and chalk prevents their good qualities from coming into action.

So great is the need of more knowledge as to the value of pigments in paints, and their mode of action, that nothing which promises new information is neglected. A committee of five chemists from different parts of the United States, with the approval of the Society for Testing Materials, made a series of tests of the principal pigments, and of some other substances, on steel immersed in water; and, as was to be expected, arrived at substantially concordant results. These results, as has been stated, were of no value from the standpoint of the paint-maker, being inconsistent with the known value of the pigments when ground in oil or varnish. When the report was published, however, the pigments were classified, according to their water value, into three groups, namely, inhibitors, indeterminates, and stimulators. This was the origin of the use of these now well-known words in paint terminology. It was expressly stated in the report that this was a classification as regards water only; but the names were so convenient and so tempting that those not familiar with the subject, and also many who saw their value for advertising purposes (two quite distinct classes), put them into common use to classify pigments in oil. It is obvious that any classification of pigments in oil should be based on their behavior in oil, and if, as must be conceded, this is radically different from water tests, the latter should not be regarded. All this investigation began some years ago; meanwhile, numerous young men, mostly students working under the supervision of their teachers, have made brief and generally inconclusive studies of paints, and almost without exception have used these indefinite terms, inhibitors and stimulators. Patents have even been taken out—which, in the writer's opinion, are not only worthless but invalid—covering the use of old and well-known pigments. What is worse, every maker of a paint nostrum assures his hearers or readers that his particular paint absolutely inhibits rust, and that everything else stimulates it. This is the whole history of this jargon about inhibition and stimulation; it never had any particular value to the consumer, and it is generally used to mislead him.

Composition and Durability

It is obvious that in a good paint the pigment particles are enveloped in a film of oil; they do not come in contact with the iron; if they did, the paint would peel off, for no dry pigment adheres well to metal. Steel rusts because air and moisture act on it; and paints are used to keep air and moisture from it. They do not inhibit rusting, except as they inhibit the cause of it.

The important practical question is whether paints have been or can be improved as to being non-porous and durable. This is essentially dependent on the relation between the pigment and the oil. As to the true nature of this relation, very little is known; but something is known about its visible manifestations. It is known, for instance, that 1 lb. of dry red lead mixed with ¼ lb. of oil makes a paint of ordinary consistency, and 1 lb. of dry lampblack requires at least 6 or 8 lbs. of oil, say, thirty times as much, or making allowance for difference in density, six times as much as the red lead. Similarly, 1 lb. of white zinc takes twice as much oil to make a paint as 1 lb. of white lead; and white lead takes nearly twice as much as red lead. These are things we know; but we have no idea why they are so. Again, red lead, which is an oxide of lead, makes an excellent paint for iron; oxide of iron is neither very good nor very bad; oxide of manganese is bad. Our knowledge of paint is as yet largely empirical. Where we are gaining is in more general appreciation of the value of the proper application of paint, better preparation of surface, more confidence in good paint rightly used, and in the better preparation of paint materials. For instance, in the older books, and until about twenty years ago, we find analyses of red lead showing as low as 55 per cent. of true red lead, with 45 per cent. of litharge. Red lead is made from litharge, and the presence of the latter is not a sign of adulteration, but of incomplete conversion. At the same time other samples showed as high as 80 per cent. of true red lead. As is well known, there was much difference of opinion in those days as to the value of red lead as a paint for iron; though most users liked it, some thought it poor stuff. It is now known that its value depends on the quantity of red lead it contains. Coarse red lead always contains litharge, because the litharge in the middle of a large particle is never oxidized. It was observed that the finer the red lead, the better it was, and so a demand arose which forced the manufacturers to make higher grades; now they are grinding their litharge to an impalpable powder before roasting it, with the result that 94 per cent. of true red lead has been on the market for some years. Then an unexpected fact was developed. The old red lead when mixed with oil would set in a day or so—often in a few hours—into a cement, just like plaster of Paris and water; this tendency made it work with difficulty and unevenly in application, and its coarseness gave it a tendency to run; but the new, or high grade, article is inactive to oil, and brushes out smoothly like a house paint. This enables the painter to cover 50 per cent. more surface with the same quantity and still get a coating having a uniform thickness which gives more protection than the thin portions of the paint formerly used. This secures greater economy, even at a slightly greater cost per gallon; and this is an economy not only in the cost of the paint, but in the labor, because the paint works more easily, and a man can cover more surface in a day; it also requires less skill, and therefore a less highly paid man, to do good work. For the last year or two, red lead ground in pure linseed oil has been offered to the trade as a paste ready to be thinned with more oil; such a paste keeps for a year or more, or indefinitely as far as known, like white lead paste. Its use saves time and waste in mixing, and, being ground through a mill, the mixture is perfect, which is not the case with hand-mixing; and, as it avoids the presence of a dusty pigment, it is more sanitary.

The only serious objection to the use of such red lead is that it dries more slowly than the older kinds. This can be obviated, however, by the use of a little japan drier. There is a well-founded prejudice against the use of excessive quantities of drier in any paint; but it should be remembered that red lead paint mixed in the (standard) proportion of 28 lbs. of pigment to 1 gal. of oil, contains 20¼ lbs. of pigment per gallon of mixed paint. If this pigment contains 15 per cent. of litharge, it has 3 lbs. of litharge per gallon. Now, ordinary, good, lead japan driers, or lead and manganese driers of approved quality, contain the equivalent of 1 lb. of litharge in about 3 gals. of drier; and 3 lbs. of litharge will make 8 or 10 gals. of drier. To make 1 gal. of mixed 94 per cent. red lead paint dry requires only one pint of drier; the rest is excess. It is much safer to add the desired quantity of drier. It may be asked why the litharge in the 94 per cent. red lead is not more active; it is probably because, when the peroxidation of the lead has been carried so nearly to completion, the particles of litharge are enveloped so completely by a dense coating of true red lead that the oil does not reach them. This is obviously not the case with the commoner and less thoroughly oxidized pigment.

It has sometimes been suggested, by those not very familiar with the chemical questions involved, that the litharge is the essentially valuable part of the paint, and that the red lead is only an inert extender. This is not so. The whole history of the subject shows that the improvement in red lead for paint during the last twenty-five years has been made by reducing the litharge contained in it; litharge alone, or used with other pigments, has not been satisfactory, though orange mineral, which is red lead free from litharge, is most excellent, and would be used if its cost were not so great. Further progress will undoubtedly produce red lead with a lower percentage of the protoxide; in fact, the 94 per cent. red lead now in the market usually contains much more than 94 per cent. of true red lead.

Progress Made

Progress has also been made in our knowledge of linseed oil. Within a few months, the American Society for Testing Materials has adopted specifications for North American raw linseed oil, which is of better quality than that made from South American seed. These specifications are the result of a great deal of work by many of the best oil chemists, and it is now possible for any good analyst to tell whether or not an oil is pure and good. Methods of paint analysis are in general being standardized; and a vast amount of work is going on in Germany and England as well as in the United States, on the chemistry and nature of drying oils. At present linseed oil has adulterants, but no substitute; China wood oil is a valuable drying oil, more valuable for some purposes than any other, but, as an oil for ordinary paints, it is used, as far as the writer knows, only to cover up the use of non-drying oils which must be regarded as adulterants. At present prices, it is not likely to be used even in this way. Fish oil is used to some extent, as it always has been, in paint for roofs and smokestacks; but one should not be disturbed by talk about the "newer paint oils," for, except China wood oil, there are none.

In closing, it may be well to mention that the committee appointed by the American Society for Testing Materials has made a final report on the condition of the paints on the Havre de Grace Bridge. As is well known, this bridge was painted six years ago by a committee of that society, which committee included several members of the American Society of Civil Engineers. This report describes three of the paints as excellent; two of these were straight red lead in oil, and the third was red lead, with about 15 per cent. of a pulverized silicate added, in oil, the red lead being about 98 per cent. true red lead. Nine other paints, of varying composition, are reported as affording generally effective protection to the structure. As all these paints were carefully applied, it is fair to conclude that the durability of any good paint may be increased one-half, and probably doubled, by proper care in its use as compared with average practice. It is only by continually reiterating this fact that we shall ever secure the most elementary and fundamental requirement for the economical treatment of structural steel—Engineering and Contracting.

According to Prof. A. V. Bleininger, who was heard at the Brantford, Ont., convention of clay-workers a few years ago, clays which are difficult to dry because of their high shrinkage may be rendered normal by heating the raw clay, as it comes from the pit, in a rotary furnace at a temperature of 250 to 400 degrees C. This destroys part of the plasticity-forming power of the clay, and enables the material to be dried in the same manner as less plastic clays. The cost is very slight. The addition of sand, burned clay, or other non-plastic material also will convert many tender clays into those of normal strength. It does this by separating the particles and increasing the pore spaces. Mixing clays with boiling water instead of cold during the pugging or tempering has a similar effect, and, in addition causes the brick to harden slightly as they cool before entering the dryer.

Constructional Activities at Calgary

Many Large Structures Nearing Completion and Excellent Prospects for 1914—Foundry Plant at East Calgary

THE end of the year finds many new industrial projects well toward realization in this city. Although Calgary has been regarded more in the light of a wholesale centre and grain distributing point, the advent of the Grand Trunk Pacific and the Canadian Northern seem to be giving this city an impetus towards the establishment of industries. There are well defined reports and a little evidence that at least two other railroads will enter Calgary shortly. The discovery of oil in even limited quantities south and in a territory tributary to the municipality cannot but accelerate the movement towards a great industrial city. The C. P. R. are even now applying to the Dominion Parliament for permission to build a branch into the oil district.

The growth of the city is attended by the construction of many interesting engineering structures in and about it. The building permits to the end of November have maintained a healthy tone. The total permits for the first eleven months of the present year amount to $8,283,153, a decrease of 47 per cent. from the preceeding year, and a decrease of 26 per cent. from the year 1911. A large amount of new work is in view for next year and a very optimistic tone prevails among the local contractors. As described below, one local citizen is preparing to expend over half a million dollars in building construction and there are besides numerous other projects, not so large, to go ahead next year. It is anticipated that a great amount of public building will be done in 1914, including the new million dollar Post Office, new buildings for the Exhibition Company, an Industrial Building for the City of Calgary, a subway at Fourth Street West, the new barracks for the Royal North West Mounted Police, and stations for the C. N. R. and G. T. P. Railways, besides at least one, or perhaps two, flour mills.

The Exhibition Company contemplate a complete re-arrangement of their grounds in Victoria Park and the construction of a new race track with reinforced concrete grand stand, new administration building, new manufacturers exhibition building, horse and cattle barns, besides a large amount for water and sewer connections, roads and sidewalks and ornamental lighting.

The City of Calgary has practically arranged with the Robin Hood Mills for all damages in connection with the construction of a subway at Fourth Street West. This will give the city five subways across the main line of the Canadian Pacific Railway in a range of ten blocks. The estimated cost of this subway, with damages, will amount to about $500,000. The by-law providing for the erection of a building for housing small industries has been passed by the ratepayers and plans are being prepared for a structure to cost $150,000. The architect is Mr. Alex. Pirie, of Calgary, with whom is associated the firm of Lawson & Fordyce, of Calgary.

A power sub-station has just been completed in the northern part of the city, and it is probable that one and perhaps two additional ones will be erected next year at a cost of $25,000 each. As noticed in the last letter, the Calgary Flour Mills, Limited, are preparing for the construction of a flour mill which will have an ultimate capacity of 6,000 barrels per day. A site aggregating 15¼ acres has been purchased in East Calgary at the junction of the Calgary & Edmonton Railway, with the Grand Trunk Pacific. Borings are now being made with a view to ascertaining the condition of the ground for a foundation, and it is intended that the contract for the first unit, together with storage bins, shall be let in the early spring.

Mr. Thomas Mawson, the noted town planner retained by the municipality, has submitted his preliminary schemes for the beautification of Calgary, including in this scheme the construction of one or more bridges across the Bow River and the replacing of existing steel structures to accommodate the present traffic as well as that which will be diverted to them by the traffic routes contemplated in the new scheme. This will reopen the controversy as to the relative merits of a high level or a low level bridge to serve the north part of the city at Centre Street.

The mild weather prevalent has enabled the contractors to make rapid progress on all large buildings. The contractors for the new Police Headquarters building for the City of Calgary have completed the reinforced concrete structure and have the building enclosed, excepting for one storey. The steel prison cells and electric elevators for this building will be ordered through the City Stores, early in January. Lang & Major, of Calgary, are the architects; Thomas, Jamieson & McKenzie, are the contractors. The tenants are commencing to enter the new building of the Herald Publishing Company. This is the tallest office structure in this Province, being ten storeys high and built of reinforced concrete, with brick and terra cotta exterior. The architects are Brown & Vallance, of Montreal. Messrs. Rutty & Weare have completed the erection of a magnificent residence for Eugene Coste, President of the Canadian Western Natural Gas, Heat, Light and Power Company, Limited, of Calgary, at a cost including grounds, of $160,000. Hayden & Skeene, Limited, of Vancouver and Calgary, have commenced the construction of the main diversion weir for the Western Section of the C. P. R. Irrigation project in East Calgary. This will necessitate a coffer dam of wooden and steel sheet piling, after which a canvas cover will be erected which will enable the contractors to place the concrete during the cold weather.

The Calgary Builders' Exchange is arranging a series of lectures during the winter months for the benefit of its members. The first of these was given by Mr. L. M. Gotch, A.R.I.B.A., on "Town Planning," November 26th last. The local branch of the Canadian Society of Civil Engineers held its first annual meeting December 6th last and the following officers were elected for the coming year:—Chairman, H. B. Muckleston; secretary-treasurer, P. M. Sander; executive, S. H. Peters, A. S. Dawson and Geo. Romanes. An arrangement has been made for the use of the rooms of the local Chapter of the Alberta Association of Architects, 115 Judge Travis Building.

A new firm for builders' supplies and contractors' equipment, the Marshall-Izlar Supply Company, with offices in the Maclean Block, have commenced business during the past month. Mr. Marshall, the senior member of the firm, is well known in this city through his connection with the Calgary Herald. Mr. Izlar has had much experience in the California oil fields.

The Calgary Power Company are about ready to put their new units into commission, giving them a total capacity of 30,000 horse-power at the plant. The Calgary Water Power Company, Limited, operating a hydro-electric plant on the Bow River in Calgary, have announced their intention to expend $300,000 to instal two gas-driven electric generator units and two water-wheels having each a capacity of 1500 kw. This plant operates from the lumber sluice of the Eau Claire Lumber Company, under a sixteen-foot head, and was the first to supply electric light and power in this city.

Carter, Halls, Aldinger & Company, Limited, of Winnipeg, have completed the construction of a new five-storey warehouse for the Canadian General Electric Company, Limited, and their subsidiary company, the Canadian Allis-Chalmers Company, Limited. The building is on trackage on 10th Avenue West and has a frontage of 50 feet. The construction is pressed brick exterior, with cut stone trimmings; with interior of mill construction. The structure will be the head office for this province, and is the result largely of the business capacity of Mr. A. P. Horner, who has been the local manager for these companies since their establishment in this city. The cost was about $150,000. The architects were Hodgson, Bates & Beattie, of Calgary.

The Allan Theatre

One of the more noteworthy structures completed recently is the Allan Theatre, a magnificent building on 8th Avenue, in the heart of the business district, to be devoted to exhibiting the films of the Canadian Film Company, Limited. The entire project has been carried out by local capitalists, who have made an expenditure of $100,000 for the building and site. The theatre was opened to the public November 14th last, and represents the most advanced ideas in the equipment of motion picture theatres. The structure occupies an inside lot with a frontage of 46 feet, has an extreme depth of 130 feet and is of fireproof construction throughout. The exterior of the building is of marble and ornamental plaster, with metal trimmings; the interior has been richly decorated in marble and onyx, with vaulted ornamental plastered ceilings. Entering the vestibule, there is the ticket window, with a small shop on one side and a shoe-shine parlor on the other, thence one passes into the lobby—off which are the office and the ladies rest room and toilet—and enters the foyer. From the foyer, access is had by marble stairways on either side to the balcony and to the main auditorium, 45 feet wide, 65 feet deep and 34 feet high. The balcony is 45 feet deep, in the centre of which is the operator's cage. The picture screen is 13 ft. 6 in. high, and is 18 feet long, with a curved surface to conform to the curvature of the lenses used in the motion picture machines. There is no stage, but on the left of the screen there is a singers' balcony, while on the right is a fine pipe organ, supplied by Kimball & Company, of Chicago, at a cost of $15,000. The keyboard is located in the orchestra pit. From the balcony there are four fire exits, two to the rear exits and two to the street, the latter leading to balconies, from which ladders reach the street.

A very complete heating and ventilating system has been provided. Warm air heating has been installed, with air-washers, forced draft mechanical ventilation, including blower and exhaust fans. The boiler installed has a capacity of 100 h.p., Alberta rating, and the entire system is capable of maintaining a constant temperature of 70 deg. F., and has a capacity of 160,000 cu. ft. per three minutes. E. J. Young Plumbing Company, Limited, of Calgary, were the contractors for the plumbing and heating and ventilating. The building was constructed by day labor and sub-contracts by the owners, under the supervision of H. L. Gage, work commencing about May 1st. In the beginning, it was necessary to shore up both the adjoining party walls, built of rubble stone, and this alone involved considerable care. The construction throughout is of reinforced concrete, the Kahn Floredome system being used. A total of 650 yds. of concrete and 68 tons of steel were used. All partitions are terra cotta tile, manufactured by the Alberta Clay Products Company, Limited, of Medicine Hat. For mixing the concrete, a 5 cubic foot cubic mixer was used, the concrete being hoisted to the required elevation and deposited in the forms from Ransome carts. The hoisting bucket and hopper were built on the job. The cost of the building was about $75,000, the architect being James C. Teague, of Calgary.

Big Foundry Plant

Westinghouse, Church, Kerr Company, Limited, have completed the construction and equipment of the plant in East Calgary for the North Western Brass Foundry Company, Limited, representing an outlay of $250,000. The main building measures 200 feet in length by 100 feet wide, and there are installed twenty furnaces, with ovens, sand bins, pattern rooms, as well as finishing, assemblying and shipping rooms. Twenty-three metal bins, having a capacity of 20 tons each, provide storage for continuous operation. The plant is alongside the main line tracks of the Canadian Pacific Railway, and is served by a spur capable of storing twenty cars alongside the building, for unloading the necessary coke and moulding sand. At the north end of the building is the garage for the company's motor trucks, 40 feet by 70 feet. The construction throughout is reinforced concrete, with a maximum of steel sash on all sides. In general, there is a crane runway 29 feet high, 27 feet wide, running the length of the main building, with wings on both sides 16 feet high in the clear. Columns are spaced 25 feet on centre longitudinally. The roof slabs are 4 inches thick, carried on beams running the length of the building, 6 ft. 3 in. on centres, these beams in turn being carried by girders spanning the 27 feet clear of the runway. The main girders are 10 in. wide by 25 in. deep, carried on 18 in. square columns. The roof slab is covered by a 5-ply tar and gravel roof. The entire plant is steam heated, and the glazed wall areas give the best lighting possible. The plant was designed by the A. E. Baxter Engineering & Appraisal Company, of Buffalo.

Dr. N. J. Lindsay, of Calgary, has under way three buildings, aggregating in cost nearly $600,000. Fyshe, McNeil, Martin & Trainer, of Calgary, have completed the construction of a fine motion picture theatre which combines several unique features. The building is of stone, brick, and reinforced concrete construction, and occupies a plot 50 ft. by 120 ft. in the middle of a block, opposite the large department store of Pryce-Jones, Limited. The auditorium has a maximum seating capacity of 550, with a stage 5 ft. deep and proscenium opening 14 ft. by 17 ft. The main floor is a patented mastic flooring, and can be flushed at will by water discharged from perforated pipes running along the bottom of the seats. A forced draft ventilating system will change the air every 15 minutes. The building is steam heated; has indirect electric lighting; and an intercommunicating telephone system adds to the convenience of the playhouse. The total cost has been about $40,000. In addition to this building, Dr. Lindsay has under construction in this city a fine residence, estimated to cost some $30,000. The exterior in Tudor Gothic, is cut stone and light brown tapestry brick, with interior walls of brick. It has steel floor beams and reinforced concrete floors. The building occupies a site on the slope of a hill and has a full basement, two living floors and an attic. There will be a large ballroom, billiard room, 7 bedrooms—each with private bath—besides dining room and service.

The excavation has been completed for the construction of what will ultimately be a ten-storey office building, on the corner of Centre Street and 7th Avenue, where the Knox Presbyterian Church stood. It is the intention now to build but six storeys, but the structure will be designed for four additional ones. The building will be 130 feet by 150 feet in plan, and will have a fireproofed structural steel frame, with reinforced concrete floors. The exterior will be ornamental terra cotta on the street sides, with hollow brick walls on the alleys. Four wells have already been driven on the property, to furnish water for tenants, boilers, and for a high pressure fire service. The owner will install his own electric light plant. Two high speed traction elevators will be installed, with provision to add a third when the height is increased. The building will be fitted up for stores on the ground floor, with offices above. The first cost will be about $500,000. The architects are Hubbell & Kelly, formerly of Seattle, now of Calgary.

Ceramics, Limited, of Calgary, formerly the Sandstone Brick & Sewer Pipe Company, Limited, have in course of erection a large plant at Sandstone, south from Calgary, for the manufacture of vitrified clay products, especially sewer pipe. At present, practically all the sewer pipe used in the Canadian West are imported from Ohio, pay a duty of 35 per cent., and a freight rate to Calgary of about 75 cents per 100 pounds. As the City of Calgary alone lays mile upon mile of vitrified sewer pipe every year, a market is already awaiting the product of such a plant. The company owns a tract of 220 acres of one of the most diversified shales in the Dominion—one of two known deposits in Canada—in fact, from which the manufacture of glazed terra cotta for architectural purposes can be manufactured. Tests have been made, and full size pipes manufactured, and the shales have been pronounced second to none for the use to which it is intended to work the deposits. A well already driven on the property will supply natural gas for power and fuel. The president of the company is Mr. John Steinbrecker, of Calgary. R. A. Brocklebank, president of the local Builders' Exchange, is a vice-president and director.

The tracklaying gang and the bridge builders of the Canadian Northern Railway are now within the city limits and the construction of freight sheds and a temporary passenger station is being rushed by the contractors, Carter-Halls-Aldinger & Company, Limited, of Winnipeg. Grading has also been commenced on the Calgary-McLeod Branch. In East Calgary, the tracks of the C. N. R. cross over the main Western Canal of the C. P. R. Irrigation System, the main line of the C. P. R., and the road and street railway to Ogden and the C. P. R. Shops, then over the Bow River, the McLeod Trail, by subway over 2nd Street East, and then over the Elbow River into the heart of the city. The first bridge, that over the C. P. R. and street railway, comprises a total of seven plate girder spans of varying lengths, with latter a 300-foot truss span over the canal. The longest of these spans is 72 ft. 6 in., the girder being 8 ft. 4½ in. deep at the centre, and 5 ft. 6 in. at the supports and spans the street railway. The girder over the three tracks of the C. P. R. has a span of 65 ft. and is 8 ft. deep. All the intermediate supports are Bethlehem H-columns. The Bow River crossing has six deck plate girder spans of equal length, and is 540 ft. long. The girders are 89 ft. 8 in. long, and 9 ft. 7 in. deep; the web plate is 115 in. by ⅜ in.; the top flange is built up of 2 angles 8 x 8 x 5-16, and two angles 8 x 6 x ⅝; the bottom flange of 2 angles 8 x 8 x 11-16, 2 cover plates 8 x ½. The girders are 8 ft. on centres, and weigh about 23 tons each, and were fabricated by the Canadian Bridge Company, Limited, of Walkerville. The erection is being done with two 35-ton, 3 drum, Lidgerwood bridge cranes, with boom 56 ft. long, a single timber 16 in. square. In the course of erection of the first span, a spliced boom broke at the boom-seat, dropping the 23-ton girder to the river bottom, 30 ft. below, one end resting on the embankment. Although slightly bent at one end, where the abutment was struck, the girder was not even badly strained, and is doing duty as intended. The contractors for the erection are Frankman Bros., of Winnipeg; the inspection is being done by the Canadian Inspection and Testing Laboratories, Limited, of Montreal, for whom Mr. J. Ormond Riddell is the local representative. As soon as the tracklaying reaches the McLeod Trail, the crossing there will be erected; a through plate girder span of 81 ft., with one approach span of 13 ft., and another of 25 ft., both deck spans. The steel for this crossing, and the C. P. R. crossing detailed above, was fabricated by the Manitoba Bridge & Iron Works, of Winnipeg.

Another ten-storey structure is to be erected in Montreal. This is the Marcil Trust Building, the site of which is on the south side of St. James Street. The plans are by Messrs. E. and W. S. Maxwell, Montreal. It is estimated that the entire cost will be about a million dollars. The building will be of reinforced concrete, with an exterior of terra cotta. A marble staircase will lead to the safety deposit vaults of the company, which are to be of the most modern burglar proof equipment. In connection with the safety deposit vault departments there will be a luxurious furnished waiting room. The corridors throughout are to be of Tennessee marble. Three electric elevators will be installed.

An unusual phenomenon was reported on November 7th by a Canadian Pacific Railway train "dispatcher." The work of dispatching is done by a telephone, and while listening at his instrument, the "dispatcher" picked up regular dashes and dots of the Morse code, and as he was an expert telegraphist he could follow the message, which was a wireless communication from some vessel at sea announcing her approaching arrival at San Francisco. Apparently the telephone wires had acted as an aeiral. The name of the ship is not known, as only her code number was signalled.

Completion of the Jordan River Dam

Noteworthy Structure of the Vancouver Island Power Company—Hollow Reinforced Concrete Type, 125 Feet High and 890 Feet Long

THE Vancouver Island Power Company, Limited, a subsidiary concern of the British Columbia Electric Railway Company, Limited, have placed themselves in a position to become one of the most important producers of electrical energy in the Dominion by the completion of the great dam at Jordan River, a work which was undertaken to meet the increased demand from the city of Victoria and environs upon the company's hydro-electric plant there. In addition to the constantly growing industrial demand for light and power in the Saanich peninsula, as increased storage capacity has also been found necessary for the purpose of keeping pace with the extensive development of the tramway system of the B. C. Electric Railway consequent upon the remarkable growth of Victoria and the districts adjoining.

The Jordan River plant is situated at the mouth of the Jordan River on the Strait of Juan de Fuca, about 43 miles from the city of Victoria, the plant at present in operation comprising two electrical units of 6000 h.p. capacity each. Energy is transmitted at 60,000 volts to Victoria and a tie line connects this plant with the auxiliary steam power plant of the Vancouver Island Power Company at Brentwood Bay.

On account of the increased load on the system the capacity of the Jordan River plant will be enlarged by the addition of one 13,000 h.p. unit, bringing the total capacity up to 25,000 h.p., and thus rendering necessary the construction of the Jordan River dam. Prior to the construction of the permanent dam the waters of the Jordan River were diverted by a temporary rock filled crib dam, located a short distance above the site of the permanent dam, into a flume 6 feet in width by 5 feet 9 inches deep, and 6 miles in length, built with a grade of 1 in 1,000. The water was delivered by the flume into the forebay reservoir, formed by the construction of two earth dams, whence it was conveyed through steel pipe lines to the Jordan River power house. Additional storage was secured by the construction of a hydraulic fill dam on Bear Creek. The waters of Wye Creek were also diverted into the main flume by means of a rock filled crib dam, and the steam known as Alligator Creek has been diverted in a similar manner.

The area of the Jordan River watershed is 67 square miles; the effective drainage area has been found to contain 55 square miles, while the elevation of the effective drainage area is all more than 1200 feet above sea level. The elevation of the watershed is from sea level to 3,000 feet above sea level.

Up-stream side Jordan River dam.

The contract for the building of the permanent dam was awarded the Puget Sound Bridge and Dredging Company at the beginning of August, 1912, and active construction work inaugurated immediately, the entire undertaking requiring just one year to complete. The work consisted of the erection of a hollow reinforced concrete dam of the Ambursen type, together with about seven hundred feet of wooden flume and a small reinforced concrete arch bridge for carrying the flume across the Jordan River. Various types of dams had to be considered, and as it was important to store the autumn rainfall of 1912, an early date for the completion of the work was essential. No sand being available in the vicinity, it became apparent that a dam containing a minimum quantity of material would be required and the Ambursen type of dam was therefore finally decided upon.

Down-stream side Jordan River dam, showing buttresses, etc.

The completed dam is about 125 feet high in the highest section and 890 feet long over all. Of this length there is 452 feet of bulkhead or non-overflow section, 306 feet of spillway and 135 feet of earth embankment with reinforced concrete core wall. The deck or upstream side of the dam is built on a slope of approximately 1 to 1 and the downstream face of the buttresses on a slope of 1 to 4. On top of the bulkhead section there is provided a walkway six feet wide, which is protected by suitable hand rails and connected at each end of the spillway by stairs with another walk which passes entirely through the dam. The spillway has an eight-foot freeboard and provides for a flood discharge of 25,000 cubic feet per second.

Water is drawn from the reservoir through two sets of Coldwell-Wilcox cast iron sluice gates, each set consisting of two 3 ft. 6 in. x 5 ft. 6 in. gates, either of the sets being capable of discharging sufficient water to supply the demand, except at extremely low water. The gates are all operated by roller-bearing, hand-power hoists set inside the dam, the stems passing through stuffing boxes in the deck. Guides for stop logs are provided for shutting off either set of gates if necessary, and the whole is protected by two sets of trash racks which are mounted on trucks and can be raised clear to the top of the dam if necessary, for cleaning. There is a suitable hand-power winch for raising the racks located on the top of the dam. Heavy concrete counterweights are provided to assist in raising the racks. The storage capacity created by the dam is approximately 615,000,000 cubic feet of water or sufficient to supply all the electric power at present used in Victoria for five months. With the additional supply of the Bear Creek and forebay reservoirs there is enough stored energy to provide Victoria's power needs for eight months.

The site chosen for the dam proved to be well adapted to the type of dam built and for the efficient location of most of the construction plant. The profile of the site is such that work could be prosecuted on any part of the structure except in the five bays in the river bed, irrespective of the flood conditions of the river. This fact proved of the utmost value during the winter months when the river was subject to sudden and destructive floods.

Solid bed rock was uncovered for the foundations of the entire structure without excessive excavation. This rock provided an ideal foundation, being extremely hard and free from seams and faults. The grain of the rock, and what seams there are, run in a direction parallel to the axis of the dam, thus reducing the possibility of a leakage of water to a minimum and making it easy to secure a satisfactory cut-off for the entire length of the dam. The site also provides an excellent location for the spillway. The waste water after passing over the dam will be discharged into a natural channel which will carry the water away from the dam rapidly and discharge it into the river at a point far enough from the dam to prevent the possibility of damage from cross wash or any scouring action. The greatest difficulty with the site was the impossibility of building a tight cofferdam on the loose gravel and boulders which formed the river bed.

Crest of Jordan River dam.

In general the equipment consisted of the following machinery: two stiff-leg derricks, one 50-ft. and one 60-ft.; boom, with hoisting engines and boilers and an assortment of one-yard wooden skips all used on excavation work on the east bank of the river; one steam-driven compressor operating two Rand drills in the quarry; four one-yard Koppel cars; two No. 2 Aurora jaw crushers; one rotary sand screen; two 24-in. x 30 ft. Superior sand rolls; one 1-yard Kohring mixer, and one half-yard cube mixer; three 1-yard centre-dump concrete buckets; two concrete distributing cars; one cableway of about 900 ft. span equipped with 2¼-in. standing line and specially designed carriage and operated by a two-drum hoisting engine; carpenter shop with circular saw and blacksmith shop with two forges, hand power drill press and bolt machine with capacity up to 1½-in. bolts; three centrifugal pumps (one 10-in., one 8-in. and one 5-in.). All machinery except derricks, cableway and compressor was driven by electric motors with power furnished from the company's plant at the mouth of the river, a seven-mile transmission line having been built for the purpose. Power was transmitted at 6600 volts and stepped down at the works to either 2200 or 220 volts as required. Sheds were provided for the storage of cement, having a capacity of about 75,000 sacks, in connection with which there was a testing laboratory equipped for making the usual tensile tests on cement.

Under the terms of an agreement with the city of Victoria the initial expenditure on the Jordan River power plant by the Vancouver Island Power Company amounted to $1,500,000. To this sum must now be added the cost of the dam, totalling $550,000, together with another expenditure of $450,000 to enlarge the existing generating plant. The work of erecting the dam was under the supervision of Chief Engineer Mr. G. R. G. Conway and Mr. G. M. Tripp, engineering superintendent of the company, and his assistants, Mr. C. A. Lee, resident engineer, and Mr. W. Faust, superintendent of construction. A complete inspection of the plant was recently made by Mr. Wm. Young, controller of water rights. Mr. E. Davis, engineer of the provincial water department, accompanied by Mr. G. R. G. Conway and Mr. Tripp. The work impressed the government officials as being carried on in the most thorough manner possible.

Work is also to commence without delay on the substructure of the Kettle Valley Railway bridge, which will span the Fraser River at Hope, and afford connection at that point with the main line of the C. P. R. This bridge will be 1,000 feet in length, and when completed will cost between $750,000 and $1,000,000. Armstrong Morrison & Company, of Vancouver, were the successful tenderers for the superstructure, the contract for the upper portion of the huge structure being held over until a later period.

Mr. James Findlay, general superintendent of the Dominion Bridge Works, of Montreal, accompanied by Mr. R. B. Common, chief accountant of the company, visited Vancouver a few weeks ago. Mr. Findlay has been inspecting the progress of the bridges being erected by his company for the Canadian Northern Pacific Railway at Lytton and Kamloops.

About five thousand men are at work on the sections of the Canadian Northern Railway between Port Mann and Kamloops. By next summer the various completed sections in British Columbia will all be linked up. At the present time the completion of a number of necessary bridges is delaying work somewhat.

The death took place on December 8 of Mr. Miles Macdonell, who was for sixty years a resident of Toronto. Mr. Macdonell was a builder, working mostly for the government throughout the province. He was born in St. Andrews, Ont.

We regret to announce the death of Mr. A. D. Harris, president and founder of the Ontario Sewer Pipe Company, which occurred in London, Eng., on December 12. The late Mr. Harris was 54 years of age.

Mr. George McPhillips, a pioneer surveyor of Western Canada, died recently at Winnipeg. Mr. McPhillips served for six years as chief surveyor of the Western lines of the Canadian Pacific Railway.

Glossary of Terms Used in Road Construction

(Concluded from last issue)

Soil.—A generic term applied to many kinds of earth, but generally used to designate the upper stratum of the ground.

Soluble.—Capable of being dissolved in water or other liquid.

Spawls.—Fragments of stone, generally the waste pieces after stone has been worked. Sometimes called "spalls" and sometimes "splints."

Spewing.—A term applied to the act of water or mud being forced through the surface of a carriageway, or to the rising up of the clay or other soft material through the surface.

Spewy.—A term applied to a wet, "soggy" road.

Spilite.—Coming under the trade name of "Basalt," as settled by the Engineering Standards Committee.

Spinney.—A small wood or clump of trees.

Spit.—In digging this word is used to designate the depth of the spade-blade.

Splay.—To cut away at an oblique angle.

Splint.—A term sometimes used to denote a splinter, or small flaky piece of stone.

Spoil.—The surplus excavated material taken away from any excavation.

Spoil Bank.—The heap where the "spoil" is placed.

Sprag.—A steel or iron pin at the back of a vehicle to prevent its slipping backwards.

Spray.—To sprinkle in the form of very fine atomised particles or drops.

Spread.—To disperse or scatter over a large surface. The word is sometimes used as a noun to denote the area covered.

Sprinkle.—To scatter in drops or small particles.

Spud.—A small kind of spade for removing weeds.

Squeegee.—A tool with a rubber addition for scraping or cleansing hard paved surfaces, and also for distributing tar, etc., on surfaces.

Squeegee Coat.—A term sometimes applied to the final fine seal coat on a carriageway, which has been spread by means of squeegees.

Standard.—The post or pillar on which a lamp or electric wire is fixed.

Standpipe.—A vertical pipe or column fixed on a water main for street watering purposes.

Steening.—The liming of a well.

Stile.—From "stigel," a step; steps to mount a hedge or wall.

Stocking.—See "Chequering," "Hacking," or "Scarifying."

Stone-breaker.—A machine for breaking stones; also sometimes called a stone-crusher.

Stone-dryer.—An apparatus for drying stone before being treated with tar or with a bituminous mixture.

Storm Water.—A term used to designate the rain water falling on a road or flowing on to it. It has the same signification as "Surface Water."

Street.—A term generally applied to a road in a town to distinguish it from a road in the country or the suburbs.

Street-orderly.—A scavenger.

Street-sweeper.—A machine for sweeping carriageways.

Streetway.—The open space of a street.

Strength-crust.—A new term introduced to designate the intermediate layer or course of a carriageway between the bottoming or foundation and the upper crust or top layer.

Strengthening.—A term sometimes employed to denote much the same thing as "resurfacing."

Stretch.—Sometimes used to denote a certain length or "stretch" of a road.

Stretcher.—A brick or stone laid horizontally with its length in the direction of the face of the work.

Strewing.—Spreading by scattering. See also "Spread" or "Sprinkle."

Striated.—Marked with slender parallel lines.

Stringy Bark.—The name of a hard wood from Tasmania and New Zealand.

Strut.—To support with timber.

Stub.—To grub up by the roots.

Stuff.—Substance or matter. The word is often carelessly used to describe indefinitely some material used in road construction.

Sub-crust.—A new term used to designate the lower layer of the carriageway construction in the same sense as "strength-crust."

Super-crust.—Also a new term used to designate the top layer or wearing surface.

Subgrade.—Also a new term used to designate the lower layer of the carriageway construction.

Subsidence.—The act of sinking or gradually becoming lower.

Subsoil.—The under soil; the bed or stratum of earth which lies immediately under the surface soil.

Suburb.—From sub (near) and urbs (a city). An outlying part of a city or town, but adjoining it.

Subway.—An underground way or passage.

Sullage.—Filthy water or sewage.

Superimpose.—To lay on something else.

Supple.—Easily bent, pliable.

Surcharged Wall.—A retaining wall in which the earth behind it is higher than the wall.

Surface-coating.—The top coating of metal or other material laid on the surface of a carriageway.

Surface-crust.—The upper layer of a carriageway; also called the "wearing surface," or "wearing crust."

Surface Flints.—Sometimes called "field flints," to distinguish them from "pit flints."

Surface-sealing.—The final operation of closing and making waterproof the surface of a carriageway with a bituminous compound.

Surfacing.—A term used to designate all work done in connection with the surface of a carriageway. Also sometimes used as a noun to designate the top layer or wearing surface of a carriageway.

Swan-neck.—A curved pipe fixed on a water stand-post.

Sward.—The same as "turf," but referring to the surface only.

Syenite.—Comes under the trade name of "Granite," as settled by the Engineering Standards Committee.

Synthetic.—The quality of composition, or combination—i.e., the unity of elements into a compound.

Tableland.—A stretch of elevated flat land. Sometimes called a "plateau."

Tail-board.—The movable back of a tipping-cart or wagon.

Tail-drain.—The end drain of a series of drains in a field which empties into a ditch.

Tailings.—A term applied to the broken stone which does not pass through the largest openings of a screen.

Tail-race.—The stream of water coming from a mill after turning the wheel.

Tar.—"A thick, dark-colored viscous product obtained by the destructive distillation of coal, wood, peat, shale, etc."

Tarbetonite.—The trade name of a bituminous compound.

Tarco.—The trade name of a bituminous compound.
Tar-coating.—One of the numerous terms used to designate the operation of placing a thin coat of tar or other bituminous mixture on the surface of a carriageway.
Tar-dressing.—See "Tar-coating."
Tare.—The actual weight of goods after deducting the weight of the vessel or vehicle in which they are contained.
Tarite.—The trade name of a bituminous composition.
Tarlithic.—The trade name of a bituminous compound.
Tarmac.—The trade name of slag specially prepared with tar as a road metal.
Tarmite.—The trade name of a bituminous compound.
Taroomba.—The trade name of a bituminous compound.
Tar-painting.—See "Tar-coating."
Tarpaulin.—Canvas well treated with tar to make it waterproof.
Tarring.—See "Tar-coating."
Tar Slag.—See "Tarmac."
Tar-spraying.—See "Tar-coating."
Tar-spreading.—"See "Tar-coating."
Tar-sprinkling.—See "Tar-coating."
Tar-surfacing.—See "Tar-coating."
Tar-topping.—See "Tar-coating."
Tar-varnishing.—See "Tar-coating."
Tarvia.—The trade name of a bituminous compound.
Tar-washing.—See "Tar-coating."
Temper.—"To mingle, mix or combine properly in due proportion; to compound or blend." The word is applied to the treating of bituminous compounds in order to obtain their proper consistency.
Template.—A full-sized mould or pattern; a frame shaped to the contour or cross-section of the finished surface of the carriageway.
Tenacious.—Tough; resisting effort to pull asunder; apt to adhere to another substance; adhesive.
Tensile.—Capable of being stretched.
Tessellated.—Small stones of different sizes and colours laid as a "mosaic."
Texaco.—The trade name of a bituminous compound.
Thermal.—Pertaining to heat.
Thoroughfare.—A passage right through.
Tine.—The tooth of a scarifier.
Tipcart.—A cart that can be tilted or tipped without unyoking the horse.
Tissue.—The same as "Fibre."
Toe.—The base of an embankment.
Tooled.—Faced so as to show the symmetrical marks of the chisel or tool.
Toothing.—Bricks, stones, setts, etc., left projecting to give a bend for the continuation of the work.
Torqued.—Anything twisted.
Torsion.—The act of twisting or unravelling.
Tortuous.—Twisted, winding.
Tough.—The quality of flexibility without brittleness; firm, strong, tenacious, resisting wear or strains.
Trachyte.—Comes under the trade name of "Porphyry," as settled by the Engineering Standards Committee.
Track.—"A beaten way or path.." The term is applied to the marks of wheels in a carriageway where the traffic has followed the same line.
Tracking.—A term applied to designate traffic which follows the same course, and consequently forms ruts. The term is also sometimes applied to the act of repairing the tracks thus caused.
Traction Engine.—A steam locomotive engine for dragging heavy loads on roads.
Traffic.—A term applied to the amount of user of a road. "Light traffic" has been held to mean about 70 vehicles a day, including an occasional traction engine or heavy motor; "medium traffic" from 70 to 250 vehicles, including not more than 5 per cent. of traction engines or heavy motors; "heavy traffic," from 250 to 600 vehicles, of which 5 to 10 per cent. is traction engines or heavy motors; "very heavy traffic" exceeds this.
Traffic-duty.—A term sometimes used to designate the amount of traffic which a carriageway has to carry successfully.
Trafficway.—A term sometimes employed to designate the carriageway.
Trailer.—A vehicle attached to the rear of a traction engine or heavy motor.
Travelled.—A word sometimes used to designate a road in which there is traffic; a "heavily travelled road, for instance, denotes a road with a large amount of traffic.
Traverse.—Method of making a rough survey.
Trench.—A long, narrow cut or ditch.
Trestle.—A movable prop or frame.
Trinidite.—The trade name of a bituminous filler, etc.
Trivet.—A three-legged stand.
Trunk Roads.—Sometimes called main trunk roads. A term applied to roads leading from one great centre to another.
Tubbing.—The lining of a well or shaft.
Tuff.—Comes under the trade name of "Grit," as settled by the Engineering Standards Committee.
Tumbrel.—A description of tipping cart.
Turbid.—A term applied to a thick, cloudy liquor.
Turf.—The surface of a sward of grass land; plural "turves."
Turgid.—Distended, bloated.
Tussock.—A clump or tuft of grass.
Tynes.—See "Tines."
Tyre.—The band of iron or rubber covering the circumference of a wheel.

Ugite.—The trade name of a bituminous compound.
Undulating.—Having an outline or profile resembling a series of waves.
Uneven.—Not level; rough, rugged.
Upkeep.—Maintenance.

Vacuity.—Space unfilled or unoccupied.
Vacuous.—Empty, unfilled.
Vacuum.—Empty space; a void.
Valley.—A surface depression, surrounded by hills or mountains.
Van.—A term usually applied to a vehicle used by tradesmen for carrying goods.
Verdure.—Freshness or greenness.
Verge.—"The extreme side or edge of anything"; margin, brink. Usually applied to the grass edge of a carriageway.
Viagraph.—An instrument for measuring the inequalities of a carriageway surface.
Vibrate.—To swing or oscillate.
Viscid.—Having a glutinous, semi-fluid, sticky consistency.
Viscosity.—Glutinous, tenacious, sticky.
Viscous.—Glutinous, clammy, sticky, adhesive, tenacious, tacky.
Vista.—A view or prospect seen through an avenue.
Vitreous.—Appertaining to glass; glassy; consisting of glass or akin thereto.
Vitrify.—To convert into glass.
Vitriol.—Sulphuric acid, etc.
Voids.—See "Interstices."
Volatile.—Evaporating quickly.
Volatilise.—To cause to evaporate.
Voussoir.—The stones forming the arch.
Vulcanite.—A chemically hardened rubber; sometimes also called "ebonite."
Vulcanol Pavement.—The trade name of an artificial paving tile or brick.

Wagon.—Or "Waggon." A four-wheeled vehicle for the transport of heavy goods.

Wain.—A kind of wagon for the transport of hay.

Warp.—To turn, twist or shrink.

Warrenite.—The trade name of a bituminous mixture.

Wastage.—A term sometimes used to designate deterioration or wear.

Water-bound.—A term now applied to carriageways constructed with broken metal, gravel binding and water to distinguish them from the roads made under the modern method of bituminous-bound carriageway construction.

Water-channel.—A term sometimes applied to the channel at the side of a carriageway. See "Channel."

Water-consolidated.—See "Water-bound."

Watercourse.—A channel or canal made for the conveyance of water.

Water-gas Tar.—See "Oil-tar."

Waterproofing.—"The act of rendering impervious to water"; sometimes applied to the application of a "seal coat" to the surface of a carriageway.

Watershed.—The area from which rain water is gathered, or from which it flows in a particular direction.

Water-table.—See "Channel."

Wavy.—Or "Wavey." "Showing waves or undulations." Applied to the surface of a carriageway which has this defect. Many theories have been suggested to account for these waves.

Way.—"A place for passing; a path, route, road, street or passage of any kind."

Wayleave.—A right of way or easement.

Waypost.—An old term for a signpost.

Wayside.—The border or edge of a road.

Wear.—The act of wearing; diminution by friction, use, time, etc. (The wear of a road must not be confused with "deformation").

Wearing Crust.—A term now sometimes applied to the upper layer of a carriageway which is exposed to the action of the traffic.

Wearing Surface.—See "Wearing crust."

Weep-holes.—Holes left in a retaining wall to prevent water accumulating behind it.

Westrumite.—The trade name of a "mixer."

Wheelers.—A term applied to stone blocks laid parallel to the kerb in a street to take the wheels of heavy traffic.

Wheelway.—A term sometimes used to designate the carriageway.

Of Winnipeg's fine architectural features one of the most interesting completed recently is a handsome structure for the housing of the Y. M. C. A. The new building, located on Vaughan Street, has a frontage of 175 feet and a depth of 120 feet. It is built entirely of reinforced concrete, with front and side walls of Tyndall stone, Menominee brick and terra cotta, the rear wall being of local brick. All of the more public rooms are connected with a ventilating system and the water supply is from a well on the premises, 417 feet deep, the water being forced through the building by compressed air. The features of the main floor are the spacious lobby and reception hall, inglenook and fireplace, general office, board room, and the association hall with a seating capacity of 450. An innovation in the form of a running track, nineteen laps to the mile, covered with cork carpet, has been provided on the third floor. The three top floors contain 128 bedrooms, and, on every floor, toilet, shower baths and telephones are installed. The building is also well equipped in the matter of gymnasium and other facilities for physical culture, and has involved an expenditure of $413,734, including $37,500, the cost of the site.

Canadian City Engineers

Mr. Wm. Ramsay, Fernie, B.C.

MR. Wm. Ramsay, City Engineer of Fernie, B.C., entered the engineering department of the Dundee (Scotland) Corporation in September, 1895, and was articled to Mr. Geo. Baxter, M. Inst. C.E., Waterworks Engineer. While serving his articles he took an engineering course at Dundee University College under Professor Fidler and obtained diplomas in junior engineering, descriptive engineering, land surveying and levelling. Continuing in the service of the Dundee Corporation until 1906, he eventually became assistant waterworks engineer in charge of all survey work. The responsibilities in this connection were not small, for Dundee is a thriving town with a population of 162,000. During the eleven years that Mr. Ramsay was in Dundee many improvements were carried out in the waterworks system. These included additional mains, better fire protection, covered concrete culverts in place of open aqueducts, sand filters and clear water reservoirs. All the details for these improvements were in the personal charge of Mr. Ramsay who made up the specifications and schedules of quantities.

City Engineer Ramsay, of Fernie, B.C.

The last work upon which Mr. Ramsay was engaged in Dundee involved an expenditure of $375,000. At the time, Mr. Ramsay was identified with Messrs. D. Y. Stewart & Company, of Glasgow, by whom he was appointed resident engineer on rather an exceptional piece of work, namely, the lifting of 4¾ miles of 27 in. cast iron trunk main and replacing it with the same size of main but with different joints. This main portion working under a pressure of 480 feet or 208 pounds to the square inch caused constant trouble from bursting at joints which were leaded and driven. To obviate this the joints on the new main were simply roped, leaded and caulked. The old main was broken by means of a pear-shaped weight of 1,700 pounds, dropped from a height of twelve feet, and the old metal was shipped back to the pipe founders and recast. Upon the completion of the work tests were made and not a single leaking joint was discovered, although in places the ground was so treacherous that the pipes had to be laid on piles driven eight feet into the ground.

Mr. Ramsay came to Canada some two years ago and was appointed City Engineer of Fernie, in June, 1912, in succession to Mr. Robert Potter, now of Battleford, Sask.

Vancouver Closing with Strong Finish

Unabated Activity in Large Building Work — Progress Reports on the Hotel Vancouver and other Important Structures

THE mild weather experienced at the Coast has proved a boon to the various contracting firms in Vancouver that are making strenuous efforts to complete as much exterior work on buildings as possible before the heavy winter rains set in. Considerable activity is in evidence at various points throughout the city, but more especially in the commercial sections, where many structures of a substantial and permanent description are rapidly assuming form, the number of men kept steadily employed being still very large on account of the extensive nature of the projects under way. Almost six hundred men are engaged on the construction of the new Hotel Vancouver and the Hudson's Bay Company's addition, the latter contract necessitating an extra force of skilled labor just recently in order to expedite the progress of the work as much as possible. Then there are such structures as the fifteen-storey Weart Building, the ten-storey Yorkshire Guarantee block, the ten-storey Credit Foncier Building, the B. C. Telephone Company's new central exchange—an eight-storey structure, and several others in various stages of construction, each of which requires a large body of skilled labor.

It must be admitted, however, that in the residential districts within the city limits there has been a considerable falling off in the volume of construction during recent months, this decrease being particularly noticeable in contrast to the remarkable activity exhibited in the building of dwellings in previous years. How long this state of affairs will continue must remain a matter of conjecture for the present, at any rate. The question of securing sufficient capital is still apparently proving as great a problem as at any previous period during the year just drawing to a close, and judging from the number of large undertakings which are held up on account of this very difficulty, it seems apparent that the opening months of the coming year will prove comparatively quiet ones where building construction is concerned.

It is believed that Vancouver's standing in the world's money market will be much improved as a result of the decision of the city council, recently made public, to submit no money by-laws to the electors in January, 1914, in view of the present unsettled financial situation. In commercial circles there is a decided tendency towards optimism regarding the outlook for the year 1914, reliable authorities forecasting a gradual betterment in conditions from March 1 onwards, this prediction in the main being founded on the fact of this year's splendid crop in the north-west, and its probable effects on the situation in British Columbia. That the readjustment now taking place in all lines of commerce represented locally will prove beneficial to the entire community there can be no doubt, the necessity for establishing business on a more solid basis, particularly in the cities at the Coast having long past been recognized by those who are directly interested in the development of the province as a whole.

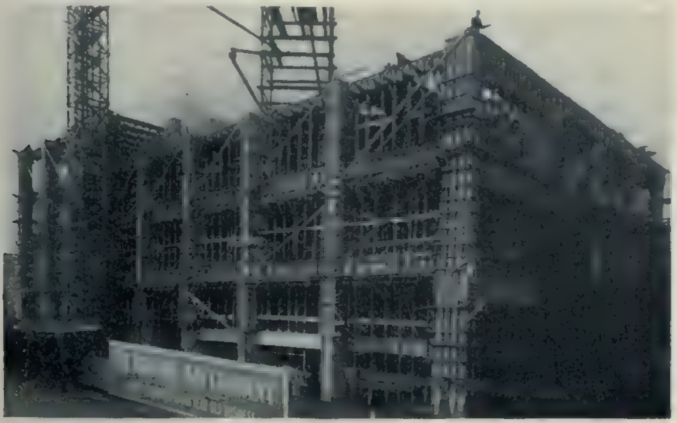
Hudson's Bay Company's Store Addition

Despite the unusually heavy nature of the work, very satisfactory progress has been in evidence since constructional operations commenced on the six-storey addition to the Hudson's Bay Company's store in Vancouver. The site of the building at the corner of Georgia and Seymour streets occupies an area 146 x 175 feet, and as bedrock lies about 50 feet below the surface at this point, the work of excavating for the foundations proved an immense task, and one which severely taxed the resources of the contractors. Before reaching bedrock, it was found necessary to remove about forty feet of hard pan, which in Vancouver resembles a natural cement in hardness. While it is admitted that this material alone would have provided an excellent foundation, the specifications called for a deep basement and excavation was therefore continued to the depth required. In addition to the extra strength of the basement, the supporting columns and sidewalks are alike being constructed sufficiently strong to carry five additional storeys should these be required in the future. The engine room, sub-basement and basement floors below ground have been completed, and at the present time concrete is being poured on the fifth floor above grade, with every prospect of the concrete frame being entirely finished at the end of the year.

It has been estimated that the concrete work in this structure is the heaviest ever undertaken in a local building. The upright supports comprise 59 columns of reinforced con-

New addition to the Hudson's Bay Company's building at Vancouver, showing (on the left) smoke breechings and tunnel, and (on the right) basement floor construction.

crete, each embedded in a concrete foundation measuring 8 feet square at the sub-basement floor, the dimensions of the columns themselves being 4 feet square, tapering at the rate of two inches to each floor. One hundred and seventy men are at present employed on this structure, which will form only one-half of the entire contract, a duplicate portion with frontage on Granville and Georgia streets being planned for erection immediately following the completion of the portion now under construction. Fireproof construction consisting of steel and concrete with terra cotta facing will be employed in both sections, the street elevations being relieved by rows of Corinthian columns placed between each row of windows. The interior fittings and fixtures will conform with the latest ideas adopted in buildings of the departmental store type, and the total expenditure involved will be over two million dollars. The architects are Messrs. Burke, Horwood & White, of Toronto.


Hudson's Bay Company's addition. Seymour street front.

The New Weart Block

Noteworthy progress on this immense structure has taken place in the last few weeks, and at the present time 10 out of the 15 storeys of steel frame work are in position, with fair prospects of the remaining five storeys being erected early in the new year. The foundations of the building rest on rock about 25 feet below the surface. The ground measurements are 78 x 120 feet, and the height from the pavement to the roof will be 175 feet. Briefly, the main constructional features comprise terra cotta facing for the three lower storeys, with a polished granite base, face brick for the succeeding eight storeys and terra cotta in the four remaining storeys. The architects, Messrs. Russel, Babcock & Rice, of Vancouver, have adopted the Francis I. style of architecture, in which the general effect is Gothic with the details in Renaissance—a blending of classic and Gothic decorative forms.

The design of the main entrance vestibule conforms with the architecture of the exterior, the wall and floors being of marble with bronze trimmings, the ceilings of oak beams and panelling. The general vestibule leading to the main corridor will be 25 feet wide. All corridor floors are to be finished in Terazzo tile, with marble borders.

The typical floor will contain 30 offices, finished in oak. The Canadian Ferro Concrete Company is handling this contract, which has been estimated at approximately $700,000.

The Credit Foncier Ten-Storey Office Block

During November, work on the Credit Foncier office building was actively prosecuted, the reinforced concrete frame being erected to the full height of ten storeys before the end of the month. This large concrete structure occupies a site at the corner of Hastings and Hornby streets in Vancouver, and was planned by Messrs. H. L. Stevens & Company, Vancouver, in collaboration with Messrs. Barott, Blackader & Webster, architects, of Montreal, the work of construction being also carried on by Messrs. H. L. Stevens & Company. The exterior will be finished with cut stone and terra cotta, surmounted by a copper cornice. All corridors will be finished with marble wainscotting and terrazzo floors. The floors of the offices will be finished with rock maple. All the offices, with the exception of those to be occupied by the Credit Foncier on the ground floor, will be decorated in oak, mahogany being chosen for the quarters of the Credit Foncier. The equipments throughout will be of the highest standard used in office block construction.

New Central Exchange for B. C. Telephone Co.

Work was resumed at the beginning of November on the new eight-storey Central Exchange Building, which is being erected for the B. C. Telephone Company in Vancouver, on Seymour street, between Georgia and Robson streets. The skeleton steel frame work is mounting steadily upward, and it is understood that every effort will be made to erect the steel for the entire eight storeys by the middle of January. The frontage on Seymour street is 50 feet, and the depth to a lane, 120 feet. The type of construction to be adopted in this building is steel frame and reinforced concrete work, with pressed brick and terra cotta as exterior facing on the front elevation, and common brick for the side and rear elevations. The decorations of the main entrance will be in marble and tile. The head office of the telephone company will have accommodation in this building and provisions will also be made for four telephone exchanges, the equipment of which will be of the most complete description. Plans for the structure were prepared by Mr. J. Johnson, supervisor of the company's building department.

Messrs. Campbell & Wilkie, the contractors who are constructing an elaborate moving picture theatre for the Rex Amusement Company in Vancouver, are making excellent progress with the work, and expect to complete the building early in the new year. The contract involves the alteration of an existing three storey and basement brick building formerly occupied by Messrs. Wood, Vallance & Leggat, on Hastings street, near Carrall street. The theatre will include a main auditorium floor, seating 1,000 people, two stores, 15 x 25 feet, an outside lobby, 12 x 32 feet, and

Credit Foncier office building under construction at Vancouver

an inside lobby, 25 x 32 feet. The work practically comprises a new front elevation in concrete and Meduca cement and the entire remodelling of the interior. Mr. Philip M. Jullien, Vancouver, is the architect. The cost is expected to reach about $40,000.

A contract was recently awarded to Carkeck & Company for the erection of a new building which will form the first section of the B. C. Pottery Company's new plant at Esquimalt, to replace the factory destroyed by fire some months ago. The new building is to be of mill construction, three storeys in height, and will cost about $20,000. It will contain the necessary equipment for the manufacture of modern earthenware. The contract calls for the completion of the work within sixty days.

Mr. E. J. Molloy recently secured the general contract for the erection of a moving picture theatre on Bridge street, Vancouver, for Mr. R. Oakes, at a cost of approximately $20,000. The dimensions of the building will be 28 x 111 feet, and one storey in height. It will rest on a concrete pier foundation, and will be of brick construction with terrazo tile for the entrance lobby. A hot water heating system is to be installed. The structure is typical of the class to which it belongs and possesses no novel features whatever. Mr. C. P. Gregory, Vancouver, was the architect.

The proposed detention building at William Head, near Victoria, for which the Department of Public Works at Ottawa received tenders until November 17th, will be a reinforced concrete structure costing about $45,000. The general design of the building shows a centre-piece and two wings, the former being utilized for assembly functions and the latter representing the various cabins and sleeping accommodations. Extending over a length of 152 feet, the building has two storeys at the wings and three storeys in the centre. All the individual cabins are fitted up with hot and cold water, separate baths, electric light, etc. The feature of the central portion of the structure is the great dining hall, which occupies the entire width of the block and almost the entire depth, the margin of the latter being reserved for the kitchen. Immediately above the dining hall there is provision for another great hall, which will probably be utilized for assembly purposes. Plans were prepared by Mr. Wm. Henderson, of Victoria.

It is reported that tenders will be invited immediately for the erection of the proposed brick additions to the Vancouver General Hospital, for which Mr. A. A. Cox, Carter-Cotton Building, Vancouver, has completed working plans.

As a result of a public meeting held in Merritt recently, it is proposed to erect a large building in the town to accommodate a skating and curling rink. The rink is to be about 120 feet x 180 feet with two curling rinks side by side at one end and a large skating rink at the opposite end of the building. Dressing rooms for both sexes will be provided and the scheme will involve an outlay of approximately $10,000.

The Vancouver board of school trustees has approved of the construction of a new eight room building on the Children's Aid Grounds, an eight room school building in Hastings Townsite, and an eight-room addition to the Livingstone and Model schools. The school board having dispensed with the services of its regular architect, it is probable that a committee of three local architects will be appointed to act in an advisory capacity in connection with the construction of the Vancouver city schools in future. Preliminary plans and specifications will be prepared in the school board offices by the regular staff of draughtsmen, but before any contracts have been awarded the committee of three will examine the plans and suggest any alterations that may be found necessary. It is understood that the committee will supervise the erection of the schools and be paid on a commission basis. Members of the board feel that under the new arrangement the school buildings will be improved and will be more varied in architecture than if one man designed them year after year.

It is understood that Messrs. Somervel & Putnam, the well-known Vancouver architectural firm, is preparing plans for the proposed palatial residence of Mr. B. T. Rogers, manager of the B. C. Sugar Refinery, Vancouver. The residence will be situated in Shaughnessy Heights, and while constructional details are not available at the present time, it is admitted that the structure will be a very elaborate one, and erected at considerable expense. Messrs. Hodgson, King & McPhalen Brothers, of Vancouver, have been awarded a contract for the gate lodge to be erected on the site, but construction of the residence itself is not expected to be undertaken before next spring.

Notification has been received in Vancouver from the Deputy Minister of Public Works at Ottawa that British Columbia sandstone and British Columbia Douglas fir will be specified in connection with the new immigration detention building to be erected in Vancouver, and all other public works in British Columbia as far as possible.

The Ritchie Contracting & Supply Company, Limited, Vancouver, recently received an order from the contractors of the Hudson's Bay Company's new Vancouver building, Rourke, McDonald & Moncreiff, for about 100,000 Kittenning face brick. This is the third large order procured by the company for this class of brick during recent weeks, the three orders being in the vicinity of 100,000 bricks each.

The Canadian North Western Steel Company, of Vancouver, were recently awarded a contract covering all the steel work required for the new provincial government bridge at Taghum, near Nelson, this firm's tender approximating $4.45 per thousand pounds of metal. The concrete substructure and the work of erection were awarded to Messrs. Hodgson, King & McPhalen Bros., another Vancouver firm, at a price of approximately $55,000. The total cost of the structure will be about $75,000. The contractors have been instructed to commence operations immediately.

What is described as a departure from the usual methods followed in road making is being adopted by the M. P. Cotton Company, of Vancouver, on the western portion of Kingsway, at Port Coquitlam. Starting on the usual subgrade of sand or earth, a heavy layer of good sized rock is first laid and well rolled, then a thick coating of tar-pitch is put on hot, after which the top layer of fine rock is laid and the whole thoroughly rolled. The contractors claim that this process gives a greater amount of solidity than the ordinary macadamized road, and afford a spring to the road which enables the surface to last much longer. The experiment is attracting a considerable amount of interest in the district.

It is the intention of the firm of Messrs. Aldous & Murray, Limited, Vancouver, joint owners of the townsite of Smithers to put in a gravity water system at this general divisional point on the Grand Trunk Pacific Railway in the interior of British Columbia. Negotiations are under way for the installation of the plant, and work will be started with the least possible delay. The Bulkley River, which flows past the townsite, will supply all the requirements of the district, the source of supply being ideal, the water clear and pure, while the problem of distributing it to all parts of the townsite is a very simple one. Water will be pumped from the Bulkley River above the town, the point of diversion being 400 feet north of the south line of section 31, township 4, range 5, Coast district. A Fairbanks-Morse engine of 8 h.p. will operate the pump which will have a capacity of 130 gallons per minute. The water will be lifted to a reservoir, located on the height of land above the town, which will have a capacity of 50,000 gallons. The water will be supplied to all parts of the townsite by gravity system.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The new children's hospital, now in course of erection in Hamilton, is expected to be ready for occupation by February 1. Mr. Robert New is the architect.

It was stated by Mr. G. L. Parsons, superintendent of the grain elevator, that 11,000,000 bushels of grain are handled annually, making Goderich the second largest grain port on the Upper Lakes.

The Balmy Beach sewerage system, draining the territory south of Queen street, Toronto, is almost completed and it is expected the whole system will be in operation before the new year.

St. Catharines city council is considering a by-law to make an addition to the Canada branch of the Russell-Jennings Manufacturing Company, the products of which will be augers, auger bits, tools and hardware.

According to reports the Imperial Oil Company have purchased at Sarnia a three-acre site for the erection at a cost of about $1,000,000, of a factory for the manufacture of crude oils into greases and other products.

By-laws will probably be passed by the city of Hamilton authorizing the borrowing of $200,000 for the erection of hospital buildings upon the new site on the mountain top; also for $125,000 for improvements to Barton Street city hospital.

An order winding up the Dominion Roofing Company was made by Chancellor Boyd at Osgoode Hall on December 16, Mr. G. T. Clarkson being appointed liquidator. The company was incorporated in August, 1912, with head office in Toronto.

The Plymouth Cordage Company, said to be one of the largest of its kind on the continent, is contemplating the erection of a large distributing warehouse at Fort William similar to the one now in operation by the International Harvester Company.

Mr. Thomas Crawford, Clerk of Scarboro Township, has applied to the city of Toronto for a supply of water to the residents of Victoria, Blantyre, Chester, and Lakeview Avenues in the township. The application will be dealt with by the Works Committee.

The new bridge over Dog Lake, Kingston, which will be 300 feet long, is to be built by day labor, the cost to be borne jointly by the county of Frontenac and the township of Storington. The work will be superintended by the chairman of good roads and bridges for 1914.

The Steel Company of Canada is erecting a factory at Fort William for the manufacture of nails and spikes. The installation of machinery will shortly be commenced and work will be in operation early next spring. It is anticipated that about 1,500 men will eventually be employed.

The abutment of St. Clair bridge, Toronto, which with the western piers has been recently finished, is considered one of the finest specimens of concrete work on the American continent. The mass consists of about 3,000 tons of material and though not plaster finished is as smooth as stonework.

The York county highway commissioners have received some useful hints from the Good Roads Convention at Philadelphia which they attended recently. It is likely that an improvement in the present roads of York county will result. Toronto will probably be the meeting place for next year's convention.

It is stated that a large cotton mill will probably be established in Welland by the Toronto Cotton Company. It is understood that the proposal of the company is to have an annual payment of $50,000 made to them, the town to erect the building which would afterwards be purchased by the company.

By-laws will probably be sought in connection with the proposal to extend the London, Lake Erie Railway and Transportation Company from St. Thomas, Ont., to Aylmer and Port Burwell. It is said that the municipalities are prepared to give a free right-of-way to the company for the construction of the line.

The new covered bridge which spans the Cocagne River on Victoria Road, Moncton, is now practically completed by the contractors, Messrs. A. E. Smye & Son. The length of the work, including approaches and roadway, is nearly 1,000 feet. Howe trusses are used, the spans being supported by concrete piers with stone riprapping, built-in pits excavated to a depth of firm foundation.

As a sequel to the Lakes disaster the coroner's jury recommends that the government, regardless of cost, equip Goderich harbor by completing the breakwater now begun, by installing up-to-date lights and fog signal at the entrance of the breakwall by dredging to the necessary depth the outside basin formed by the breakwall. A wireless installation for the lakes is also recommended.

The annual good roads report on the year's construction as presented to the Welland county council shows an expenditure of $58,427, of which the county will receive a refund of one-third from the government. The roads built in the neighboring townships cost about $4,000 per mile. There appears to be some agitation in favor of a more permanent class of road than is now being constructed in the county.

The Daprato Statuary Company of Chicago have secured the contract for constructing the main altars and two side altars for the basement of the new St. Dunstan's Cathedral, Prince Edward Island, also the altar for the private chapel in the Archbishop's palace. This will be of Sagliola artificial marble finished in white veined carrara marble effect. The altar for the palace chapel will be of rigalico which is made of English Keene cement.

In St. John, N.B., more than four thousand feet of the seven miles of water mains have been taken out and replaced by pipes of at least eight inches diameter during the present year. In west St. John seven thousand feet of the old sheet iron mains have been replaced with eight-inch cast iron pipe, the work being carried out by Mr. Wigmore. commissioner's department, who is active in his efforts to bring the city water system up to the modern standard.

An impression of the magnitude of civic works carried out under the direction of the Toronto Works Commissioner, Mr. Harris, will be gathered when it is stated that over 23 miles of sewers, 54 miles of pavements and 68 miles of sidewalks were constructed during the year. Five miles of macadamized roadways were re-surfaced and the length of sidewalk from which the snow was cleared opposite vacant properties, and for which the owners were charged, was 446 miles.

Among the many large institutions on which work has been rushed throughout the season is the plant of the Canadian Car & Foundry Company, Limited, in west Fort William. The structure is of steel and the plant which is being installed at a cost of a million and a half dollars will turn out complete freight and passenger cars. Work will be in operation early next summer when it is expected that employment will be found for between two and three thousand.

The salesmen of Messrs. Bird & Son, Hamilton, Ont., held their annual meeting in Hamilton last week. The company are well-known as the manufacturers of the now famous "Neponset" products, consisting of Paroid roofing, waterproof building papers and Neponset wall-board. Representatives were in attendance from points as widely separated as East Walpole, Mass.; St. John, N.B., and Vancouver, B.C. Mr. Geo. E. Messer has been manager at Hamilton for the last two years.

The Montreal Builders' Exchange have written to the mayor and controllers complaining of the inadequacy of the building inspectors' staff and alleged disregard of the by-laws in relation to permits. It has been found that in some instances permits are not taken out until the buildings are partly completed, and in others houses have been occupied before the permits have been applied for. The Builders' Exchange desire that the penalties for violation of the laws should be enforced more strictly.

Dr. J. W. McCullough, Provincial Officer of Health, Toronto, gave an interesting address on sewerage problems before the Niagara District Medical Association at Welland club, December 13. Dr. McCullough was positive that the government would build a pipe line from Port Colborne all along the canal to supply fresh lake water, the intake to be about a mile out in Lake Erie. In the discussion which followed it was stated that the problem of leakage troubles is now under investigation by a government commission.

That Port Arthur has grown steadily during the past year is shown by the large number of buildings that have been erected. Among these is an eight-storey office for the Whalen interests at a cost of $450,000, which is expected to be completed by the end of the present year. The government have just completed a new elevator with storage capacity for 2,260,000 bushels of wheat in order to meet the increasing quantity of grain being handled in the city. Nearby the firm of Davidson & Smith are erecting an elevator and flour mill, while in the same part of the city the C. N. R. have added storage tanks with a two-and-a-half-million bushel capacity at a cost of $6,357,000.

Fort William's finest office building, the Grain Exchange, is the first large international building to be erected at the head of the lakes. The contract was awarded the A. C. Stewart contracting company last February when the work of excavation was immediately commenced. Concreting the basement was begun early in April and despite adverse weather and other conditions the work was completed in October. The plans called for reinforced concrete construction with an exterior of brick. The foundations extend twenty feet below the ground level which is eight feet below the sewer level, and rest upon wooden piles varying in length from forty to seventy feet according to variations in the depth of the rock. The building, which cost $320,000, is five storeys high with a deep basement, the dimensions being 100 x 125 feet.

The Quebec Government have introduced a bill to assist in the construction of dwelling houses. It empowers municipal councils to guarantee the loans of a company incorporated to build dwelling houses intended to be let at a moderate price. The loans are only to be guaranteed by a municipality provided additional dwelling houses are required properly to house the people who live or work within its boundaries. The object of the company is in good faith to furnish comfortable dwellings, and not to make a profit greater than six per cent. per annum. The by-law authorizing the loan is only to come into effect after approval by a majority of the electors who are proprietors. The guarantee of the municipality is to be protected by a first mortgage on the houses and lands, and the total amount of the loan is not to exceed eighty-five per cent. of their value.

WESTERN CANADA

A by-law is to be submitted to the ratepayers authorizing the city council to borrow $150,000 for the purpose of rocking, planking and macadamizing streets and lanes in the city of Vancouver.

Splendid progress is being made by the Canadian Explosives, Limited, in the construction of their new works on James Island, B.C. About one hundred and fifty workmen are engaged on the work.

The Department of Works, Ottawa, has awarded a contract for the erection of a wharf at Gillis Bay, B.C., to Hodgson, King & McPhalen Bros., Vancouver. The amount of the tender is not made public.

Building contractors, painters and decorators from all over Western Canada will meet in Edmonton early in February when questions of importance to these industries will be discussed by prominent members.

The western association of the Builders' Exchanges will hold its first convention early in February. The western body it will be remembered, divided from the eastern section at the last convention of the Canadian National Association of Builders' Exchanges. This inaugural function bids fair to be an unqualified success.

At Tranquille, eight miles west of Kamloops, B.C., a tuberculosis sanitorium is to be erected at a cost of $150,000. At last hearing tenders had been called but no contracts awarded. The building is to be four storeys high of reinforced concrete construction. Messrs. Dalton & Eveleigh, of Vancouver, are the architects.

In an action brought by Mr. H. P. Hazell against the Standard Milk Company as owners and J. J. Dissette & Company as chief contractors, Vancouver, for damages for $1,988 for material and labor supplies, Judge Grant ruled that under the Mechanics Lien Act a sub-contractor who has paid all his labor and material bills is entitled to succeed in lien action against the owner even though he has failed to fulfil the section of the act which provides that he must post up on the work his receipted pay-roll the first day after pay day.

The Government has given expression of its recognition of Fort William's rapidly growing importance in Dominion affairs by starting in the early autumn the erection of a customs house at the corner of May and Leith Streets which will cost $200,000. The imposing structure will be two storeys and basement, 100 feet long by 80 feet wide. The foundation work is well under way. The government has also asked for tenders for a modern armory and drill hall to be built in Fort William, which will be one of the most modern in the country. A site has already been provided for the armory.

With its natural beauties and the art of the town planner the district of South Winnipeg has come to the front as one of the choice residential localities surrounding that city. Together with the town planning and actual laying out has gone forward the installation of asphalt pavements, etc. A subway will shortly carry the traffic under the railway tracks which cross Arlington Street, this having been already ordered by the railway commission. The engineering building of the University of Manitoba is well under way and thirty-two of these buildings have been planned to adorn the government reservation.

Canadian Railroad Development

The feasibility of constructing a railroad from the Yukon to Alaska, with Edmonton as a starting point, was discussed at a recent meeting of the Edmonton Board of Trade. Some of the main features of the project were dealt with by Mayor W. A. Greisbach who led the discussion.

Mr. D. B. Hanna, vice-president of the Canadian Northern Railway, has given a pledge to St. Catharines city council that in the construction of the line from Toronto, through Hamilton to the Niagara River, the section between Grimsby, Beamsville and St. Catharines, will be completed within two years.

City Engineer Latornel has prepared plans for sixteen subways, costing $1,160,000, to be built under the main lines of the Grand Trunk Pacific and the Canadian Northern roads at Edmonton. The cost of raising the tracks for the subways is estimated at $80,000. Track raising to a height of twelve feet is estimated to cost $2,000,000.

The Intercolonial Railway at Truro is about to open one of the finest stations on its line. The new building is a handsome structure of red sandstone with rock-faced body and dressed trimmings. It is 380 feet long, 55 feet wide and is surmounted by a tower on the street side, 19 feet square and 78 feet high. From each end to the central part there is an extension, the one to the north being 80 feet long by 50 feet wide and the one to the south 121 feet long by 50 feet wide. The foundations are of concrete and the floors of reinforced concrete and structural steel. The roof is supported by steel roof trusses being built of slow burning wood covered with pitch and gravel. The walls for a height of seven feet are tiled, the upper part and the ceiling being done with rough-cast plastering, with finishing cornices, beams, etc. All the wood finishings are quartered golden oak and a ten-foot verandah supported on structural brackets with roof covered by asbestos shingles extends along the whole track front and around both ends.

The building of the Canadian Pacific Railway tunnel, five miles long, at Rogers' Pass, B.C., in connection with the double-tracking work in Calgary and Vancouver, has been let to Messrs. Foley, Welch & Stewart. In addition to the boring of the tunnel the contract calls for the construction of 11.1 miles of double track approaching the eastern portal and 2.3 miles approaching the western portal. The work will reduce the height of the summit at which the line crosses the Selkirks by 537 feet, will eliminate 4.4 miles of distance and 2,500 degrees of curvature and on fifteen miles of track the gradient will be reduced from 2.2 to 1 per cent. The tunnel will be a single one carrying a double track 30 feet wide by 20 feet high, and in the boring a new method will be adopted. Instead of boring simply through both ends it has been decided to bore a pioneer tunnel 7 feet by 8 feet parallel with the main tunnel and cross-cut at short intervals so as to enable several headings to be worked simultaneously. The boring of the pioneer tunnel which will add ventilation to the railway tunnel during construction has been started and about the end of December the first cross-cuts will have been completed. The project is likely to cost the C. P. R. about $8,000,000, the plant alone for the boring of the tunnels involving an expenditure of half a million. An interesting feature of the work is the erection of model villages at the two portals of the tunnels at a cost of $50,000. The work which will take about three years to complete is the biggest single feature that the C. P. R. has undertaken.

Constructional Interests Re-organized at Vancouver

SATISFACTORY progress is reported in connection with the organization of the various building and allied interests which have become members of the Vancouver Builders' Exchange, and by January 30th next the Secretary of the Exchange, Mr. W. Hamilton-Lindsay, hopes to complete the work of forming the members into their respective sections.

Following is a list of the different divisions proposed: general contractors; electrical contractors; general supply houses; sheet metal manufacturers; glass dealers; hardware merchants; brick manufacturers; machinery houses; electrical supply firms; elevator manufacturers; wholesale paint and oil merchants; structural steel fabricators; cabinet manufacturers; stone and quarry operators; sash and door manufacturers; ornamental iron workers; painters and decorators; plumbers; plasterers.

A number of sections have already been organized, and these are getting down to work in a fashion which indicates that a strong association will be the result. Among the important matters under discussion at the present time are the provincial lien law and the question of a uniform contract for contractors and sub-contractors. A feeling of general dissatisfaction exists in British Columbia regarding the operations of the lien law and every effort will be made by the exchange towards persuading the provincial authorities to adopt a more satisfactory measure.

Other matters pertaining to the welfare of the building and allied trades will be brought up for discussion in the course of the next few weeks, and presented in the form of resolutions before the first annual meeting of the Exchange, February 3, 1914, at which a revision of the existing by-laws will be made and the officers elected for the ensuing year.

The membership of the Exchange is steadily increasing, and it is hoped that as a result of the vigorous campaign which the secretary is conducting at present that a total of 150 members will be enrolled before the date set for the annual meeting.

Personal Mention

At the annual meeting of Saskatoon Builders' Exchange Mr. J. Priel was re-elected president, and Mr. A. W. Cassidy, first vice-president, both appointments being for a third term.

Prof. E. J. McCaustland, professor of engineering at the University of Washington, has been appointed consulting engineer for the construction of $3,000,000 worth of county roads in King County, Washington.

It is rumored in Ottawa circles that Major R. W. Leonard, chairman of the Transcontinental Railway Commission, will be among those upon whom the King will confer New Year honors, and that a knighthood will be given him in recognition of his various services to the Dominion. Major Leonard is one of Canada's best known engineers and a man of considerable wealth. A gift of half a million dollars from him to Queen's University for military training was recently announced.

Mr. David Ewart, chief architect of the Department of Public Works, Ottawa, is likely to be retired shortly at his own request. Entering the public service in 1871 as assistant engineer and architect of the public works department, Mr. Ewart has been at the head of the architectural branch since 1897 and has designed most of the public buildings erected in Canada since that time. He was decorated with the Imperial Service Order in 1903 and was also honored by the French government in connection with designs for the Canadian buildings at the Paris Exposition.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.
The following sewers are recommended by Board of Health. Alice, Gordon, North Park and St. Georeg Sts., Henry Ave. and Elliott Ave. Clerk to City Council, H. F. Leonard.

Montreal, Que.
Council has voted $5,500 for Mentena St. sewer. Tenders will be called about March. Sec., L. N. Senecal.

Niagara Falls, Ont.
Ratepayers will vote on by-law January 5th, on storm water sewer to be constructed on Third Ave. and Maple St., at an estimated cost of $5,000. Clerk, W. J. Seymour. Engineer, F. J. Anderson.

Ottawa, Ont.
Surveys made for asphalt pavement, cost $35,000 to $40,000, on Osgoode St., from Nicholas to Range Rd. 3,800 ft. long on 6 in. concrete base, with gutters and headers. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

The city council contemplate re-paving Sussex St. between Rideau and St. Patrick, with asphalt and stone setts in track allowance. City Engineer, Arch. Currie, C.E.

Surface drainage having been completed, the city council have had the following surveys made for asphalt paving:—James St. from Bank to Bronson, $27,000; Lisgar St. from Bank to Bronson, $26,000. Mayor, J. A. Ellis. City Engineer, Arch. Currie.

Owen Sound, Ont.
Ratepayers will be asked to vote on Roads by-law in January. Mayor, Mr. Lemon. Clerk, Chas Gordon.

Port Robinson, Ont.
Cement sidewalks planned by Thorold Twp. Council. Clerk, Major Donald Sharpe, Thorold. Engineer-in-charge, J. C. Gardner, Niagara Falls. Plans and specifications at office of Engineer. Tenders to be called shortly.

Richmond, Ont.
The village council are considering the expenditure of $3,000 on a macadam roadway between Bells Corners and Richmond. Further particulars from Councillor Chanonhouse.

Simcoe,Ont.
The Town Council has decided to call tenders about February 1st for lateral sewers and house connections. Clerk, W. C. McCall.

St. John, N.B.
The following permanent pavements are contemplated by city council. Main, Garden St., Chipman Hill, Orange, Princess Charlotte, Union, Horsefield and Market Sq. Commr., Miles Agar.

Toronto, Ont.
The Commissioner recommends walks on Arlington, Chandos, Conduit, Caledonia, Dartford, Greenlaw, Indian Road, Monarch, McRoberts and Toronto, which has been approved. The estimated cost is $6,312. Commr. of Works, R. C. Harris.

Plank roadway is contemplated by Board of Control, on St. Clair Ave. between McRoberts Ave. and G. T. R. tracks, also on Mt. Pleasant Rd. from Soudan to Victoria Ave. Commr. of Works, R. C. Harris.

The following grading has been approved by Commr. of Works. 940 ft. on Indian Grove, $5,914; 3,424 ft. on Queen, east of Beech, $12,296. Commr. of Works, R. C. Harris.

The following paving has been approved by Com. on Works. Brick block on Wilton Cres., $2,825; asphalt on Gladstone, $11,112; bitulithic on Teddington Park Blvd., $26,470; bitulithic on Brock. $4,731. Commr. of Works., R. C. Harris.

Whitby, Ont.
A sewerage system is contemplated by Town Council. Clerk, Jos. White. Engineer, T. Aird Murray, Lumsden Bldg., Toronto. Plans and estimates will be presented to citizens shortly.

Wingham, Ont.
8-in. sewers are contemplated by town council, in Victoria St., Diagonal Road, Francess St. and Shuter St. Clerk, John F. Groves.

Winnipeg, Man.
Pump house, cost $2,429.30, at Well No. 25, planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, J. W. Astley, Supt. of Construction.

Sewer and watermain planned by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. General contractor, D. Kuxhaus, 654 College Ave., for sewer in Louise St., at $941. General contractor, J. W. Astley, Supt. of Construction, for water main in Richard Ave. at $152.05.

By-law providing for park improvements at an estimated cost of $110,000 was defeated by ratepayers Dec. 12th. Sec. Board of Control, M. Peterson.

C. I. water pipe required by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. 50,000 ft. of 6 in. pipe; 12,000 ft. of 10 in. pipe; 6,000 ft. of 8 in. pipe; 3,000 ft. of 12 in. pipe. Specifications at office of Engineer. Tenders received by Board until Jan. 2, 1914.

Yarmouth, N.S.
Sewerage system, cost $107,888.27, planned by town council. Mayor, S. C. Hood. Clerk, Hiram Goudey. Engineer-in-charge, E. S. Matheson. Plans drawn.

CONTRACTS AWARDED

Regina, Sask.
Sewage disposal works, cost $3,800.39, planned by City of Regina. City Commr., L. A. Thornton. City Engineer, F. McArthur. Steel roof for filter bed, awarded to Hamilton Bridge Works Co., Ltd., Barton and Bay Sts., Hamilton, Ont. Additional contract awarded.

Toronto, Ont.
Sewers planned by Board of Control. General contractors, Godson Contracting Co., Manning Chambers. Quebec Ave. to Runnymede, $34,730; Woodbine Ave. from Kingston Rd. north, $61,730. General cntractors, J. H. McKnight Contracting Co., 88 St. David St., Danforth Ave from Hillington to Woodbine, $28,945.

Sewer, cost $3,148, planned by York Twp. Council. Clerk, W. A. Clarke, 40 Jarvis St. Engineer, Frank Barber, 57 Adelaide E. General contractors, Routly & Summers, Benamond Ave. Sewer on Kennedy and Barrie Ave. Contract awarded but subject to approval City Engineer.

Railroads, Bridges and Wharves

Province of Alberta
Edmonton, Durwegan & B. C. Rly. have been authorized to construct bridge across Athabasca River, Mileage 131, west of Edmonton.

Broadacres, Sask.
Location of C. P. R. station at Broadacres on S.W. ¼ Sec. 32-35-21, W.3.M., has been approved.

Cobalt, Ont.
Dam, etc., contemplated by Cobalt Lake Mining Co. Sec.-treas., G. F. Morrison, 418-20 Traders Bank Bldg., Toronto, Ont. Company has made application to drain Cobalt Lake into Farr Creek. Dam pipe line flues and pumping machinery will be required.

Coniston, Ont.
Location of C. N. O. Rly. station at Coniston, Twp. Neelon, Dist. Nipissing at mileage 257 from Toronto has been approved.

Edmonton, Alta.
Bridge, over Sask. River, planned by City of Edmonton. Mayor, Mr. Short, Civic Offices. Clerk, C. Cox, Civic Offices. City Engineer, A. Latornell, Civic Office. Lyall Mitchell Constr. Co., 389 Main St., Winnipeg, is the general contractor for this work.

Fitzroy Twp., Ont.
Ratepayers will be asked to vote on by-law Jan. 5th to raise the sum of $20,000 for erection of 2 bridges over the Mississippi River in the above Twp. Clerk, Alex. Murphy, Antrim, Ont. En-

gineer-in-charge, David Barry, C.E., c/o Clerk.

Granby Bay, B.C.
Plans are filed with Registrar of Deeds for a wharf which is contemplated by Granby Consolidated Mining & Smelting & Power Co., Ltd. General Manager, T. M. Sylvester, 509 Richards St., Vancouver, B.C.

Kingsbury, Que. (Near)
C. P. Rly. have been authorized to construct bridge No. 49.8, over Salmon River, Orford Sub. Div.

Lambeth, Ont.
Surveys made for 2 bridges, cost $1,600, between Lambeth and Delaware, each 1 span, 20 ft. long, reinforced concrete. Clerk to County of Middlesex, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London.

Twp. of Metcalfe, Ont.
Surveys made for bridge, cost $2,300, 3 spans, 10 ft. long, reinforced concrete and steel. Clerk to Twp. Council, Richard Ward, Strathroy. Tenders to be called after the New Year.

County of Middlesex, Ont.
Surveys made for bridges, cost $1,400, between Lobo and London Twps. and between London and Biddulph Twps. Each 1 span, 20 ft. long, reinforced concrete. Clerk to County Council, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year.

Montreal, Que.
Shed, Lachine Canal, planned by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Architect, Mr. E. Marceau, Supt. Engineer, New Birks Bldg. Tenders will be called about Feb. 1st for corrugated galvanized iron sides and rolling gates for St. Gabriel shed No. 1, Ottawa St., Montreal, Lachine Canal.

C. P. Rly. have been authorized to construct bridge No. 2.0, Montreal Terminals, Eastern Div.

Nassau, Ont.
Dredging required by Canadian General Elec. Co., Peterboro. Consulting Engineer, Henry Holgate, Richelieu Bldg., Montreal. Plans at office of company in Peterboro and Toronto, and office of Engineer. Tenders received until Dec. 31 for excavation and dredging tail race for power plant, about 24,000 cubic yards.

Prov. of Ontario
Four bridges, cost $90,469, Abitibi District, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Canadian Bridge Co., Ltd., Walkerville, Ont. Piers and abutments completed. Steel work will not be erected until spring.

Parkhill, Ont.
Bridge, over Mud Creek, cost $1,400, planned by County of Middlesex. Clerk, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year. One span, 20 ft. long, concrete and steel.

Two bridges, over Mud Creek, cost $5,000, planned by County of Middlesex. Each 1 span, 60 ft. long, concrete and steel. Clerk, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London. Tenders to be called after the New Year. Plans and specifications at office of Engineer.

Toronto, Ont. (York)
The G. T. Rly. will be petitioned by residents to build a new station building.

Toronto, Ont.
Bridge, Cherry St., planned by Toronto Harbor Commission. Sec., A. C. Lewis, 76 Adelaide W. Plans approved for scissor type lift bridge, 86 ft. span. Contracts not yet awarded.

$142,000 will be included in estimates for reconstruction of Dundas St. bridges. Commr. of Works, R. C. Harris.

CONTRACTS AWARDED

Coniston, Ont.
Railroad construction, cost $20,000, for Mond Nickel Co. Chief Engineer, Mr. Dotloff. General contractors, Nipegon Constr. Co., Nipegon, Ont. Six miles 80 lb. rail standard gauge.

Sussex, N.B.
Station planned by Dom. Govt. Dept. of Railways & Canals. Sec., L. K. Jones, Ottawa. General contractors, British America Constr. Co., Ltd., St. John. Plumbing and heating, Carland & Regan, Princess St., St. John, N.B. Stone and brick construction.

Richmond County, N.B.
Bridge planned by County Council. General contractors, The Standard Construction Co., Ltd., Metropole Bldg., 193 Hollis St., Halifax, N.S. Geo. T. McNutt, D. W. B. Reid, Jas. E. Gould and Roy A. Smith. Bridge to be built from mainland to Burnt Islands, thence to Madame Island. To consist of 9 cement piers faced with granite and will have a draw in the centre for passage of vessels.

Public Buildings, Churches, Schools, etc.

Brampton, Ont.
Negotiations have been opened by the St. Michaels Hospital Board re establishing a branch in Brampton. Archbishop, N. McNeil, Wellesley Place, Toronto.

Brussels, Ont.
Church, cost $20,000, for Melville Pres. Church. Pastor, Rev. A. J. Mann. Architect, J. S. Russell, 21 Downie St., Stratford. Chairman Com., J. Leckie. Sec. Com., Malcolm Black. Tenders received by Sec. until Jan. 8th for erection of new church and stables. Plans, etc., at Fox's Drug Store, Brussels.

Gravenhurst, Ont.
Plans are in progress for a recreation hall in connection with the Muskoka Free Sanitarium. Architects, C. S. Cobb and F. A. Spangenberg, 71 Bay St., Toronto, Ont. Two storeys, frame and stone construction, steam heating, metal casement sash. Cost is estimated at $10,000.

Hamilton, Ont.
Alterations and addition to school planned by Board of Education. Sec., R. H. Foster. Architects, Stewart & Witton, H. P. & L. Bldg. Tenders received by Sec. until 5 p.m. Dec. 24th. Plans and specifications at office of Architects. Alterations and addition to Queen Victoria School.

Hespeler, Ont.
By-law for providing $25,000 for the erection of Town Hall will shortly be submitted. Clerk to Town Council, Winfield Brewster.

Kitsumgallum, B.C.
Large one-room school planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Engineer, J. E. Griffith, Victoria. Tenders received by Minister until noon Dec. 29th. Plans, etc., at office of J. H. McMulin, Govt. Agent, Prince Rupert, S. H. Hoskins, Govt. Agent, Hazelton, W. J. Goodwin, Sec. School Board, Kitsumgallum, and at Dept. Public Works, Victoria.

London, Ont.
The Com. of Board of Education (Chairman E. R. Dennis) have recommended that the McCormick property on Grand Ave., be purchased for school purposes. Building to be remodelled and school furnishings purchased.

Matsqui, B.C.
School (4 rooms) planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Engineer, J. E. Griffith, Victoria. Tenders received by Minister until noon Dec. 30th. Plans, etc., at office of Wm. Merryfield, Sec. School Board, Mount Lehman, F. C. Campbell, Govt. Agent, New Westminster, and Dept. Public Works, Victoria.

Millbrook, Ont.
A site has been purchased by the Dominion Govt., Dept. of Public Works, for the erection of a Post Office building. Secretary, R. C. Desrochers, Ottawa.

The Library Board of the Village Council, through their clerk, W. S. Given, has applied for a grant from the Carnegie Trust.

Montreal, Que.
A proposal is on foot for the erection of a Synagogue with a seating capacity of 1,000 at Mt. Royal and Mance streets, and a committee is applying to Legislature for incorporation at next session.

Province of New Brunswick
The Intercolonial Railway contemplate the erection of a bridge over the Miramichi River between Chelmsford and Millerton. General manager, F. Guletius, Moncton.

Port Arthur, Ont.
A new church will probably be erected by St. John's Anglican Church. Bertram Grosvenor Goodhue, New York, N.Y., is spoken of as the architect.

Regina, Sask.
Nurses Home, $75,000, planned by City Council (Hospital Board). City Commissioner, L. A. Thornton. Architects, Reilly, Dawson & Reilly, 512 Westmount Chambers. Brick foundation and construction, electric lighting. Plans in progress.

Police station planned by City of Regina (Police Commission). Architects, Clemesha & Partnell, 1721 Scarth St. Com. appointed:—L. A. Thornton and Chief of Police Yeats, to work out details in plans before tenders are called. Work to start in spring.

Church, cost $50,000, 7th Ave. and Garnet. Owner, St. Chads Congregation. Architect, J. H. Putin, 308 Darke Block. Seating capacity 600, plans are in progress, and work will start in spring.

Saskatoon, Sask.
Hospital, cost $500,000, planned by Saskatoon Hospital Board. Sec., Jno. Ryan. Architects, Brown & Vallance, 1006 McArthur Bldg., Winnipeg. Representative Architect, Allan McLean, Willoughby Sumner Block. Heating and ventilating, Jas. Maalleer, 343 S. Dearborne St., Chicago, Ill. Work has been postponed, but may go on next year.

Swift Current, Sask.
School, $125,000, planned by Public School Board. Ses.-Treas., J. T. Dodds. Foundations completed, but the Board has decided to wait until early spring before calling tenders for construction.

Sudbury, Ont.
Post office, Elm, cost $99,000, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, Doran & Devlin, Sudbury or Eastern Blk., Ottawa. Three storeys, 80 x 60, steel, stone and terra cotta construction. Work postponed until spring.

St. John, N.B.
Tuberculosis hospital, Merrit, planned by Board of Hospital Commrs. Chairman, H. B. Schofield, City Hall. Architect, F. Neil Brodie, 42 Princess Street. Tenders to be called in spring. Plans in progress.

St. Thomas, Ont.
Y. M. C. A., cost $50,000. Architect, John Findlay. General contractor, A. E. Ponsford, 605 Talbot St. Sub. tenders close with Architect Dec. 27th.

Vancouver, B.C.
Hastings Council authorized by-law providing $10,000 for the erection of a fire hall in 1914. Clerk, Wm. McQueen.

Welland Jct., Ont.
The Welland Jct. Public School Board (C. W. Nugent, Welland Jct.), propose erecting a new school building at an estimated cost of $14,000. Four rooms, brick construction, school furniture and supplies required.

Winnipeg, Man.
University planned by Prov. Govt. of Manitoba. Minister, Hon. W. H. Montague. Prov. Architect, W. Harwood, 261 Fort Street. Consulting architects, Brown & Vallance, McArthur Building. Working plans and specifications will be ready about April, 1914. Three storeys, 200 x 75.

By-law providing for public lavatories at an estimated cost of $50,000 passed by ratepayers Dec. 12th. Sec., M. Peterson.

Suburban fire stations. By-law passed by ratepayers Dec. 12th. Sec., M. Peterson.

By-law providing for isolation hospital at an estimated cost of $100,000, passed by ratepayers Dec. 12th. Sec., M. Peterson.

CONTRACTS AWARDED

Lakefield, Ont.
Post office, etc., planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Jas. Bogue, 220 Dublin St., Peterboro. Two storeys, basement and tower, brick and stone construction, structural steel.

Montreal, Que.
School, Poupart St., for R. C. Board of School Commrs. Sec., U. Lafontaine, 92 St. Catherine W. Architects, Venne & Labelle, 5 Beaver Hall Sq. General contractors, O. Filton & Sons, 869 De St. Valier. Heating and plumbing, W. J. McGuire & Co., Ltd., 332 Craig St. Additional contract awarded.

Toronto, Ont.
School, Western, planned by Board of Education. Sec., W. C. Wilkinson. Additional contract awarded. Iron stairs, Shipway Iron Bell & Wire Mfg. Co., 773 King W., $2,370.

School, Regal Rd., planned by Board of Education. Sec., W. C. Wilkinson. Additional contracts awarded. Plumbing, John Ritchie Co., 56 Adelaide E., $6,160. Heating and ventilating, Fred Armstrong Co., Queen W., $12,595. Heat regulators, Johnston Temperature Reg. Co., Adelaide W., $773. Wiring, Bennett & Wright, Queen E., $616.

School, Strathcona, planned by Board of Education. Sec., W. C. Wilkinson. Additional contract awarded. Iron stors, Shipway Iron Bell & Wire Mfg. Co., 773 King W., $990.

School, Howard, planned by Board of Education. Sec., W. C. Wilkinson. Additional contracts awarded. Steam heating, Fred Armstrong Co., Queen W., $4,063. Warm air heating, W. F. Rutley Heating & Ventilating Co., 36 Toronto St., $1,995. Heat regulators, National Regulator Co., 408 Lumsden Bldg., $675.

Business Buildings and Industrial Plants

Chatham, Ont.
The by-law providing for a bonus of $12,000 to the Saginaw Match Co., for the erection of a factory was defeated on Dec. 15th.

Edmonton, Alta.
Office building is contemplated by E. F. Hutchings, 112 Market St., Winnipeg. Architect not chosen yet. Nothing will be done until spring. Six storeys, brick construction.

Three stores, 1st, contemplated. Owner, architect and general contractor, C. Horne, 1700 24th St. Work to start about Jan. 1st. One storey, 50 x 75, brick construction, concrete foundation.

Englehart, Ont.
Addition to West & Jackson's sawmill will be made next spring to increase capacity.

Fort William, Ont.
Picture theatre, cost $25,000, Victoria, contemplated by Ben Ross, Corona Theatre. Seating capacity 1,000. Work to start in spring. Fireproof construction.

Goderich, Ont.
Planing mill, Maitland Rd., for Goderich Milling & Lumber Co. Architect, J. Ades Fowler. Tenders received by Co. One storey, 200 x 60, concrete and brick construction, cement foundation, felt and patent roofing (flat), dry kiln, 30 x 60, some machinery arranged for other lines required. Plans drawn.

Grimsby, Ont.
Theatre, $12,000, for A. W. Moore. Architect, Joseph Daw, 165 St. Paul St., St. Catharines. Two storeys, 50 x 150, brick construction, stone foundation, felt and gravel roofing, electric lighting, steam heating, maple floors, metal ceilings. Plans in progress.

Hamilton, Ont.
Theatre (moving picture or vaudeville) James St. N., for Princess Theatre. Manager, Geo. Swanick, 108 James N. Architects, Watt & Blackwell, Lister Chmbrs. Seating capacity 2,300. Building operations not likely to start until next summer. Plans in progress.

King St. E. store projected by owners and architects, Sparks & McKay, 133 Cannon St. E. Nothing will be done till next summer.

London, Ont.
The Fraser Hat & Cap Co., Carling St., contemplate an addition to their factory at an estimated cost of $5,000. One storey, 40 x 80, white brick construction, felt and gravel roofing, electric lighting, steam heating, pine floors, lime and sand plastering.

W. R. Vining, 269 Dundas St., has in mind the erection of an arena. Reinforced concrete construction, concrete foundation, felt and gravel roofing, electric lighting, concrete floors, wire glass, ventilators, metal sash, architectural iron railings and stairs, seating. Architect not appointed.

Montreal, Que.
Borden Milk Co., 108 Hudson Street, New York, contemplate the erection of a chain of stores in Montreal and will probably also build big distributing station.

Office building, cost $150,000, 153 St. James St., for National Trust Co., Ltd., 153 St. James St. Architect, K. G. Rea, 54a Beaver Hall Hill, who will call for General Contractor about Jan. 10th. Three storeys, 31 x 100, concrete foundation, waterproofed, stone, granite and brick construction, felt and gravel roofing, gas and electric lighting, steam heating, fireproof, maple, birch and concrete floors, hard wall plaster, marble, terrazzo and mosaic tiling, passenger elevator lifts, copper skylights, ventilators, fireproof doors and shutters, architectural iron railings and stairs, prismatic, plate and wire glass, revolving doors, bank fixtures, vaults, safes, weather strips, time recording clocks, vacuum cleaner, fire extinguishers, boilers, stocks, air compressors.

Nicolet, Que.
Ice house, cost $5,000, is contemplated by Borden Milk Co., 108 Hudson Street, New York, who will decide as to building at once as work has to be completed within two months.

Niagara Falls, Ont.
Chain factory contemplated by Dom. Chain Co., Ltd., Ellen Ave. Negotiations for site are being made. Will manufacture dredge chains as well as lighter lines.

Ormstown, Que.
Bottling warehouse, cost $10,000, is contemplated by Borden Milk Co., 108 Hudson St., New York. Work will prob-

ably start early in new year as owners want warehouse for spring.

Ottawa, Ont.
Factory, cost $14,000, for M. J. O'Brien, Aberdeen St. General contractor, A. E. Spooner, Windsor House. Electrical, H. L. Allan, 377 Somerset. Two storeys, solid brick construction. Additional contract awarded.

Peterboro, Ont.
Alterations to Royal Theatre. Manager, M. Geo. Clayton. Architect, Geo. M. Miller & Son, 93 Yonge St., Toronto. Alterations to increase seating capacity to 1,100. Sketches drawn.

Sketches are drawn for rennovation of and alterations to National Hotel (Mr. Geo. Graham). Architects, Geo. M. Miller & Son, 93 Yonge St., Toronto.

Pooles Resort, Ont.
Plans have been drawn for boat house, cost $6,185, for J. W. Butler, New York City. Architect, A. Stuart Allaster, Brockville, Ont. Two storeys, 40 x 65, frame construction, shingle roofing, electric lighting, maple and spruce floors, hard wall plastering, galvanized iron, screens.

Port McNicoll, Ont.
Two stores, cost $10,000, contemplated by Mr. Dan Robins, Victoria Harbor. Architect not yet chosen. Work will probably start in spring. Two storeys, brick construction.

Quebec, Que.
Pulp and paper mill, cost $4,000,000, is contemplated by Syndicate in which Col. B. A. Scott, 3 Genevieve Ave., Que., is interested. It is proposed to erect dam at Grande Descharge Rapids on the Saguenay River, for power to operate mill.

Regina, Sask.
Bank, cost $50,000, Lorne and 11th Ave., contemplated by Bank of British North America, Montreal. Manager, C. A. Cruik, Regina Branch. Site has been purchased.

Smithville, Ont.
Hardware and jewellery store, cost $5,000, contemplated by Murgatroyd Bros. Address inquiries to owner either before Jan. 15th or after April 15th. To be erected next spring or early in summer. Two storeys, 60 x 30, brick construction, stone foundation, gas and electric lighting.

H. Gracey contemplates erecting furniture store and undertaking establishment, to replace building recently destroyed by fire. Two storeys, stone foundation. Fixtures required at once for temporary quarters.

St. Catharines, Ont.
The Merchants Bank, Montreal, has purchased site on St. Paul St. and contemplate the erection of a branch thereon.

St. John, N.B.
The walls of Atlantic Sugar Refinery Co.'s new buildings, Balast Wharf, are about up. General contractor, E. G. M. Cape, New Birks Bldg., Montreal. Seven buildings, brick and steel construction.

Swift Current, Sask.
Plans are being prepared at an estimated cost of $12,000, for business block, Central Ave., for MacKenzie & Mann, (men's furnishings), 11th ave. Architect, G. A. Ferris. Two storeys, concrete foundation, concrete block construction, steel girders, tar and gravel roofing, electric lighting, steam heating, hardwood floors, hard wall plaster, encaustic tile, plate and wire glass, fire escapes, tile front entrance. Work to start in spring.

Toronto, Ont.
Warehouse, $36,000, for E. Pullan, 490 Adelaide St. W., who is open to receive tenders for carpentry, roofing, painting, heating, plumbing and electrical. Five storeys, 40 x 68, brick and mill construction, brick foundation, felt and gravel roofing, electric lighting, steam heating, birch floors, wood lath, wire glass, galvanized iron, skylights, fireproof doors. Masonry, day labor. Plastering, none.

Alterations to storage, cost $7,000, for Bowes Produce Co., 76 Front St. E. Architect, L. J. Foulds, King St. and Leader Lane. Tenders will be called by architect after January 1st. Four storeys, steel and brick construction, concrete floors, galvanized iron, fireproof doors, fire escapes. Plans drawn.

Hotel, cost $125,000, contemplated by Jas. J. O'Neill, 53 Wellesley St. Architect, J. R. Hynes, 199 Yonge St. Board of License Commrs. have approved of site and have given permission to owner to erect building on N.E. corner of Bay and Richmond Sts. Three storeys, brick and steel construction.

Plans drawn for theatre, cost $5,000, for C. Letros, 228½ Yonge St. Architect and general contractor, T. P. Whitlam, 117 Summerhill Ave. Architect will superintend construction and let work. One storey, 24 x 120, brick and steel construction, brick foundation, felt and gravel roofing, electric lighting, hot water heating, maple floors, lime and sand and asbestos plastering, metal lath, store fronts and fixtures, seating.

Vernon, B.C.
Temporary additions will be made to the plant of Okanagan Steam Laundry Co. Concrete construction.

Victoria, B.C.
Departmental store, cost $1,250,000, Herald, Douglas & Fisguard, for The Hudson's Bay Company, Wharf Street. Manager, H. V. Pratt. Architects, Burke, Horwood & White, 28 Toronto St., Toronto, Ont. Tenders received by owners until December 27th for masonry, reinforced and plain concrete, architectural terra cotta, ornamental iron, carpentry and joinery, roofing and sheet metal, plastering, painting and glass, marble and tile. Plans, etc., at office of owners. Structural steel, reinforced concrete, granite, tile and brick construction.

Permit has been issued to F. Fairhurst, 1304 Queen St., for an addition of 35 rooms to hotel, at a cost of $20,000. Work to be done by day labor.

Plans are prepared for alterations to hotel at an estimated cost of $25,000, for H. H. Maloney, 1023 Government St. Architects, Coates & Fleet, Winch Bldg. Work to start shortly. Complete steam heating system to be installed.

Winnipeg, Man.
Hotel on William Ave., for E. J. Rochon, Leland Hotel. Architect, Mr. Hall, Chicago, Ill. Old building to be razed. New building to be erected next year. 100 x 88, brick and steel construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, fireproof, oak and maple floors, hard wall plastering, mosaic tile, plate glass, passenger elevator, fire escapes, bar fittings, revolving doors, telephone system, vacuum cleaners, boilers, stacks. Plans prepared.

Store and office, Market St., for Lord Northcote, London, Eng. Two storeys and basement, cut stone front. Work to start in spring. Plans drawn.

Interior alterations to C. P. R. Co.'s office, cost $8,750, Portage and Main. Owners, Canadian Pacific Rly. Co. Architects, Engineering Dept. General contractors, C. W. Sharp & Sons. Plans drawn.

Weston, Ont.
Grand stand may be erected by York, Etobicoke & Weston Agricultural Society, near new race track now being laid out.

CONTRACTS AWARDED

Calgary, Alta.
Hotel, cost $65,000, 8th Ave. E. and 4th St., for Col. J. Walker. General contractor, Jones & Lyttle, 6th St. W. and Bow River. Steel, E. M. Huyck. Sheet Metal, D. R. Foulds, 1335 10th Ave. W. Sub contract awarded.

Montreal, Que.
Extension to jewellery factory, cost $30,000, 259 St. James St., for Estate Lyman, 259 St. James St. Two storeys, 83 x 29, brick construction. Architects, MacVicar & Heriot, 104 Union Ave. General contractor, Mr. Fromson, 68 Colonial Ave. Architects will award tenders for heating and plumbing shortly.

Residences

Brockville, Ont.
Residence, cost $5,000, Riverdale Ave., is contemplated by Arthur Stuart.

Dundas, Ont.
Four residences, cost $10,000, Alma, are contemplated by The Dickson Bldg. Co. Pres., J. W. Dickson. Site purchased. Two storeys, brick construction.

Edmonton, Alta.
Apartment block, 24th, is contemplated by C. Horne, 1700 24th St. Work to start about Jan. 1st. Three storeys, 50 x 150, brick construction, concrete foundation.

Hamilton, Ont.
Seymour Walker Co., Bank of Hamilton Bldg., contemplates erection on Garfield St., 5 residences, at an estimated cost of $12,000. 2½-storeys, brick construction, concrete and stone foundation, shingle roofing, gas and electric lighting, hot water heating, plumbing, hard wall plastering, wood lath, mantels.

Montreal, Que.
O. Lamoureux, 15 St. James St., has purchased a site on St. Catharine St., Westmount, and contemplates the erection of an apartment house.

Flats, cost $12,000, Durocher St., Outremont, for Mr. S. Paulhus, care architect, Mr. J. A. Ouellet, 250 Amherst. Tenders for general contract received by

(Continued on page 69)

Tenders and For Sale Department

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on **Tuesday, the 3rd day of February, 1914**, for about forty-two miles of steel pipe, fifty-four inches internal diameter, about thirty-two miles of steel pipe fifty-eight inches internal diameter, and about eleven miles of steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dam on French River, South Channel, Ont.," will be received at this office until 4.00 p.m. on **Monday, December 29, 1913**, for the construction of a Dam across the South Channel of the French River, at head of Big Chaudiere Falls.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont.; Post Office Building, Montreal, and on application to the Postmaster at North Bay, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 5, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51842. 51-52

Tenders Wanted

Lump sum and separate tenders for the following trades: Mason and Bricklayer, Carpenter, Plumber, Plasterer, Painter and Glazier, Heating and Ventilation, Iron Stairs, Galvanized Iron, Hollow Tile, and Reinforced Concrete, Electric Wiring; for the erection of a new High School, will be received by the High School Board, Welland, up to 6 p.m., **January 10th, 1914**..

Address all tenders to Mr. Wm. H. Lowe, Secretary.

The lowest or any tender not necessarily accepted.

Plans and specifications may be received upon application to the Architect, D. F. Forbes, 43 Temple Building, Welland.

51-52

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m. on **Thursday, the 15th of January, 1914**, for 10 knots of gutta-percha cable with 4 conductors and 14 knots of gutta-percha cable with 2 conductors, to be delivered at Halifax, N.S., or St. John, N.B., by the 1st of May.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 9, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51974. 51-52

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

Sealed tenders addressed to the undersigned, and endorsed "Tender for bridge substructure and approaches at North Timiskaming, P.Q.," will be received at this office until 4 p.m. on **Monday, January 12, 1914**, for the construction of the substructure and approaches of a highway Bridge at North Timiskaming, County of Pontiac, P.Q.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont., Post Office, Montreal, and on application to the Postmaster at North Timiskaming, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, he nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 19, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—52858. 52-53

FOR SALE

Steam Driven Air Compressors
thoroughly refitted

One 1,000′ Machine, Duplex Type, Compound Steam, Compound Air.
One 1,200′ Machine, Duplex Type, Compound Steam, Duplex Air.

For particulars and prices write

The Jenckes Machine Company

SHERBROOKE, QUE.

Montreal Office, - - - - - E. T. Bank Building

50-5

Tenders for Dredging

The undersigned will receive tenders up to **December 31st, 1913**, for excavation and dredging in the tail race of their Power Plant at Nassau, about six miles from Peterborough. The estimated amount of material to be removed is 24,000 cubic yards. Plans and specifications may be seen at the offices of the company, either at Toronto or Peterborough, or at the office of Henry Holgate, Consulting Engineer, Richelieu Building, Montreal. Lowest or any tender not necessarily accepted.

Canadian General Electric Company, Ltd.
52

Good Opportunity to Importers of Waste and Steels

Firms interested in above write
British Manufacturers' Association, Limited
803 McGill Building, Montreal

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Residences

(Continued from page 67)

architect until December 24th. Three storeys, 26 x 90, stone foundation, stone and brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, birch and pine floors, lime and sand plaster.

12 flats, Outremont (D'L'Epee Ave., cost $20,000. Owner and general contractor, G. Zudick, 829 St. Urbain St. Architect, A. Mendelsohn, 943 City Hall Ave. Work to start in a couple of weeks. Three storeys, 80 x 90, concrete foundation, brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, maple floors, lime and sand plaster. Plans in progress.

Three flats, cost $12,000, St. Denis, for A. Bleau, 190B Christopher Columbus. Three storeys, 50 x 35, concrete foundation, felt and gravel roofing. Permit issued.

Residence contemplated by J. Laurendeau, 30 St. James St., Montreal. Architect, R. Gariepy, 25 St. James St. Plans will probably be drawn this winter and tenders called in spring.

Montreal, Que., Outremont
A. St. Louis, 80 St. Gabriel. Architect will probably call for tenders about Feb. 15th for the erection of cottage at an estimated cost of $25,000. Three stys., 40 x 57, concrete foundation, waterproofed, brick construction, felt and gravel roofing, gas and electric lighting, hot water heating, maple and birch floors, lime and sand plaster, plate and art glass, mantels, built in fireplaces, pool and billiard tables, marble tiling.

Residence contemplated by N. Belanger, 30 St. James St. Architect, R. Gariepy, 25 St. James St. Plans will probably be prepared this winter and tenders called in spring.

Regina, Sask.
Five-storey apartment building, 16th Ave., cost $30,000, for A. M. Fields, c/o W. A. Burns, New Dallas Block. Architects, Story & Van Egmond, 1 Credit Foncier Bldg. Nothing further will be done until next spring.

Sussex, N.B.
Residence contemplated by Geo. E. Fowler, Sussex. Probable architect, H. H. Mott, 13 Germain St., St. John.

St. John, N.B.
Apartments, Princess St., cost $15,000, for F. G. Spencer, c/o Unique Theatre. Architect, Garnet Wilson, 50 Princess St. Two storeys, brick construction, concrete foundation. Plans in progress.

Toronto, Ont.
One pair residences, cost $5,000, Carlaw Ave. Owner, general contractor and mason, Robert Oakley, 39 Wolfrey Ave. Two storeys, 36 x 42, brick construction, concrete and brick foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences, cost $5,000, Highfield. Owner and general contractor, I. Pigoan, 1335½ Queen St. E. Two stys., 34 x 42, brick construction, concrete foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, built-in fireplaces. Plans drawn.

Four duplex residences, cost $10,000, Beatty Ave. Architect, Henry Simpson, 82 King E. Two storeys, 72 x 80, brick construction and foundation, felt and gravel roofing, electric lighting, hot water heating, maple and birch floors, lime and sand plastering, mantels. Plans drawn.

Two detached residences, Ferndale Ave., cost $7,000. Owner and general contractor, Chas. Hough, 44 Ellsworth Ave. Owner superintends construction. Two storeys, 21 x 32, brick construction and foundation, shingle roofing, electric lighting, hot water heating, oak and birch floors, lime and sand plastering, built in fireplaces, mantels. Plans drawn.

One pair residences, Ashburnham, cost $5,000. Owners and general contractors, Coxworth & Galloway, 73 Harvie Ave. Owners superintend construction. 2½-storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels, built in fireplaces. Plans drawn.

Residence, Spadina Rd., cost $10,000. Owner and general contractor, J. E. Shaw, 381 Manning Ave. 2½-storeys, 36 x 42, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, marble tiling, mantels, built in fireplaces. Plans drawn.

Dominion Bank, Yonge and Colborne, contemplate erecting garage, Davenport and Avenue Rd. Commr. Chisholm recommends that permit be granted.

One detached residence, Joseph Ave., cost $5,000, for Dr. Dunlop, c/o General Contractors, T. H. Jones & Co., 310 Clinton St. 2½-storeys, 26 x 42, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in furnaces. Plans drawn.

One pair residences, McRoberts, cost $5,000, for F. A. Rode, 324 Symington Ave. Owner now receiving tenders on roofing, plastering, painting, drains, plumbing and electrical. 2½-storeys, 36 x 42.

One detached residence, Glen Rd., cost $12,500, for C. W. Defoe, 47 Simcoe. Architects, S. B. Coon & Son, Temple Bldg. Plans drawn, but tenders will not be called for until after Jan. 1st. Two storeys, 30 x 60, brick construction, stone foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built in fireplaces.

Lodging house, Yorkville Ave., cost $35,000, for Wm. J. S. Tremaine, 171 Keele St. Architects, Cross Engineering Co., 165 Yonge St. Owner superintends construction. Will let plumbing and heating. Three storeys, 63 x 120, brick and steel construction, brick and concrete foundation, waterproofed, felt and gravel roofing, gas and electric lighting, steam heating, oak and maple floors, lime and sand plastering, metal lath, terrazzo tiling, skylights, fire escapes, pool or billiard tables. Plans drawn.

Three attached stores and residences, 954-58 St. Clair, cost $13,000. Owner and general contractor, Jethro Crang, 982 St. Clair Ave. Owner superintends construction. Three storeys, 54 x 64, brick construction and foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and maple floors, lime and sand plastering, mantels, built in fireplaces, store fronts and fixtures. Plans drawn.

One detached residence, Hogarth Ave., cost $6,000, for Geo. Gayton, 2 Wayland Ave. Architect, H. Salisbury, 17 Bowden. Owner will sublet some trades. 2½-storeys, 24 x 49, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

One detached residence, Lauder Ave., cost $5,000, for H. S. Gansby, 36 Highview Ave. Two storeys, 25 x 30, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Apartment, Christie, cost $8,000, for J. G. Hedges, 210 Clinton St. Two storeys, 36 x 48, brick construction and foundation, felt and gravel roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, built in firepalces, mantels. Plans drawn.

Wm. Horwood, 491 Concord Ave., has purchased a site on St. Clair Ave., and contemplates erecting a brick residence thereon.

Residence, Glenholm, is contemplated by Thos. Robinson, 1310 Lansdowne Ave. Site purchased, 37 ft. frontage.

Alterations to apartment, 126 Garden Ave., cost $5,000, for F. H. Ross & Co., Lumsden Bldg. Contract not yet awarded. Two storeys, brick construction, gas and electric lighting, hot water heating, birch and oak floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Winnipeg, Man.
Apartment Block, Jessie and Helen, for J. A. Patterson, 664 Carydon Ave. Architects, Ross & McDonald, 928 Union Bank Bldg. Pressed brick construction, stone foundation, felt and gravel roofing, electric lighting, steam heating, oak and maple floors, hard wall plastering. Plans in progress.

CONTRACTS AWARDED

Regina, Sask.
Residence, Lorne, cost $5,000, for Geo. Middleton, 2169 McIntyre St. General contractors, Johnson & Mills, 101 Westman Chmbrs. 2½-storeys, brick and frame construction, concrete foundation, shingle roofing, electric lighting, hot air heating, maple floors.

Ottawa, Ont.
Residence, cost $7,000, Wurtemburg. Owner and general contractor, J. P. MacLaren, 104 Sparks Street. Iron and tinsmith, J. E. Sheppard, 261 Albert. Painting, J. H. Baron, 420 Gladstone. Two and one-half storeys, brick veneer construction. Additional contract awarded.

Toronto, Ont.
Residence, Park Place, cost $6,000, for L. J. Richardson, 415 Dovercourt Road. Architects, Symons & Rae, Home Life Bldg. Mason, Wm. Edwards, 281 Howland Ave. Carpenter, G. L. Robinson, 107 Armstrong Ave. Tenders in for other trades, but not yet awarded. 2½-storeys, brick construction and foundation, slate roofing, gas and electric lighting, hot water heating, oak, concrete and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels.

Power Plants, Electricity and Telephones

Blenheim, Ont.
Town Council require additional tanks and piping for fire protection purposes. Clerk, Geo. W. Riseborough. Reeve, A. Denholm.

Montreal, Que.
Tenders received by Board of Commissioners until noon, December 30th, for lighting fixtures for City Hall Annex. Specifications, etc., at office of Superintendent of Lighting Department, City Hall.

Power house equipment required by Dom. Govt. Dept. of Railways and Canals. Sec., L. K. Jones, Ottawa. Engineer, Mr. E. Marceau, New Birks Bldg., Montreal. Two turbine wheels, 60 in. diameter; 2 electric generators; 2 transformers. Tenders to be called shortly.

Electric and gas fixtures, cost $9,000, required by Board of Commrs. Sec., L. N. Senecal, will probably call tenders.

Ottawa, Ont.
Ottawa Light, Heat & Power Co. will use $700,000 new capital for construction of gas mains and general development. President, F. Ahearn. Superintendent, A. Dun, Sparks Street.

Winnipeg, Man.
Copper wire, $7,532, required by Board of Control. Secretary, M. Peterson. Engineer, J. G. Glassco, 54 King St. General contractor, E. F. Phillips, Electrical Works, Ltd., 602 Electric Ry. Chambers.

Incinerator by-law, $85,00, defeated by ratepayers Dec. 12th. Sec., M. Peterson.

Transformers required by Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. For supply of pole type and subway transformers during year 1913-14. Specifications at office of Engineer. Tenders received by Board until Jan. 5th .

By-law passed by ratepayers Dec. 12, providing for the installation of power plant at an estimated cost of $1,000,000. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Yarmouth, N.S.
A committee of the Board of Trade has been appointed to look into the matter of erecting a cold storage plant for the preservation of fresh fish specially, also a medium sized artificial ice plant.

CONTRACTS AWARDED

Regina, Sask.
Power house equipment required by City Council (Light and Power Dept.). Supt., E. W. Bull. Contract for asbestos covering for steam pipes awarded to H. W. Johns-Manville Co., Ltd., 92 Arthur St., at $1,362.32.

Miscellaneous

Brussels, Ont.
George Edwards requires castings to be used in manufacturing new ditching machine.

London, Ont.
Bank of Toronto, Manager, John Pringle, will probably be purchasing fire escapes.

Newmarket, Ont.
Town Council has decided to install water meters on premises of all consumers. Clerk, J. E. Hughes.

Ottawa, Ont.
Foley & Gleeson, Central Chambers, contemplate purchasing portable asphalt mixer.

Ventilating system contemplated by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Estimates for 1914 include ventilating system for Printing Bureau.

Smithville, Ont.
Village Council contemplates the purchase of a number of chemical fire extinguishers and hose for fire engine, 6-in. suction pipe and quantity of reel hose, 4-in. Sec. Board of Trade. F. H. Patterson.

Sudbury, Ont.
Hospital fittings required by St. Joseph's R. C. Church. General contractor, J. B. Laberge.

Sydney, C.B.
Dom. Iron & Steel Co. intend to install new heating furnace in rolling mill, will also install new tables.

St. John, N.B.
New Brunswick Cold Storage Co. will receive tenders for waterproofing cellar. Manager, H. R. Ross, 33 Wright St. Engineer, Geo. Wetmore, C. P. R. Bldg., King St.

Winnipeg, Man.
Ice fender required by Board of Control. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave. Ice breaker and fender for Louise bridge. Specifications, etc., at office of Engineer. Tenders received by Board until Dec. 26th.

New Companies

J. R. Baxter & Co., Ltd., has been incorporated with a capital of $75,000, to carry on business as manufacturers of builders materials, etc., with head office at Montreal. The provisional directors are J. R. Baxter, merchant, W. J. W. Booth, manager, T. R. Eeland, traveller, H. Warfield and P. Ledien, advocates, all of Montreal.

Richmond Construction Co., Ltd., has been incorporated with a capital of $100,000, to carry on business as builders and contractors, with head office at Montreal. The provisional directors are P. Bercovitch, W. P. Kearney, E. Lafontaine, advocates, J. Johnston and J. O'Reilly, accountants, all of Montreal.

Brick & Construction Products Company of Montreal, Ltd., has been incorporated with a capital of $600,000, to carry on business as general contractors, with head office at Montreal. The provisional directors are R. Taschereau, K.C., Thibaudeau Rinfret, K.C., N. Z. Cordeau, deputy prothonotary, and A. R. W. Plimsoll, advocate, all of Montreal.

Transcontinental Construction Co., Ltd., has been incorporated with a capital of $50,000, to carry on business as general contractors, with head office at Montreal. The provisional directors are W. J. White, K.C., and A. W. P. Buchanan, K.C., and T. S. Owen, advocate, all of Montreal.

D. Morton Co., Ltd., has been incorporated with a capital of $20,000, to carry on business as timber merchants, sawmill owners, etc., with head office at Victoria, B.C.

ERIE MACHINE SHOPS
Send for our Catalogue of Asphalt Rollers and Mixers.
P. W. DIFTLY, Proprietor

"Our 20th Century Roller"
1303 Peach Street, - Erie, Pa.

The
Laurentian Granite Co.
Limited
Manufacturers of
Building Granite, Granite Setts, Curbing, Crushed Granite
Samples Furnished and Prices Quoted on Application
Rose and Pink Granite Quarries at Staynerville, P. Que., Co. Argenteuil, on C.P.R.
Bank of Ottawa Bld'g, 224 St. James St. Montreal
Bell Tel. M. 4354

Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20, 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.15
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ¾-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¾ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.
Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

"DULL"

Sand and Gravel Washing Outfits

We have perfected every device necessary for an up-to-date sand and gravel washing outfit and have a staff of competent engineers who can design and erect a plant of any capacity.

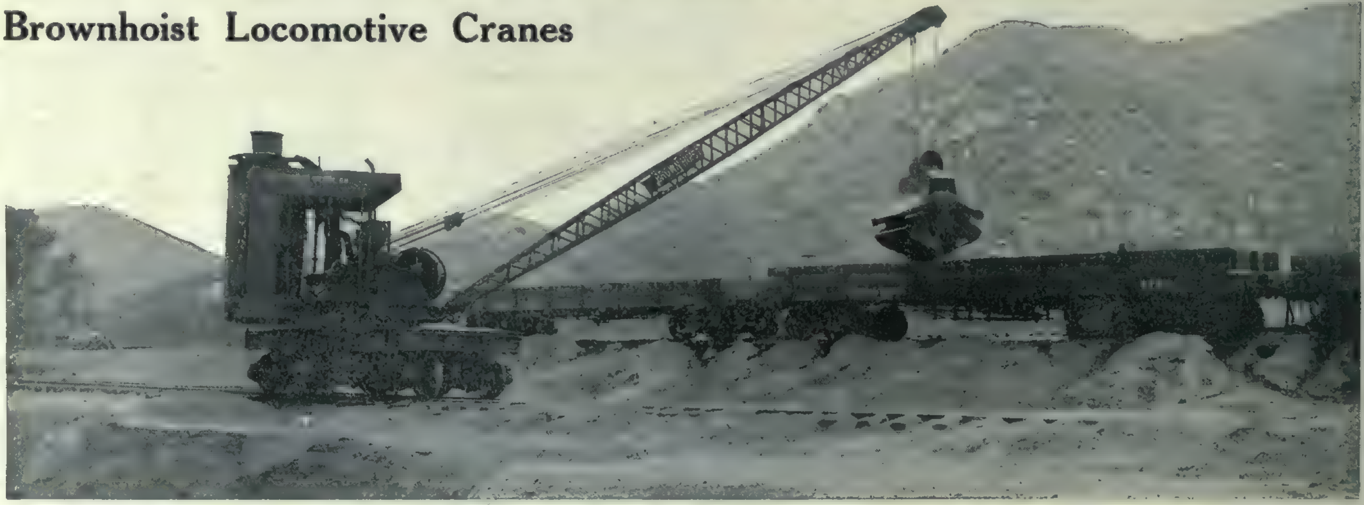
The illustration shows a "Dull" designed and equipped plant in successful operation in Grand Rapids, Mich. There are many such plants in operation in every part of the country.

We would like you to have our catalogue. It is sure to contain some equipment that would mean dollars to you if installed in your plant.

WRITE US TO DAY

The Raymond W. Dull Co., 719 Chamber of Commerce Bldg., Chicago, Ill.

Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Calif.

If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.

New York Pittsburgh Chicago San Francisco The Colby Engineering Co., Portland, Ore.

A Product Without a Peer

KEYSTONE COPPER BEARING SHEETS

BLACK AND GALVANIZED

Rust Resisting **Anti-corrosive**

For making tanks, stacks, roofing, gas holders, culverts and all sorts of pipe, flumes and conveyors, our **Keystone Copper Bearing Steel Sheets** are superior to anything on the market today. Copper in the Steel makes it resist rust and defy corrosion. Its first cost is but a little higher than that of ordinary steel, while its durability is very much greater. You pay a little more at first for this extra grade but you find it real economy and satisfaction in the end.

United States Steel Products Company

NEW YORK, U. S. A. **Branch Offices: Winnipeg and Vancouver**

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO., Ltd.

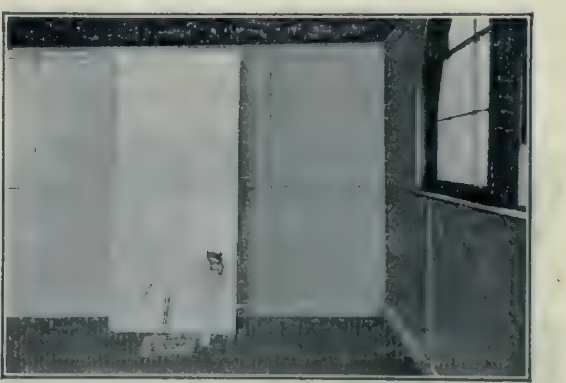
Transportation Building, MONTREAL. **Traders' Bank Building, TORONTO**

The Permanent Protective Building Board

LINABESTOS

Linabestos is a damp-proof, fireproof Building Board made of Asbestos and Portland Cement. It is smooth on one side and somewhat rough on the other and is made in sheets 42 inches wide, 48 or 96 inches long and 3-16 inches thick.

Though hard and semi-rigid, Linabestos can readily be worked with carpenters' tools and nailed direct to the studding. It is either applied smooth side out and panelled with strips of wood or of the same material or put on rough side out and covered with a thin skim coat of plaster.



Walls and ceiling of Linabestos will confine an ordinary fire to the room where it starts and check the spread of even the worst blaze. They are sanitary, easily decorated, non-conductors of heat, practically everlasting and inexpensive.

Write for folder No. 9 giving full particulars.

ASBESTOS MANUFACTURING CO., Limited

Address: E. T. Bank Bldg., 263 St. James St., Montreal—Factory at Lachine, P.Q. (near Montreal)

Water Turbine Installations

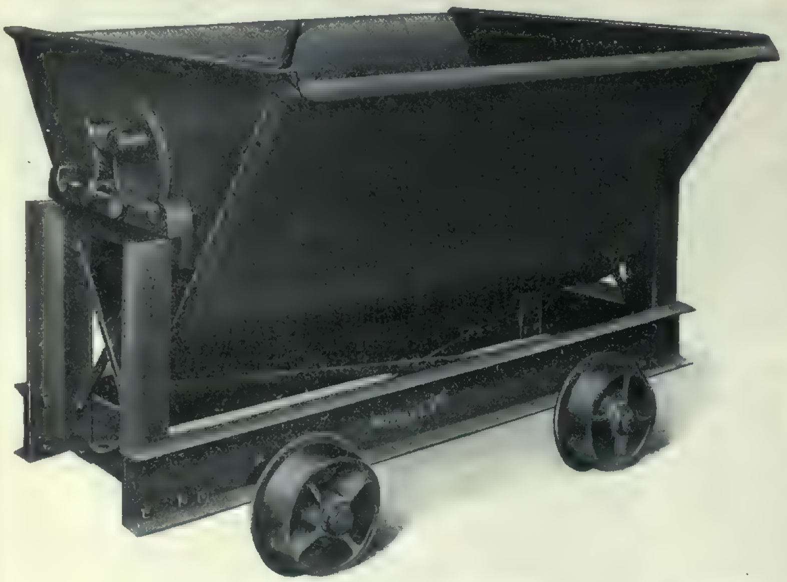
Seamless
Steel
Tubes
up to
12 inches
diameter

Lap-
welded
Steel
Tubes
from
12 inches
upwards

Distributing Pipe for The Ontario Power Co., Niagara Falls
Length 32′ 6″ Height 12′ 2″

MANNESMANN TUBE CO., Limited, Montreal
51 Victoria Square

Simplicity and Strength



These are the things that a Contractor demands of Dump Cars and the only way to get them is to buy **Bechtel Cars.** Our Cars are strongly built and braced throughout with nothing to get out of order on them.

OUR LINE

Side Dump Cars
All-round Dump Cars
Bottom Dump Cars
Winding Drums
Portable Track and Switches
Switch Points, Frogs and Throws
Brick and Tile Machinery
Brick and Tile Driers

Favor us with your inquiries.

Bechtels Limited **Waterloo, Ontario**

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STONE

PORTLAND
CEMENT

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CLEAN STONE

Quick Deliveries
By
G.T.R., C.P.R. or Team

New Code Rubber Covered Wires AND Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

Price list and discounts on application to head office or nearest agent.

Canada Wire & Cable Co., Limited

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John T. Hepburn Limited

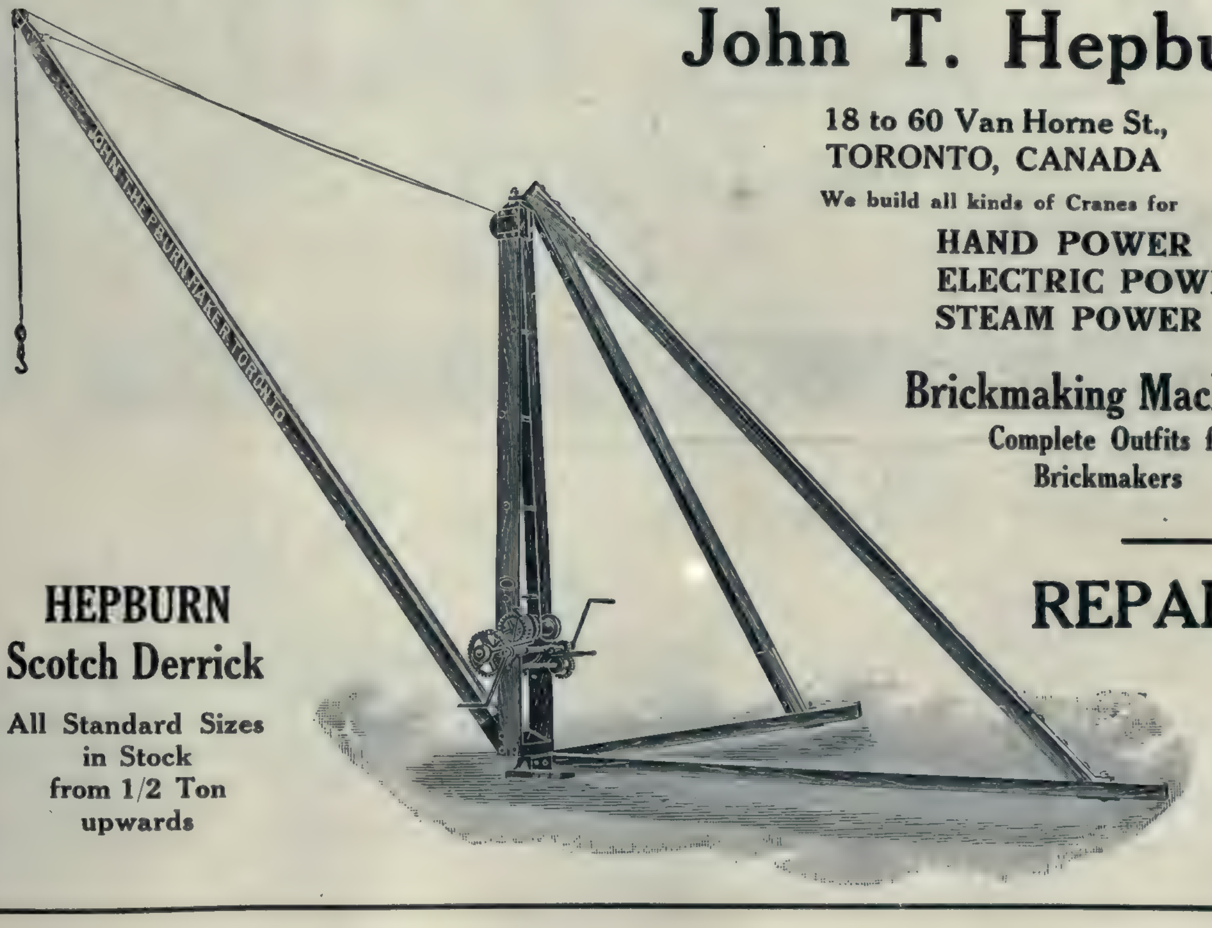
18 to 60 Van Horne St.,
TORONTO, CANADA

We build all kinds of Cranes for

HAND POWER
ELECTRIC POWER
STEAM POWER

Brickmaking Machinery
Complete Outfits for Brickmakers

REPAIRS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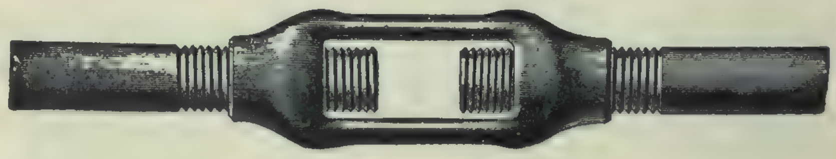
HEPBURN Scotch Derrick

All Standard Sizes
in Stock
from 1/2 Ton
upwards



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B TRADE MARK

B TRADE MARK

Full line of steel specialties for Contractors and Builders

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The Steel Company of Canada Limited
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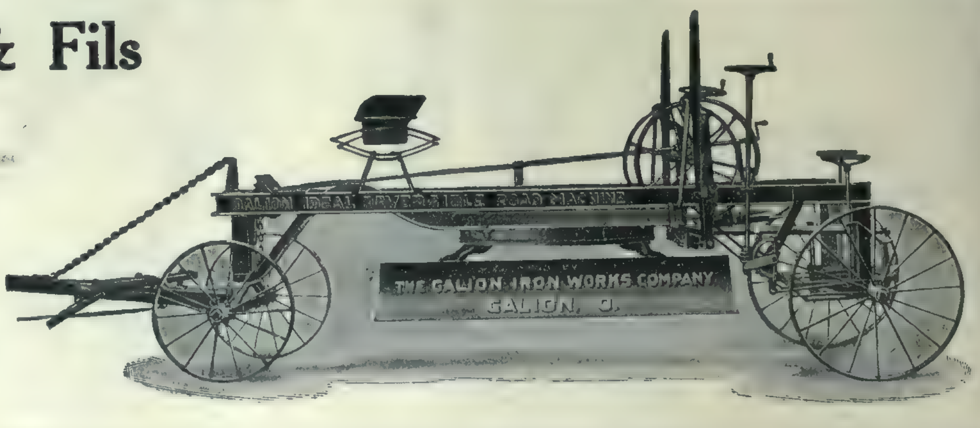
PLAIN ROUNDS,
& SQUARES,
COLD TWISTED
SQUARES

STEEL BARS
for Reinforcing
Concrete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BY
THE GALION IRON WORKS COMPANY
GALION, O.

J. B. Dore & Fils

Road Graders, Rock Crushers, Portable Engines, Steam Road Rollers, Sprinklers etc.

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CANADA STEEL CO
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HAMILTON CANADA

STEEL

For Reinforcing Concrete
Plain Rounds Squares
Twisted Squares
Cross Arm Braces, Plain and Galvanized

We can ship from stock

Ask for prices—they will interest you.

STEEL

Angles from ¾ x ¾ in. up to 2 x 2 ins.
Round and Square from ⅜ in. up to 1¼ ins.
Flats from ¾ in. up to 4 ins. in width, and other special sections.

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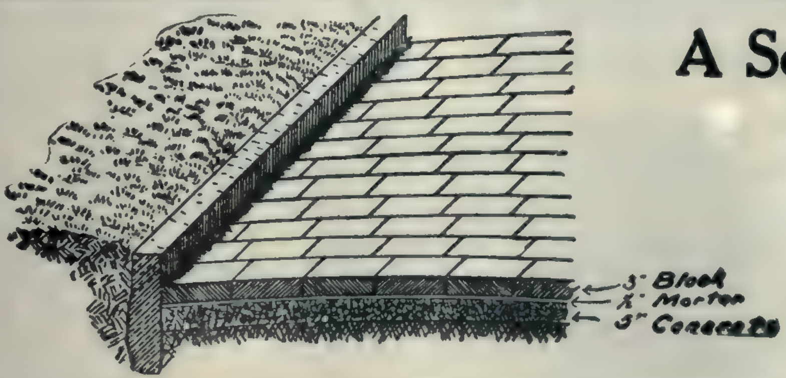


A Scientific Pavement

must be

Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature
Sightly and Sanitary.
Easily Repaired and easily Cleaned.

These requirements are met by

Asphalt Block Pavements

Send for Descriptive Literature

The Ontario Asphalt Block Company, Limited - Windsor, Ont.

The Berg Plant at Toronto

Berg Boilers

Our prices are right and our shipments prompt for every kind of boiler and plate work : : : : : : : :

Water Tubes

Horizontal Return Tubular
Fitzgibbons, Scotch Marines, Scotch Drybacks

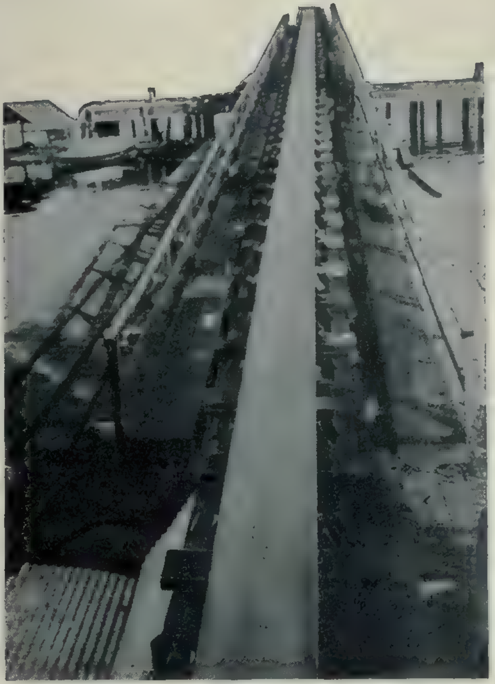
Steel Water Towers, Tanks and Heavy Plate Work.
Cast Iron Columns and Bases. Post Hangers.

The Berg Machinery Mfg. Co., Limited

Boiler Department

Bathurst and Niagara Sts. **TORONTO, ONTARIO**

Goodyear Conveyor Belt for the Rainy River Gravel Co., Vancouver. Made in one piece—seven hundred and fifty feet long.



A seven hundred and fifty feet Goodyear Conveyor Belt in actual service at Rainy River, Vancouver.

GOODYEAR

SPECIAL BELTS for Special Purposes

GOODYEAR IMPERIAL HIGH-SPEED BELTING

FOR high speed a High Speed Belt should be used. Great strength is demanded. A belt that is to grip a small pulley and transmit high power must be specially built for the purpose. It must resist the strong tendency to slip on the small, rapidly-revolving pulleys.

This Goodyear High-Speed Belt is made with a friction surface that grips the face of the pulley—conveying all the power.

It gives long service. The belt is durable because there is no internal friction—no ruinous grinding. That is where the Imperial High Speed Belt excells. It flies around a small, high-speed pulley without setting up internal friction.

In Goodyear Belts the elimination of all stretch, and the solid cohesion of duck and rubber, prevent any movement within the belt. Thus the belt gives long service and efficient service.

ELEVATOR BELTS

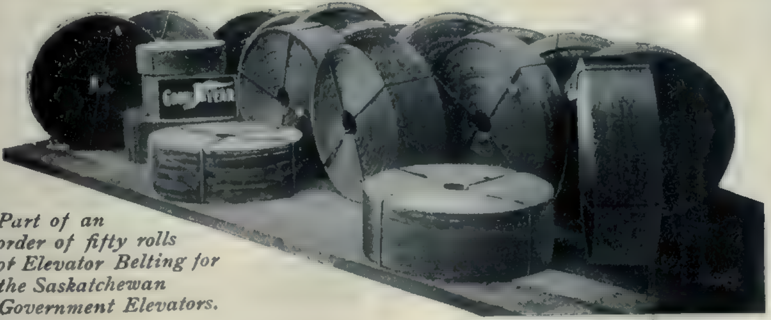
Elevator Belts are a Goodyear Specialty. The essential requirement in these belts is strength—and Goodyear Elevator Belts have it. That is why they are in constantly increasing demand. The buckets do not pull out. Long wear in the belt is assured because the plies of fabric do not separate in service. Goodyear Rubber Belts are used in hundreds of elevators throughout Canada.

CONVEYOR BELTS

Where a sound and reliable belt is needed for hard service—for the conveying of stone, grain, ore, coal, etc., a Goodyear Conveyor Belt specially made for the work is the best investment. The Goodyear Conveyor Belt has a rubber face of great toughness, which prevents cutting and chipping, and increases the life of the belt. Not affected by weather. We make Conveyor Belts to any specifications. No better conveyor service can be given than that obtained from a Goodyear Belt.

ENDLESS BELTS

We make Endless Belts to order in any width, length and thickness—and for any purpose.



Part of an order of fifty rolls of Elevator Belting for the Saskatchewan Government Elevators.

Send for our interesting book on the choosing of a Belt—you'll find it useful. It is free.

THE GOODYEAR TIRE & RUBBER CO.
of Canada, Limited

Head Office **TORONTO**
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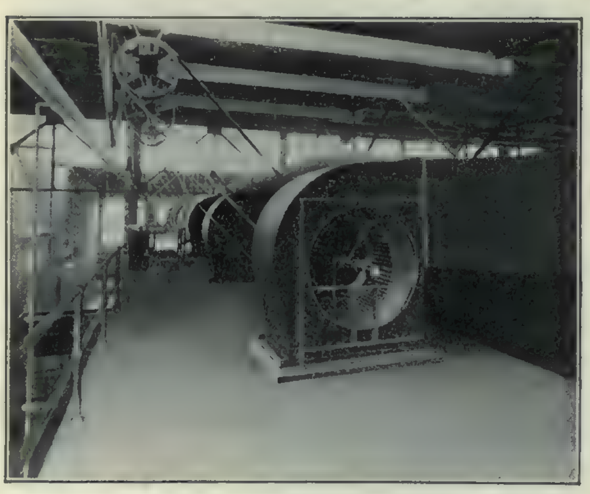
Branches: Victoria, Vancouver, Calgary, Edmonton, Regina, Winnipeg, Toronto, London, Hamilton, Montreal, St. John, N. B.



The efficiency of the operatives and plant production is being increased in this Large Manufactory by the use of "Sirocco" Fans.

8 of 29

"Sirocco"
TRADE MARK

Fans for Heating Ventilating and Drying installed in One Plant

It isn't necessary for a plant to be large or new, to get the benefits of a "Sirocco" System. Any plant that has outgrown the capacity of its old system, or those who never had a system, appreciate **even more,** the great benefits derived from a "Sirocco" System of Heating and Ventilating.

We design the entire system to meet your requirements.

We give service with the sale of our product---Real-Expensive-Hard-to-Get Service.

Let us tender on your needs—and get advice from "Men who know." Catalogue No. 101 will be mailed at your request.

CANADIAN Sirocco COMPANY
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WINDSOR. ONTARIO.

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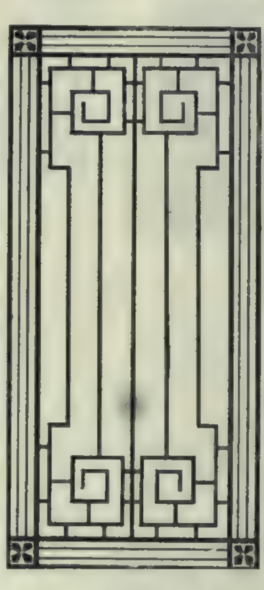
We Solicit Your Inquiries for all Kinds of Ornamental and General Iron Work



Iron Stairs
Fire Escapes
Door Grilles
Wire Work

Metal Store Front Construction

Athey Metal Cloth Lined Weather Strip

The EBERHARD & WOOD Mfg. Co.
36-38 Lombard St. TORONTO
Main 6338

The Quality Stone

OF INDIANA IS

Dark Hollow Gray

Bedford Stone

WE CAN SUPPLY IT IN BLOCKS, SAWED, PLANED OR TURNED

The Consolidated Stone Company

General Offices, Quarries and Mills,
BEDFORD, Ind.

AZTEC ASPHALT

Unharmed By Temperature Extremes

TRADE MARK

The extremes of temperature in most Canadian cities make asphalt more of a "problem" for Canadian engineers than it is for engineers in any other part of the Continent. Other asphalts that are entirely successful in South America, Mexico, Europe or in central or southern parts of the United States, might fail in Canada because of the extremes in temperature here.

For Canada asphalt must not only be pure (nearly 100 per cent. bitumen) but the bitumen must retain its tenacity at all temperatures. In this regard Aztec excels. It is impervious to water, stays malleable even when buried under snow or ice for long periods, does not soften noticeably in Summer and has great coherence, resisting wave tendencies.

Canadian municipal and highway engineers and road contractors should buy Aztec Asphalt on account of the qualities possessed by its bitumen. It is not—like other asphalts—merely "over 99 per cent. bitumen." Aztec is over 99 per cent. bitumen of special qualities that make it particularly suitable for Canadian requirements.

Commercial Uses

Aztec is supplied with the consistency best suited to the special purposes for which it is required. Prompt deliveries on asphalt for

Roofing
Pipe Dip
Block Filler
Insulating
Waterproofing
Rubber Making

For sheet asphalt or for road binder—either mixed or penetration method—Aztec excels.

We would be pleased to mail you literature, quote prices or send samples.

Aztec Oil & Asphalt Refining Co.
of Canada

311 Shaughnessy Building
Montreal

Wells & Gray, Limited

Engineers and Contractors

Our Record with Some of the Largest Concerns in Canada

Canadian Pacific Railway

In 1910 we built the North Parkdale Station, since then we have built a station at Guelph, a freight car repair shop at West Toronto, a subway at Jane Street, West Toronto, a subway at Runnymede Road, West Toronto, four subways, a large reinforced concrete retaining wall and several minor jobs at North Toronto and we have also been awarded the contract for the Yonge St. Subway at North Toronto. Total value of work nearly $250,000.00.

Ford Motor Co. of Canada, Limited

In 1910 we built a three story reinforced concrete factory building for these people at Walkerville, Ont. Since that time our men have never been off the job. We have built two large extensions to main factory building, a large fireproof office building, an engine house, gas producer building, heat treatment building with two large extensions, amounting in all to $450,000.00.

Swift Canadian Co., Limited

In 1911 we built a Concrete building for the Union Stock Yards Co., (an allied firm) at West Toronto, since then for the Swift people at West Toronto we have built a large Reinforced Concrete Fertilizer Building, a nine story Reinforced Concrete Cold Storage Building and three smaller buildings amounting in all to $275,000.00.

Hiram Walker & Sons

Three years ago we built a Reinforced Concrete Power Building for Walker Sons, at Walkerville, Ont., since then we have built a large four story extension to this building and also three other extensions to this building for the Peabody Co., Limited and the Leather Label Overhaul Co., in which building the Walkers were interested. So that now we have a whole block of Reinforced Concrete buildings 3 and 4 storeys in height covering about 30,000 square feet of land and worth $95,000.00.

Why have these firms given us one contract after another to the value of over one million dollars?

We have satisfied them,
We can satisfy you.

For information and estimates, write

WELLS & GRAY, LIMITED,

247 Confederation Life Bldg.
TORONTO, ONT.

BRANCH OFFICE—
Manning House Chambers,
Windsor, Ont.

FOR SALE

1—Class B 1 Rand Duplex steam driven Air Compressor, duplex steam and air cylinders 8 x 12, Automatic oil feed and self regulating governor, heavy fly wheel.
1—8 x 12 C. C. Engine with Pickering governor.
1—6½ x 8 S. C. Engine with Pickering governor.
2—Plunger or Jack Pumps pistons 2 7/16 and 2 7/8.
1—30-in. Boston Cupola and forge blower.
1—Single Drum 8 x 11 double purchase Mast Winch.
1—Set Car Irons, 24-in. chilled wheels, 3½-in. axles, 36-in. gauge. Babbitted bearings outside wheels.
1—Vertical Boiler, 33-in. x 84-in. new mountings and short stack.
1—Vertical Boiler, 37-in. x 90-in., new mountings and short stack.
3—Vertical Boilers (new), 30-in. x 72-in., mountings and short stack.
1—Rand Air Hoist Class "B" 4-in. x 4-ft. lift.
1—Steel Ore Bucket, straight sides, 37 x 37, ring and pin fastening (new).
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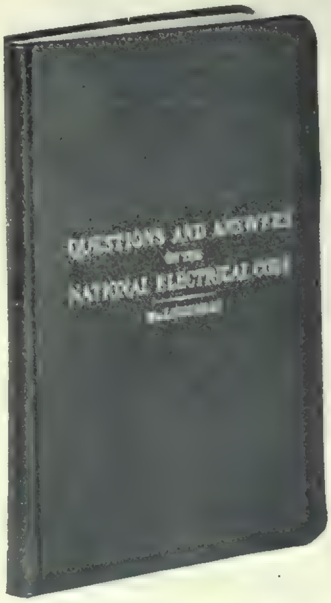

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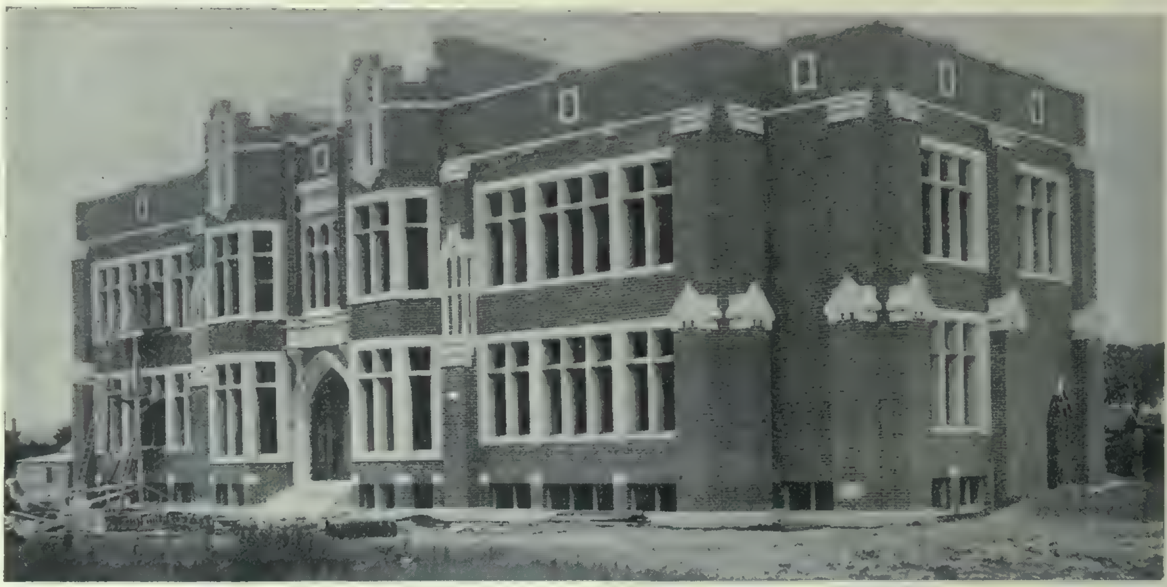

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Alphabetical Index of Advertisers
Page 16

Vol. 27 December 31, 1913 No. 53

Encouraging Records in the Field of Railway Building

JUST at the present time when pessimistic utterances are plentiful and so many doleful comparisons are being made, it is gratifying to turn our attention to the field of railway building whose activities during 1913 have easily constituted a record for this or any other country.

During the year 1913 the railways of Canada have had in hand, in one stage or another, fully 6,000 miles of new construction. By June 30 last, when the year for railway statistics closed, between 1,800 and 2,000 miles had been taken into operation as finally completed, and since that date there has been immense activity. Including lines which have been surveyed, lines for which the contracts have been let, and lines for which the contracts have been completed, the total will run into the extraordinary figure quoted. At present the Canadian Pacific has well over 1,000 miles in hand, the Canadian Northern not far short of 2,000, and the Grand Trunk Pacific about 1,000, while there also is to be considered the 500 miles of the Hudson Bay Railway and the National Transcontinental, which now is nearing its completion.

The Canadian Pacific Railway is in a more desirable financial position than many roads, as it has already received the necessary capital for its betterment and extensions. As a result its construction programme for the coming year will be of interest to contractors. This includes the continuation of the work started in 1913, and a number of new branch lines and extensions. The programme covers the double tracking between Sudbury and Port Arthur; between Port Arthur and Calgary, which calls for 1,095 miles of trackage; between Brandon and Calgary; the double track tunnel through the Selkirks; the double tracking between Revelstoke and Vancouver; a line between Sedgwick and Edmonton, 290 miles; two new lines from Bessano to a connection with Swift Current. In addition there is the Weymouth branch, running north of and parallel to the main line in Saskatchewan and Alberta to a connection with Alberta Railway south of Lethbridge—436 miles. There are also several other shorter lines ranging from twenty to one hundred miles in trackage, which are included in the programme.

Local Contractors and Labor

FOR its size—not geographically but considering the extent of its population—Canada is about as rich in examples of interesting contract awards as any community we ever read about in books. We do not wish to dilate upon the bad practices of our country but with the new year in sight there can be no harm in mentioning matters which may lead to good resolutions. We blush to recall many instances of bias and unfairness in the procedure of our public bodies, and although things are on the mend there is still plenty of room for improvement.

Upon this occasion we are inspired by a pithy editorial article in the columns of Engineering and Contracting. The observations made have a far wider application than they would appear to have. The principles apply generally to the stupid prejudice which some people entertain against outsiders. In its larger aspect the article constitutes a plea for the recognition of ability irrespective of local considerations, and it may be extended beyond contractors to the employment of engineers and architects. The employment of subterfuge in defence of a sound principle, which occurred in the "small Illinois city" to which reference is made below, is only justified where a community is of such agricultural density as to work for and expect to attain great developments within itself. To quote our contemporary:

"There was a time when some small cities in undertaking a municipal improvement went upon the principle of "let George do it," George, of course, being the local contractor. He lived in the town; he was a taxpayer; he was helping pay for the improvements; therefore he should be favored. Besides it would keep the money at home. As a consequence the city officials did not make much of an effort to reach outside contractors. The official advertisement was inserted in the local paper more as a matter of legal procedure than to make public the fact that bids were wanted on a piece of construction work. In a general way this served the purpose of restricting the bidding to George and a few others in that particular section of the country. Sometimes an outsider would get wind of the work and would submit a bid. Needless to say that he had to be quite a bit lower than the local man in order to get the contract. And even then he had to show a mighty good health certificate. To be sure he was the lowest bidder, but the city officials reserved the right to say whether he was the best bidder. To convince them of this it was almost necessary for the contractor to bring some of his previous work for actual inspection. But conditions have changed and most municipal officials now realize that only through broad competition can they secure the best terms obtainable. In country towns, however, there is still a strong tendency to keep the money at home by requiring the contractor to use local labor wherever possible. This requirement is set forth as follows in a recent specification for work in a small Illinois city:

> The contractor shall employ local labor so far as it may be practicable, and in all cases, local labor, either skilled or common, shall have preference, other things being equal.

This is an excellent example of skilful phrasing for handling a rather difficult proposition. It is fair to the city officials and to the contractor. The intent is that the latter shall use local labor "so far as it may be practicable, other things being equal." It does not bind him down to give employment to useless old codgers simply because they are residents of the city, nor does it require him to pay higher wages than he would give to imported labor."

Proposed Expenditure of Three Millions on Ottawa Pavements—An Interesting Report

THE cost of putting the streets of Ottawa in good condition provides groundwork for a particularly interesting and instructive report by Mr. Arch. Currie, the city engineer. The estimated cost of the improvements recommended by Mr. Currie is $3,172,119, apportioned (to the nearest dollar) as follows: asphalt, $502,298; asphalt macadam, $558,370; asphalt and stone blocks, $472,955; asphalt macadam stone blocks, $96,068; concrete, $39,420; macadam tar painted, $1,300,267; macadam tar painted and stone blocks, $5,073; macadam tar painted and granitoid, $23,756; stone blocks, $66,782; tar macadam, $107,122.

Mr. Currie goes into a detailed description of each type of roadway pointing out its advantages and its limitations. There are forty miles of asphalt pavement in Ottawa at present and the type is recommended by Mr. Currie as possessing the following good points: (a) Ease of traction; (b) Comparative noiselessness under traffic; (c) Imperviousness to water; (d) Ease of cleaning; (e) Pleasing appearance to the eye; (f) Suitability to all classes of traffic; (g) No vibration or concussion in travelling over it.

The point is emphasized that asphalt pavement should not be used on grades steeper than five per cent. The defects in this pavement are slipperiness, disintegration, a tendency to soften in extreme heat and crack in extreme cold, and unsuitability for steep grades. Asphalt macadam will be used on streets where the traffic is not so heavy.

Mr. Currie speaks favorably of concrete. The construction will be reinforced and transverse expansion joints about fifty feet apart will be provided. The painting of the surface of the road with some bituminous mixture and the subsequent sprinkling of sand are recommended as giving a good surface for a concrete pavement. Mr. Currie describes various other types and concludes by emphasizing the importance of maintenance.

Mr. Eugene W. Stern, the Secretary, and Mr. Alfred Noble, the President of the American Institute of Consulting Engineers (New York), have sent a formal letter to President Wilson asking that an experienced engineer be appointed to one of the vacancies on the Interstate Commerce Commission. It is pointed out that an engineer would have a special value as a member of such a body by virtue of his inside knowledge of transportation matters, particularly in regard to the physical valuation of railways, safety appliances, and the regulations of rates.

Effects of Salts on Strength of Concrete

TESTS to determine the effect of sodium chloride and calcium chloride, separately and together, upon 1:2:4 concrete were made at the University of Wisconsin during the winter and spring of 1912 by Messrs. H. E. Pulver and S. E. Johnson, instructors in mechanics. The test pieces were cured at temperatures of from 60 to 75 deg. Fahr. and below freezing. The results have been published in the "Wisconsin Engineer" by Mr. Pulver.

All mix was by volume and the salts were dissolved in the mixing water. The test pieces were 4-in. cubes, and those cured at a temperature below freezing were broken after fourteen and sixty days, while those cured at normal room temperatures were broken after fourteen, sixty and three hundred and sixty days. Four pieces were tested at each age for each batch of concrete. Atlas Portland cement was used, and to prevent variation in the quality it was mixed thoroughly in the beginning and a sufficient quantity stored in airtight cans.

The test curves show that as the percentage of NaCl is increased there is a nearly straight line decrease in the strength of the concrete cured under normal conditions. The effect of NaCl alone, when added to concrete cured at low temperature, is probably to reduce the freezing temperature, and hence retard the freezing of the concrete, thus permitting of its setting and hardening. The curves show an increase in strength for the addition of NaCl up to 12 per cent., after which there is a decrease. It may be that beyond 12 per cent. the weakening of the concrete due to the excess of NaCl more than offsets the strengthening due to the reduction of the freezing temperature.

When $CaCl_2$ alone is added to the concrete, cured either at normal or low temperatures, the effect is to increase the strength up to about 4 per cent. $CaCl_2$, at which point the maximum strength seems to be obtained. This increase in the strength of the concrete may be due to the acceleration of the setting of the cement by the $CaCl_2$. Serious disintegration was observed on the surfaces of the cubes cured at low temperatures with 6, 8 and 10 per cent. of the $CaCl_2$. This disintegration did not appear on any of the cubes cured at normal temperature or where NaCl was used.

With concrete cured at low temperatures, the best effect seems to be obtained by using NaCl and $CaCl_2$ in the mixing water. It was noted that a 2 per cent. $CaCl_2$ and 9 per cent. NaCl mixture appears to give the most satisfactory results. For concrete cured at low temperatures this mixture gives about as much strength as any of the mixtures tried, and for the concrete cured normally there was not a very great reduction in strength due to the addition of the salts in those percentages.

All tests were made with only one brand of cement. It is probable that there would be some variation in the results with other brands, but it is not thought that this variation would be great enough to affect the general conclusions. It is also possible that some brands of common salt might contain a sufficiently high percentage of calcium sulphate to affect the results to some extent.

Constructional Features of Transmission Line Work in British Columbia

STARTING operations at sea-level and working to and over an elevation of 2,000 feet and then back again to sea level within the short distance of seven miles is a condition not often encountered in the building of transmission lines, Such, however, was the case in connection with the construction of the new transmission lines just completed for the Vancouver Power Company, a subsidiary concern of the British Columbia Electric Railway, by Mr. Tully R. Cornick, contracting engineer, of Vancouver. This company has heretofore been operating at 34,000 volts transmitted over wooden pole lines, but with the additional installation of 42,000 h.p. at No. 2 power house, situated below Lake Buntzen on the North Arm of Burrard Inlet, it was decided to increase the line voltage to 60,000 volts and utilize steel instead of wooden towers for transmission purposes wherever possible. The section of steel tower line just erected is seven miles in length, extending from No. 2 power house to Barnet crossing, the point at which the main transmission lines are strung across Burrard Inlet en route to Vancouver. The company's right-of-way between its main generating stations and Barnet is 100 feet in width and formerly carried two wooden pole lines of two circuits each, the pole lines each running twenty-five feet from the centre line. It was originally intended to construct the new tower line on the centre line, but this plan was later abandoned as impracticable on the ground that the angles would be too great for safety. The line, as finally built, crosses the old lines at several points, while at others it is directly over them. This form of construction necessitated a great deal of close work, in tower erection as well as in stringing of cables. The foundations of all towers are of concrete. Tie rods were first grouted in to the solid rock, and the forms and anchor bolts were placed and the concrete poured before any of the tower material had arrived from the factory. The towers stand 62 ft. 6 in. over all from foundation level, with the lower wire strung at approximately 40 ft. 6 in. from the ground. One ⅜-inch steel ground wire is carried at the apex of the towers. The distance between the conductors is seven feet, these consisting of two 3-phase circuits 000, semi-hard drawn seven strand hemp core copper cables. Standard O.B. suspension insulators and hardware are used throughout. There are sixty-three standard towers and two special towers. One of the latter, which is located at No. 2 power house, weighs approximately 5 tons; the other will be built for the Barnet crossing. The tower at Barnet will not be erected until next spring, the existing crossing facilities being utilized in the meantime.

Foundation work under difficulties. The precipitous bluffs upon which some of the steel towers were erected.

Two steel towers on the shore of Lake Buntzen. Densely-wooded country in the background.

Before proceeding to give a detailed account of the manner of erecting the towers, it may be as well to mention that although the actual distance from No. 2 power house (at sea level) to the level of Lake Buntzen is only half a mile, the land between these points rises to an elevation of 500 feet. The new transmission lines follow the shore of Lake Buntzen for a distance of 3 miles, at some points being only a few feet above lake level, while at others it is constructed at least 500 feet above the level of the water, this being due to the indented nature of the lake shore, crags and bluffs of great height occurring at frequent intervals. After leaving the southerly end of the lake, the line passes over a mountain known as The Summit, which has an elevation of 2,000 feet above sea level. From here it drops down to the North Arm side of the mountain and in the course of its windings towards the Barnet crossing, passes Deer Lake. This body of water stands at a height of approximately 200 feet above sea level and is about three-quarters of a mile in length.

An idea of the precipitous nature of the rocky bluffs upon which some of the steel towers were erected may be obtained from one of the photos reproduced herewith. The foundation forms as shown stand over 12 feet high, while the anchor bolts for the other two legs of the same tower are embedded in solid rock with no more of a concrete base than was necessary for levelling-off purposes. So difficult from the transportation standpoint was the mountainous country encountered that pack-horses had to be used for carrying the South African water bottles con taining water for concrete mixing.

The work on practically all of the foundations was rendered extremely difficult for the reason that it was impossible to blast on account of the direct proximity of the wooden pole transmission lines which were handling power for the city of Vancouver.

Method of moving camp during construction of new steel tower transmission lines for Vancouver Power Company, Limited.

One of the illustrations shows two steel towers on the shores of Lake Buntzen as well as the two wooden pole lines. The presence of the wooden cross arm and insulator supporting one of the live 34,000 volt cables will be noticed on the tower in the foreground. The background provides a striking illustration of the wild country encountered directly on the route.

On account of the uneven nature of the ground and the difference in the height of the piers, as well as the presence of the operating high tension lines, it was found absolutely necessary to construct every single steel tower in a vertical position, no space being available for assembling on the ground and erecting afterwards.

In addition to the steel tower line described above, the Vancouver Power Company has built and placed in operation a single circuit wooden pole tie-line between its power houses numbers 1 and 2, a distance of approximately 2,300 feet. This line carries one 60,000 volt three-phase circuit, as well as a ground wire on one end of the upper arm. This ground wire is used primarily as an equaliser, and secondarily as a ground wire. It should be mentioned that the present 60,000 volt cables on this line will be removed in the near future and placed upon a single circuit steel tower line running alongside the present wooden pole line. The latter line will then be used for carrying two 2200 volt circuits as well as the telephone lines between the power houses. The manner of constructing the base of the pole merits special mention. The entire stretch of ground between the power houses is composed of solid rock with a very thin layer of earth above. It was therefore considered more economical in the placing of these poles to drill a 2¼-inch hole into the rock and also a 2-inch hole into the butt of the pole, then grout into the rock a 4-foot piece of 2-inch round iron, 2 feet of which was in the pole and the other two feet embedded in the rock. Eight holes were then drilled for the same depth into the rock in a circle round the pole with a diameter of 18 inches. In these holes was placed reinforcement consisting of ⅝-inch round iron standing 2 ft. 6 in. above the level of the rock. Forms were then built these standing 3 ft. 6 in. square, and 5 ft. in height into which concrete was poured.

The greatest difficulty experienced in the construction of the steel tower line was that of transporting material. All of the steel required was carried along the route by the workmen employed on the contract, and the cement, gravel, sand and water for the concrete was packed in on horseback, as many as twenty-five horses being necessary. The different stages of transportation were as follows: Vancouver to the generating stations on the North Arm of Burrard Inlet by scows; generating stations to the level of Lake Buntzen over an inclined railway, thence along the lake on floats hauled by motor launches. From the lake shore onwards all material was carried by the workmen and on horse pack train. Both of the lakes mentioned in the course of the article were utilized not only for the transportation of material, but also for camp locations, in view of the fact that it was impossible to discover a level spot along the entire route of sufficient extent to even assemble a steel tower. Floats were built and boarded over and upon these the tents were erected, the floats being towed down the lakes by motor launches whenever it was found necessary to move camp. Transportation on the lakes was provided by three power launches, in addition to several row boats.

Mr. T. R. Cornick, who undertook the entire work in connection with the construction of this steel tower line, has had an interesting career. As field superintendent he handled the erection of the Mexican Light and Power Company's steel transmission line (170 miles of direct transmission) under Mr. R. F. Hayward, now general manager of the Western Canada Power Company, and later erected all the ground wire masts and cable on the same line as an independent contractor. This work was accomplished within a proximity of 30 inches to 60,000 volt hot cables. Coming to Vancouver at the inauguration of the development of the Western Canada Power Company's project at Stave Lake, Mr. Cornick built the entire steel tower high tension system for this company on independent contract work between the generating point at Stave Lake and Vancouver, a distance of 32 miles. The contract he has just completed forms the first section in the work of re-building the Vancouver Power Company's high tension lines between Lake Buntzen and Vancouver, in conjunction with the additional horse-power recently provided at the company's main generating station.

Large Dam of Hydraulic Fill Type at Lake Coquitlam, B. C.

THE great dam at the outlet of Lake Coquitlam on which the British Columbia Electric Railway Company has been at work since 1908 was completed recently and is now providing an ample water storage supply for the company's two power houses on the north arm of Burrard Inlet where hydraulic and generating units are now turning out 67,500 h.p. of electrical energy, with plans for further development, making a total output from the power station of 85,000 h.p.

The Lake Coquitlam dam was constructed under the direction of the chief engineer, Mr. G. R. G. Conway. The structure is of the hydraulic fill type, with very heavy rock toes on both the up-stream and down-stream side. The maximum height of the dam is 99 feet and its length along the crest is 850 feet, the width at this point being 40 feet. The down-stream slope of the dam is 2 to 1 at the crest, 3 to 1 at a lower elevation and 4 to 1 from this point to the toe. On the up-stream side the slope is 5 to 1 and 1½ to 1. Both slopes are covered with rip-rap three feet thick. On account of these gradual slopes the total volume of the dam is very large, 530,000 cubic yards of material being employed in its construction. Of this amount 132,600 cubic yards is rock used in the toe walls in riprap. The remainder of the dam is of the hydraulic fill type, this material being almost entirely sluiced from the high hills on either side of the dam through flumes extending across the line of structure.

The work of sluicing was done by a large number of hydraulic monitors. The material is of a fine blue glacial clay, interspersed with boulders. This material when sluiced into the dam makes a perfect fill and the dam as it now stands is as solid and enduring as any dam on the continent.

During the construction of the dam the flow from the lake was diverted through a tunnel driven through the rock just east of the dam. This tunnel is 490 feet in length and has a sectional area of 400 square feet. Now that the dam is completed this tunnel is closed, but provision is made where this service may be separated in cases of emergency.

The spillway of the dam is about 15 feet below the crest and has a width of 250 feet. The capacity of the spillway is 12,000 cubic feet per second when the water is 7 feet deep over the sill. The plans for the spillway provide for its carrying three times the maximum flow from the Lake according to records of recent years.

Coquitlam Dam. Water running over spillway for first time.

The new dam raises the lake level 60 feet and increases the storage capacity by 162,000 acre feet. The total capacity of the reservoir behind the dam is 175,600 acre feet, or 7,560,000,000 cubic feet.

The larger illustration is a general view of the dam practically completed. The gradual slopes on both the up-stream and down-stream side make the construction appear far smaller than would be expected in a dam having a maximum height of 99 feet.

General view of Coquitlam dam nearing completion.

A record in output has been established, it is claimed, by the travelling plant which is making the concrete blocks for facing the Kinsico Dam of the Catskill Aqueduct at Valhalla, N.Y. The concreting tower is carried on railroad trucks, and traverses three rows of Blaw-steel forms in which 4,200 blocks per month are cast, equivalent to about 5,000 yd. of concrete. The concrete is delivered from the mixers directly into the forms. No buckets or derricks are employed. A large number of blocks have already been manufactured and are piled up, many tiers high, adjacent to the casting yard to season before being placed in the structure. An important advantage of the plant is said to be the elimination of concrete buckets and the direct delivery of the concrete.

Experiments have been made to determine the availability of concrete for oil storage tanks and it was found that the material was entirely suited for the purpose. Accordingly a number of them have been built at El Paso, Texas, by one of the railroad companies of that section which is engaged in extensively handling oil from the fields of that state. Up to this time it was generally agreed that the presence of oil had some serious effect on the concrete.

Design and Construction of a Reinforced Concrete Elevated Water Tank at Park Hill, Ont.

DURING April, May and June of the present year there was built, at Park Hill, Ont., an elevated reinforced concrete water tank of 100,000 Imp. gals. capacity. This tank, for the description of which we are indebted to our Chicago contemporary, Engineering and Contracting, is supported on a cylindrical shell which is 71 ft. 6 ins. high, 23 ft. in inside diameter and with 9-in. walls. The tank bottom is a reinforced concrete disk 29 ft. 4 ins. in diameter and 18 ins. thick. The overhang of this bottom beyond the outer surface of the supporting shell is 2 ft. 5 ins. The design at this point led to the adoption of an interesting construction method which is later described. The tank proper is a cylindrical shell 27 ft. in internal diameter, 29 ft. high, and with 8-in. walls. This shell is surmounted by the tank roof, which is a portion of a spherical surface of 35 ft. 1 in. radius. The roof is uniformly 4 ins. thick. The foundation ring is trapezoidal in cross section, the bases of the trapezoid being 6 ft. 6 ins. and 1 ft. 3 ins. respectively. The bottom of the foundation was placed 4 ft. below the finished grade of the surrounding soil.

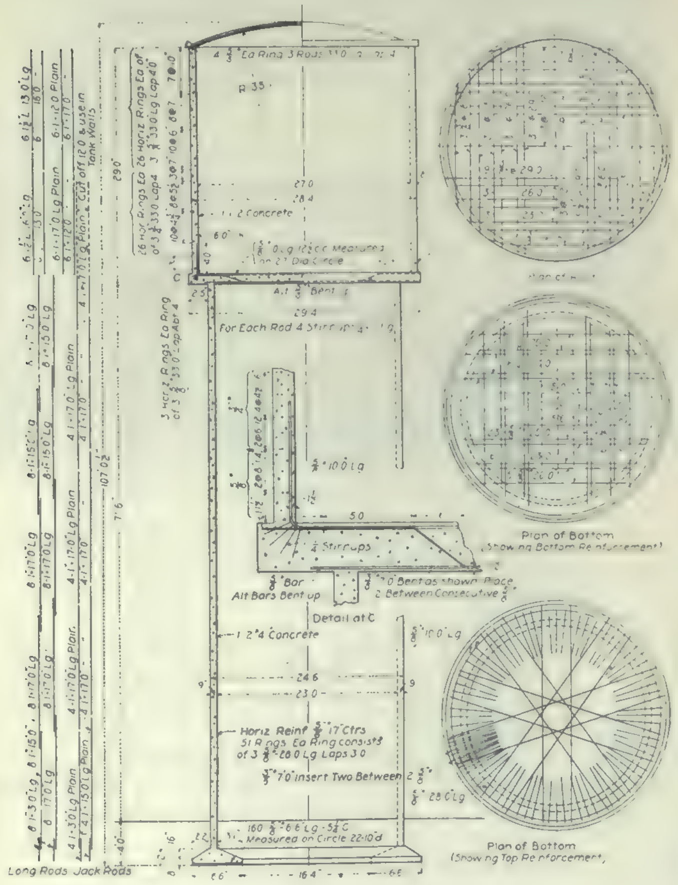

Fig. 1.—Sectional elevation and cross section of reinforced concrete water tank at Park Hill.

The reinforcement used is clearly indicated in amount, size and position by the elevation and sectional views shown in Fig. 1. The amount of the reinforcement may be summarized briefly as follows: Footing, 1,040 ft. of ⅝-in. round rods; supporting shell, 2,048 ft. of 1-in. round rods and 4,284 ft. of ⅝-in. square rods; bottom, 2,982 ft. of ⅝-in. square rods, 1,120 ft. of ⅜-in. round rods, and 480 ft. of ¼-in. round rods; tank wall, 272 ft. of 1-in. round rods, 2,871 ft. of ¾-in. square bars, and 2,871 ft. of ⅝-in. square bars; roof, 396 ft. of ⅝-in. square rods and 1,326 ft. of ⅜-in. round rods; bottom, 94 ft. of 1-in. round rods.

The supporting shell is used also to house a booster pumping unit. The shell is provided with windows and a door. The ladder to the tank extends upward outside the shell. This was practicable on the Park Hill tank because of the small overhang of the tank proper beyond the cylindrical supporting shell.

It will be noted that where water is in contact with the concrete the mixture used was 1:1:2. In all other parts of the tank a 1:2:4 concrete was used.

A construction view of the tank is shown in Fig. 2. The concreting plant consisted of a Chain Belt mixer, a hoisting tower, hoisting engine, two hoisting platform cages, and ordinary wheelbarrows. The barrows were placed on the cages with their handles toward the tank. Since the tower was only a foot or two from the nearest part of the tank or supporting shell at any time, it was an easy matter for laborers, standing on the working platform within and at the top of the tank walls at any stage of the construction, to reach across to the hoisting tower and grasp the handles of the wheelbarrow. A short piece of plank extended from the hoisting cage to the working platform to provide a bridge upon which to roll the wheelbarrow.

The method of manipulating the forms on the lower shell is indicated in Fig. 2. The forms were suspended from 1-in. rods which were imbedded in the concrete and spaced 9 ft. 6 ins. apart circumferentially. These rods formed the support for a hollow screw which on being turned, raised the forms. The hoisting tower used was 112 ft. high and was divided into 7-ft. panels. The tower posts, four in number, were 4 x 4 ins. in section. There was horizontal bracing at the top of each panel, of 2 x 4 in. or 2 x 6 in. stuff, and there was a 2 x 6 in. diagonal brace in each panel.

A running board on the inside of the shell was always at the same level as that occupied by the one outside the shell as shown in Fig. 2. In addition to these running boards a working platform, previously mentioned, on the inside of the shell, supported on trusses, was attached to the jack frames in such a manner as always to be flush with the top of the wall forms.

The main form for the tank bottom was supported by a set of forms built up within the supporting shell. This form-work consisted essentially of 6 columns, each 6 x 6 ins., in section. These columns were symmetrically disposed at the corners and in the middle of the long sides of an 8 x 12 ft. rectangle. These main verticals were braced both horizontallyand diagonally in each 10-ft. panel. At the top of the supporting framework three parallel lines of 3 x 12-in. plank were placed horizontally across the tops of the six 6 x 6-in. verticals. On top of the 3 x 12-in. plank 2 x 6-in. plank were laid to form a floor which, in turn,

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* In our issue of April 30, 1913, we published an article (by Mr. A. W. Connor,) descriptive of a large reinforced concrete water tower at Berlin, Ont. Our contemporary, Engineering and Contracting, comments upon the fact that the Park Hill tank is similar to this structure, with one important exception, namely, the use of a flat bottom for the tank instead of the dome and frustrum type of bottom which was adopted at Berlin.

was covered with ⅞-in. sheeting. Upon this sheeting platform the concrete tank bottom was poured, after the brackets and slabs later mentioned were in place. The diameter of this platform was 23 ft.; the inside diameter of the supporting shell. Since this did not provide for the overhang of the tank bottom the following method was devised to handle the concreting at the junction of the tank bottom with the two shells.

A series of separately cast but permanent reinforced concrete brackets and slabs was utilized for the purpose of supporting the overhang of the tank bottom and, of course, to partially support the tank wall forms and the walls themselves. This saved the expense of a complicated set of bracing to extend from the ground to the tank bottom. The details of this construction are as follows:

Twenty-six 1-in. gas pipes were placed in the walls of the supporting shell, at 3 ins. below its top, at intervals of about 3 ft. circumferentially. About 2½ ft. below this row of gas pipes there was placed an exactly similar row. Bolts built into the reinforced concrete brackets were passed through the gas pipes and tightened up in that position by nuts turned on the bolts from inside the supporting shell. After the brackets were placed in this manner the gas pipes were filled with mortar around the bolts. The ready-made reinforced concrete slabs were then placed upon the brackets and the concrete of the floor of the tank was poured upon these slabs and the platform previously described. The form work and concreting of the walls of the tank were then proceeded with.

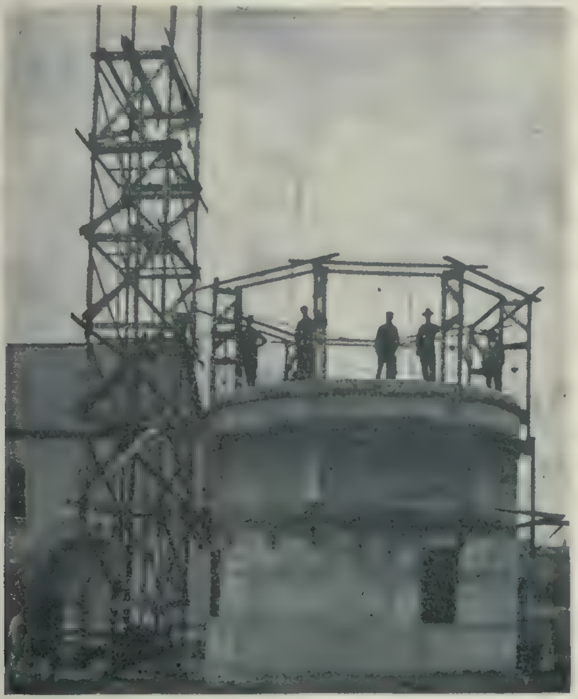


Fig. 2.—Constructional view of Park Hill tank.

The brackets are of approximately triangular shape in side elevation, being 2 ft. 3 ins. on the top of the triangle and 7 ins. at the bottom. They are 2 ft. 11 ins. high and are 4 ins. thick. In plan the slabs are sections of a circular ring. They are 2 ft. 4¼ ins. wide and 3 ft. 6¼ ins. long on the outside edge. They are 2 ins. thick. Both slabs and brackets are made of 1:1:2 concrete.

The tank here described was designed and built by Mr. L. J. Mensch, Mem. Am. Soc. of C. E., general contractor, Chicago, Ill., at a contract cost of $6,000.

Army Engineers Build Bridge by Hand Labor at North Vancouver, B. C.

THE Third Fortress Company of the Royal Canadian Engineers recently spent six weeks in field practice in the neighborhood of North Vancouver, B.C., in the course of which a structure designated as the Claxton-Fiddle inverted, rigid-suspension bridge was constructed in twenty-eight hours by a force totalling fourteen men. The work is described in the Engineering Record. The structure had a span of 92 ft. and was designed to carry a total, uniformly distributed load of 14 tons. Two pairs of 20-ton cable were used to support a floor system of timber which was braced and guyed so as to give it a high degree of rigidity; 3,000 ft. b.m. of cut lumber were used, in addition to the vertical supports and their braces.

The most arduous part of the work was the digging of the trenches to hold the anchorages of the wire cables which carry the load. These were sunk 18 ft. deep at right angles of the two main cable lines, and in them were buried logs 14 to 16 ft. long and 15 in. in diameter. From these trenches inclines were excavated to carry the cables on a straight line from the anchorages to the cross-bar supported on uprights extending 14 ft. above the bridge floor at either end of the structure. The lower ends of the uprights supporting these cross-bars were sunk in holes dug for the purpose, and were braced in two directions by timber struts attached to the uprights well above the bridge floor. Care was taken to brace these uprights firmly in a vertical position so that the strain from the cables would be transferred direct to the ground.

A movable transom was slung from the main cables and was used to place the vertical tie cables, from which, in turn, the floor system was extended out from either bank. Operations proceeded simultaneously from both banks until the span beams met at the center, at which point they were lashed together by rope.

The work was carried out under the personal direction of Maj. A. B. Carey, R.E.

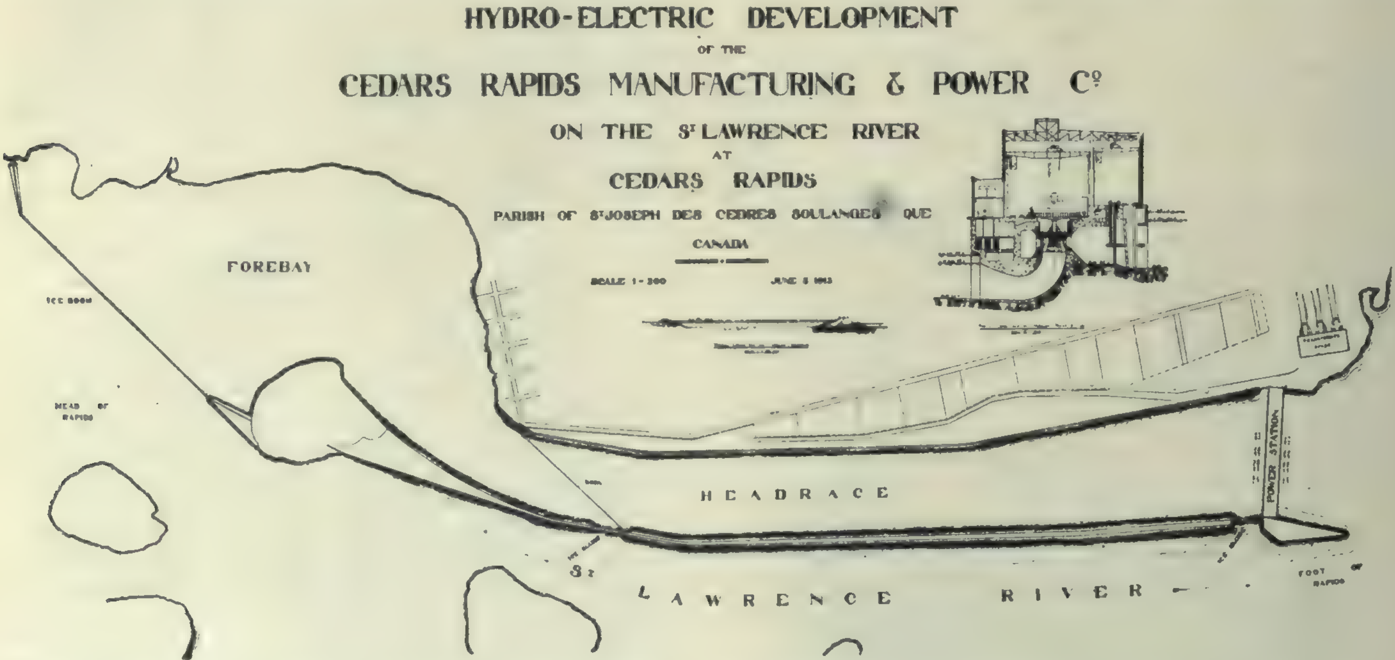
Electrolysis of water pipes in Seattle, Wash., has caused much damage, it is reported, especially in the case of wood-stave pipe wrapped with continuous steel wire. Wood-stave pipes have been laid in some of the city's streets largely because of the rapid growth in population and the consequent temporary nature of the water-distribution system. The service pipes from the mains to the buildings and the steel-riveted pipe are also affected a great deal. Cast-iron pipes are subject to the same action, but owing to the larger volume of metal they do not deteriorate as rapidly as the other kinds. In the vicinity of street railway sub-stations the deterioration has been much more rapid than elsewhere, often resulting in the complete destruction of the bands, and even the disintegration of large cast-iron pipes.

To clean painted walls, advises an exchange, dissolve two ounces of borax in two quarts of water and add one tablespoonful of ammonia. Use half this quantity to each bucket of water. Do not use soap. Wash a small amount of paint at a time and rub dry with a clean cloth.

Hydro-Electric Development at Cedars Rapids, Que.

Progress Report

THE Cedars Rapids Manufacturing and Power Company are carrying out, through Messrs. Fraser, Brace and Company, the contractors, the most important hydro-electric development in the neighbourhood of Montreal. The map, together with the cross-section of the powerhouse, shows the general arrangement of the plant. The water is taken in above the Cedars Rapids between the island, forming the upper part of the dam and the main shore. The canal extends from this island to the power house, a distance of about 12,000 feet, which forms a dam at the end of the canal, concentrating at that point the fall of 30 feet. In the power house are to be installed vertical waterwheels, each of about 10,000 h.p. capacity.



The water passes through the screen or racks at the up-stream face of the power house into the flume or casing of the waterwheel, the casing being constructed of reinforced concrete. Passing along the casing the water enters the wheel, presses against the vanes of the wheel, and discharges through the centre through the draft tube, thus out to the tailrace and down the river below the rapids. The generator will be mounted immediately above the waterwheel. The weight of the rotating part will be carried on a thrust-bearing located on the top of the generator.

The transformer house is located on a hill above the power house at a distance of about 300 feet. It is being constructed to take care of 100,000 h.p. The power-house foundations are of concrete. Work is proceeding on the erection of the steel frame work and the super-structure, a cantilever crane being used for placing the concrete. By the method of construction the power house building is made up of reinforced concrete units, which at the present time are about two-thirds completed. During the winter, and as rapidly as the foundation work will permit, the steel work will be assembled and these units or slabs put into place, so that the erection work on the waterwheels can go forward without delay.

A dyke extending from Isle-aux-Vaches to an earth bank known as the south bank is being constructed. This earth dyke extends a distance of about 12,000 feet from the Isle-aux-Vaches to the power house. The upper end of it about 2,000 feet long, is being built across a bay of the river. A thin earth bank is being retained at the present time to act as a coffer dam, so that the main canal excavations are carried on with steam shovels in the dry ground.

The turbine units are being constructed by the I.

Transformer-house foundation.

Power-house substructure.

P. Morris Company, of Philadelphia, and Wellman-Seaver-Morgan Company, of Cleveland, Ohio. The first three turbine units have already been delivered at Cedars, and about January 1st, 1914, the work of erection will be commenced. The electrical generators, of which nine will be installed, are being constructed by the General Electric Company, of Schenectady, N.Y.

Instructive Paper on Stave Falls Development

HYDRO-ELECTRIC development at Stave Falls, B.C., the project of the Western Canada Power Company, Limited, was the subject of an interesting paper by Mr. R. F. Hayward, general manager of the above company, presented at a recent meeting of the Vancouver branch of the Canadian Society of Civil Engineers.

The paper, which was illustrated by a number of lantern slides, described the design and construction of the power plant which is now in operation at Stave Falls, gave a general outline of the proposed additional developments on the Stave River, which will ultimately bring the capacity of the plants to 120,000 horse-power, and dealt very fully with the question of water supply and the most economical development that could be made under the physical conditions which obtain in the Stave Valley. The existing plant is designed for four 13,000 h.p. units, two of which are now in operation, with two additional ones on order.

The development consists of a heavy concrete intake dam, about 60 feet high, which is to be raised in the course of the coming year another 20 feet; a sluice dam consisting of piers closed by removable stop logs; a reinforced concrete power house on a foundation excavated out of solid rock, and a tailrace about 1,500 feet long excavated to a depth of about 30 feet.

The power house is now operating under 100 ft. head. When the dam is completed to its full height it will operate under a maximum head of 120 feet.

Alternative Plans

From the tailrace of the existing plant to the mouth of the Stave River there is available for further development, a fall of 130 feet. Two plans of developing this fall are now under investigation: the first contemplates the whole development at one place and involves the construction of a dam 165 feet high in a rock gorge at the mouth of the river, and the second provides for two power-houses, each operating under 65 ft. head, one to be built at the mouth of the river, and the other about one mile below the existing plant at Stave Falls. On account of the great saving that can be made in the cost of dams, the two low head plants will probably prove the most economical development.

Stave Lake lies to the north of the Fraser River, about 35 miles east of Vancouver. The watershed, which is only partly explored, has an area of about 450 square miles. It is formed by the granite mountains of the Coast Range, which rise to elevations of over 8,000 feet and carry perpetual snow. The river, from its source in a large glacier to the mouth at the Fraser River, is about sixty miles. The lake has an area of about 12 square miles and lies at an altitude of 230 feet above sea level. There is a fall of only 14 feet in seven miles of the river from the foot of the lake to Stave Falls. There it drops about 80 feet and flows thence in a series of rapids to its tidal mouth at Ruskin, on the Fraser River.

The annual rainfall, taken over a period of the last twenty years in the vicinity of Stave Falls, has averaged 77.5 inches, with a minimum year of 50 inches and a maximum year of 90 inches. The average precipitation over the drainage area is unknown, as Stave Falls is the only point at which the rain gauge has been established. Stream measurements have been taken continuously for nearly six years. The mean annual run-off of the river is approximately 4,000 cu. ft. per second, and the lowest mean annual run-off was 3,400 cu. ft. per second.

The ratio of run-off to the precipitation, as measured at Stave Falls, is 1.6, which indicates that the average precipitation over the whole basin is probably twice the precipitation at Stave Falls.

The maximum flood discharge that has been measured in the natural state of the river is about 36,000 second feet, but if the controlling action of the lake were eliminated the actual maximum flood run-off would be nearly 60,000 c.f.s., and this is the amount which must be taken into account in calculating the design of spillways.

It is practicable to build a dam at Stave Falls to raise the water 40 feet above its low level, thus increasing the area of the lake for storage purposes from 12 to 24 square miles.

Mass curves of the run-off have been plotted for the past six years and the following series of curves was computed to determine the most economical development that could be carried out, viz.:—

1. A curve showing mean flow available for varying height of dam.
2. A curve showing mean head available for varying height of dam.
3. A curve showing mean power available for varying height of dam.
4. A curve showing cost of increasing height of dams to store water 30, 35 and 40 feet above low lake level.

From these curves the maximum available power on a sixty per cent. load factor, with turbine efficiency of 83 per cent., is worked out as follows:—

1. For dam to start water 30 feet above low level—52,000 h.p.
2. For dam to store water 35 feet above low level—59,000 h.p.
3. For dam to store water 40 feet above low level—64,000 h.p.

The cost of increasing the dams above the 30 ft. level worked out as follows:—

From 30 to 35 ft. level	$20.00 per h.p.
From 35 to 40 ft. level	$25.00 per h.p.

Beyond this limit the cost per h.p. increases very rapidly.

The power-house was designed to operate under a maximum head of 120 feet, a minimum of 100 and a mean of about 110. It was laid out for four 13,000 h.p. units.

The turbines, which are horizontal type double Francis wheels with central discharge, running at 225 revolutions, were built by Escher Wyss & Company, of

Zurich; and the 9,000 kv.a. generators were built by the Canadian General Electric Company.

The intake dam is founded upon solid rock and is built of concrete, heavily reinforced at certain parts. There are four main intake gates of the radial type, each gate closing an opening 20 feet square under a maximum head of 45 feet. Each penstock is 14 ft. 6 in. in diameter and about 150 ft. long. The power-house foundation is excavated out of solid rock and the building is a heavily reinforced concrete structure.

The mechanical and electrical features of the plant have been very fully described in the various techical journals and, therefore, were not discussed to any extent in this paper.

Pavement Construction with Bricks Laid Flatwise or with the Fibre in a Vertical Position

By James T. Tucker*

A brick pavement varying in several important particulars from the usual standards, was laid at Norman, Oklahoma, seat of the State University, during the present season. In December, 1912, the Western Paving Brick Manufacturers' Association, Kansas City, Mo., after extended consideration, resolved to substantially modify the specifications under which it would recommend pavement construction. The Norman pavement is a good example of the new type proposed. The chief advantages claimed and expected for this pavement are three in number.

The first difference relates to putting the fibre of the brick in a vertical position in the pavement. Experiments with an augur machine prove conclusively that as the clay column is forced through the die of the augur machine, there is a well-pronounced arrangement of the plastic material in concentric layers. This arrangement of material is closely represented by the fibre in wood. The clay column is cut into blocks by wire in the usual fashion, but instead of being passed to the repressing machine, the green blocks are immediately passed to the dryers and thence into the kilns. The augur machine expends perhaps 75 h.p. of energy in compressing the material and building up the fibrous structure just mentioned. These blocks are ordinarily passed to the repressing machine where the moveable sides of the die bring a heavy pressure to bear on the six surfaces of the block, effectually upsetting or breaking down the fibrous structure previously obtained besides expending a considerable amount of energy to undo what the augur machine has just done.

Other differences are that the repressed brick has smoother surfaces, is habitually given rounded edges, and usually carries the maker's name. The new style of block is purposely left as square-edged as the process of manufacture will permit, is cut by a coarse wire with a view to producing a roughened surface, and therefore has only the four smooth surface given by the sides of the die in the augur machine. It has been common practice to so proportion the repressed brick that each brick went into the pavement lying on its side so far as the fibre was concerned, though on edge as to size, the effect being as though wood paving blocks were laid with their grain parallel to the direction of traffic, instead of having it vertical. On the hypothesis of a fibrous structure it appears that the resistance to wear should be much greater if the fibres are placed vertically in the pavement instead of lying flat since the tendency to spall or break is thereby greatly lessened. The vertical-fibre method of laying brick is now carried out. The dimensions of the brick are 8¼ x 3½ x 3 ins., and they are laid flatwise; i.e., with the 3-in. dimension vertical.

From the manufacturer's standpoint, there is a considerable saving of material due to lessening the pavement thickness. Also as the bricks have their larger dimensions flatwise, a less number of bricks is required to the square yard and substantial savings may be thereby made, while the consequent lessening of cost tends to popularize brick paving. Also the cost of power required to operate the repressing machine is saved, as well as the extra handling required to put the brick through it.

The second important variation deals with the problem of a suitable joint filler. Brick makers in this southwestern country have, for a considerable time, looked upon the sun as the worst enemy of their pavements when the specifications of the National Association calling for a cement grout filler have been followed. The frequent presence of cracks in different grouted pavements was often attributed to carelessness or want of taking pains on the part of the contractor. Also, the subgrade was often assumed to have been either improperly drained or not sufficiently rolled whereupon surface cracks were said to appear. Investigations carried on by the U. S. Bureau of Standards to determine the amount of pavement expansion due to varations in temperature, together with extended local observations forced these brick makers to the conclusion that the strong cement grout filler promoted the setting up of severe shearing and crushing stresses, and tended to eventually destroy the pavement, instead of being an element of inherent strength as it is generally assumed to be.

The trend of reasoning in this section of the country, therefore, is toward separating the functions of the foundation and the pavement surface. In other words, it is felt that the aim should not be to make a pavement sufficiently strong in its wearing surface to enable it to do its own work and that of the foundation as well. Sound design evidently calls for a good sub-grade and a strong foundation such as concrete, possibly reinforced, whose function is primarily to distribute loads. But the wearing surface must be fundamentally designed to resist wear and abrasion, a purpose distinctly different from that of distributing loads. Pursuing this line of reasoning the need for a cement grout filler is not apparent and by omitting it, troublesome and disastrous cracks can be avoided. It should not be assumed, however, that any sort of bituminous filler will suffice, since evidently this is not so, but if a good grade of asphalt with a relatively high melting point is used the filler should be absolutely permanent. As each and every brick is surrounded by a complete expansion joint, plainly more than sufficient for each individual's requirement, it follows that there can be no cumulative effects of expansion which have proved so disastrous to many brick pavements.

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*Director, School of Civil Engineering, University of Oklahoma, Nebraska, Okla.

The third advantage in the use of asphalt filler is its noiselessness. Noise has been one of the principal arguments against the old style of brick pavement. The surface of the new type of brick purposely made rough in manufacture, engages whatever asphalt falls upon the surface, prevents it from being pulled up by traffic and effectually cushions the flat surfaces. In applying the filler, therefore, no effort is made to pour the joint lines, which is a tedious and costly process, but the asphalt is heated to a suitable degree of fluidity, is leave a thin squeegee coat over the entire pavement. The object is to fill each and every joint full and to then cast upon the pavement with buckets and immediately spread by hot steel, hoe-shaped scraping plates. This quickly cools, and a generous sprinkling of coarse sharp sand is thrown over the surface, when the street is immediately ready for traffic.

A further important element of noiselessness is found in the square edges of the new vertical fibre blocks, since the joint depressions which in general quickly come between the brick in a grouted pavement are here entirely missing. Some care is, of course, necessary in gauging the quantity of asphalt to be used, since if too small, the joints are not completely filled and the depressions between the courses become very pronounced. On the other hand, with an excess quantity of a material such as Sarco filler, its ductility after cooling is such that the sanded surface readily slips upon the surface in contact with the top of the brick, gives a poor foothold for horses, and further exposes a fresh asphaltic surface, which may be tracked into houses, etc.

This pavement when completed shows a still further advantage over any other pavement, even sheet asphalt, in the regularity and smoothness of its wearing surface. This is because it is a relatively simple matter to screed the cushion coat of sand to a smooth surface, and a uniform density. When the brick are laid upon it and well rolled, a surface, true and regular in grade and cross section, is readily obtained. With a sheet asphalt surface, however, it does not seem possible to obtain so true a grade and cross section. The laborers who spread the hot asphaltic aggregate from the heaps into which it is dumped as it comes from the mixing plant are unable to gauge accurately the density of the aggregate after it has been shovelled or raked into place. In preparing for the roller they leave the surface as smooth and regular as is practical, but the roller quickly detects the spots of less density. The depressions thus formed may not be extensive, but on a street having a slight grade their presence is plainly shown by the appearance of shallow pools of water standing after heavy rain. These depressions are also plainly to be felt while riding in an automobile at greater than the most moderate speeds, while no variation of speed detect similar holes in the brick pavement.

The brick for the pavement at Norman were furnished by the Francis Vitric Brick Company, of Boynton, Ohio, and each car was tested on the "1911 Rattler" at the University, passing a rattler test of 24 per cent., with no allowance for the square edges. About 11,000 square yards in all have been laid here.

One piece of pavement about 1,800 ft. long by 30 ft. wide abuts the University property and half its cost was borne by the State. The School of Civil Engineering at the University was responsible for all the testing and the inspection of the state work and prepared the specifications for it. The director of the school also took an active interest in securing the adoption of this type of pavement on other streets, believing thoroughly in the merit of the new principles which this pavement exemplifies.

The pavement already built has created so favorable an impression among the townspeople that it is probable more will be laid in the near future. The contractor for this work was the Connelly Construction Company, of El Reno, Okla., and the contract price with a 4-in. concrete base was $2.10 per square yard. There are no local concrete materials, sand and stone being shipped in about sixty miles, and cement costs approximately $1.75 per barrel.—Engineering & Contracting.

New Plant of the Paris Brick and Clay Products Company

THE new plant of the Paris Brick and Clay Products Company is situated in Paris, Ont., on the right side of the Nith River, just above the point where it enters the Grand River. The plant is located about half-way up the bank. In order to secure a level position it was found necessary to excavate some of the ground on the steep bank of the river. This necessitated a considerable amount of labor, which was completed in the fall of 1912. In the spring of the present year the plant had been built and put into operation, with the result that brick-making has been in full progress during the summer months.

The machinery and driers are situated ten feet above the kiln ground, thus making it possible to set the brick as high as the checker in the kiln. Then, planking the whole kiln above the checker, the setting is finished 32 high without tossing. This is a great advantage in the working of the plant, as it cuts down considerably the expense of setting. The plant is turning out wire-cut brick exclusively—both end and side cut—the brick being of the most peculiar shade of light red with white spots scattered over the face. It is sound and hard, with good square corners. The clay is such that the cut, except on close examination, can scarcely be noticed. The brick is of a very close nature and is so high grade that it can hardly be distinguished from a dry press brick. The machinery in the plant consists of one 60 h.p. gas engine, the gas being piped into the plant from the wells of the Domniion Gas Company in the neighborhood of Dunnville. The machinery complete was supplied by Bechtels, Limited, Waterloo, Ont. It consists of two steel cars into which the clay is loaded by hand directly behind the machine head. These are hauled up to the plant by a Bechtel double friction hoist. The contents of the car are then dumped into a Bechtel 10 x 24 pug mill, then through one of their barred roll disintegrators into another pug mill of equal capacity. The brick machine is a Bechtel No. 5, to which is attached a No. 15 automatic end cutter. A certain proportion of brick are made side-cut by using a revolving hand side cutting table. After leaving the cutting tables they are placed upon Bechtel trucks and conveyed to the open-air drying sheds. The brick are at present being burned in open kilns, but it is the intention of the company to erect a down-draft kiln of the double rectangular type in the near future, thus making the plant thoroughly up-to-date in every respect. The capacity of the plant is from 25,000 to 40,000 brick a day.

The fact that a satisfactory output is being maintained daily is a good augury for the future success of the company.

Early Piledrivers

THE piledriver has always been one of the most important machines in civil-engineering construction, as piles were the only (or at least principal) means of securing reliable foundation in soft ground, until a recent epoch. The present-day contractor may well wonder how his predecessors before the time of the steam engine carried out their pile-driving jobs. Engineering News has compiled some sketches from models and old drawings in the great German technological museum at Munich (Deutsches Museum), which give a fairly comprehensive idea of old pile-driving machines.

To begin with very primitive methods: Driving with a maul is shown in the small sketch at the upper left corner of Fig. 1. Below is a machine for the same purpose that may be called a hand-operated machine maul; it was adaptable to inclined piles. The problem of driving batter piles was, in fact, of great concern to the old builders, as considerations of stability often demanded such piles. Another primitive device, lacking the idea of a machine, is the one sketched at the top middle in Fig. 1; it is interesting as presenting the ram idea in most simple form. A guide rod or bolt driven into the top of the pile served as guide for the ram, which had a hole in it to slip over this rod.

The three sketches just referred to are from a medieval work on construction. Probably they represent devices which even then were only of historical importance, for the same work sketches the machine piledriving ram at top right in Fig. 1. Here the essential elements of the piledriving machine are present; a pair of leads, a ram moving between them, a hoist rope led over a pulley at the top, and a winch for hoisting. In this case a ratchet winch is used, so that one man can lift the ram. It is not apparent how the ram was released; possibly it was released simply by throwing out the ratchet pawl.

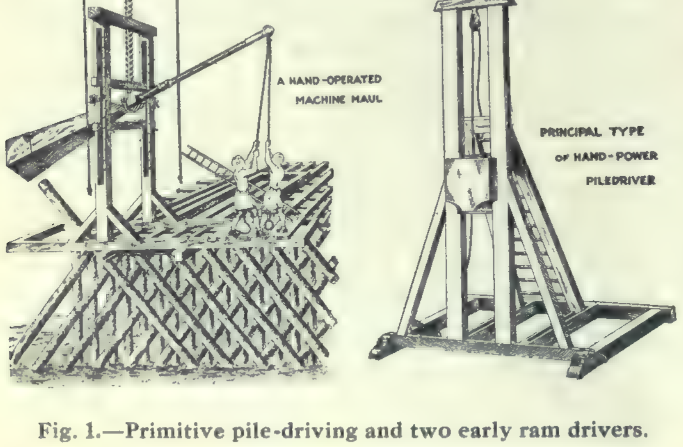

DRIVING PILE WITH MAUL
A HAND RAM
RATCHET-WINCH RAM
A HAND-OPERATED MACHINE MAUL
PRINCIPAL TYPE OF HAND-POWER PILEDRIVER

Fig. 1.—Primitive pile-driving and two early ram drivers.

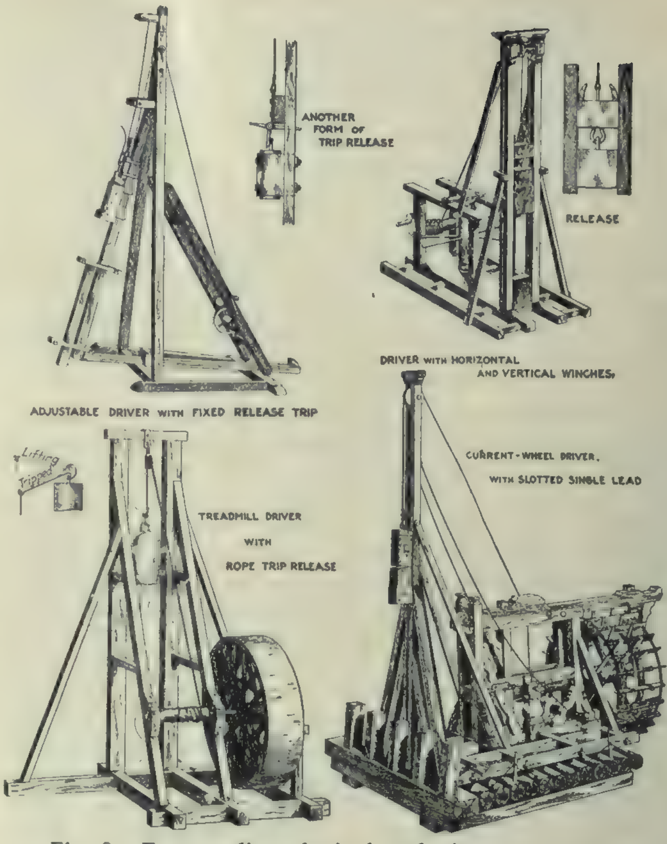

ANOTHER FORM OF TRIP RELEASE
RELEASE
ADJUSTABLE DRIVER WITH FIXED RELEASE TRIP
DRIVER WITH HORIZONTAL AND VERTICAL WINCHES.
Lifting
Tripped
TREADMILL DRIVER WITH ROPE TRIP RELEASE
CURRENT-WHEEL DRIVER. WITH SLOTTED SINGLE LEAD

Fig. 2.—Four mediaeval winch and trip arrangements.

The machine of doubtless most extensive use until relatively recent time is the rapid-stroke gang driver shown in the lower right corner of Fig. 1, sketched from a model in the museum. Here the tail of the hoist rope was fitted with grips for eight or ten men, who by pulling and letting go could give a fairly rapid series of short blows. The base frame of the driver was fitted for inclining the leads by setting back the rear brace legs in slots of the base as shown.

The application of the winch to piledrivers is shown in various forms in Fig. 2, also sketched from models in the museum. An essential requisite in such machines is a ram trip. Various forms of releasing hook are shown, tripped by hand or by fixed (probably in some cases movable) dogs. The nature of the releasing devices is clearly enough shown by the sketches to require no special reference. It is worth remarking, however, that the scow driver shown at the right at the bottom probably had a clutched winch-drum, instead of a releasing hook. There are cases in which both devices were used, the releasing drum then being probably a time-saving device in returning the rope to pick up the ram after a blow.

We have to thank Dr. Oskar von Miller, Munich, Germany, founder and president of the Museum, for photographs of the models and for the opportunity to make sketches in the museum.

These old-time piledrivers make it specially interesting to find, in inspecting German construction work, that steam-hammer piledrivers there are generally worked with manual operation of the steam valve.

In different jobs carried out by first-class contracting firms, in both land and scow driving, one man was constantly occupied at the valve rope, giving it a pull for every blow. On inquiry it was explained that this style of steam-hammer driver was used because automatics are not yet in a satisfactory perfected state.

With further reference to the above historical sketches, a note on American piledriver construction of 1841 may be of interest. It indicates that power piledrivers were exported to Europe from America even

70 years ago. The item was reprinted by the American Railroad Journal from the Oneida (N.Y.) Whig of the same year, and reads as follows:

> Steam Piledriver.—Messrs. Pond, Higham & Co., the enterprising proprietors of the Vulcan Iron Works in this city, have just completed a machine for driving piles, which is to be sent out to Liverpool, England, from whence it was ordered by a company who have taken large contracts on the great Russian railroad. This machine, which we saw in operation on Tuesday last, is worked by steam, and with half a dozen hands to manage it, is capable of performing the labor of 200 men and 20 old-fashioned piledrivers. It carries its own locomotive, sets up the piles, drives them, and cuts them off at a proper grade with a circular saw.

The Construction of Gravity Concrete Chimneys

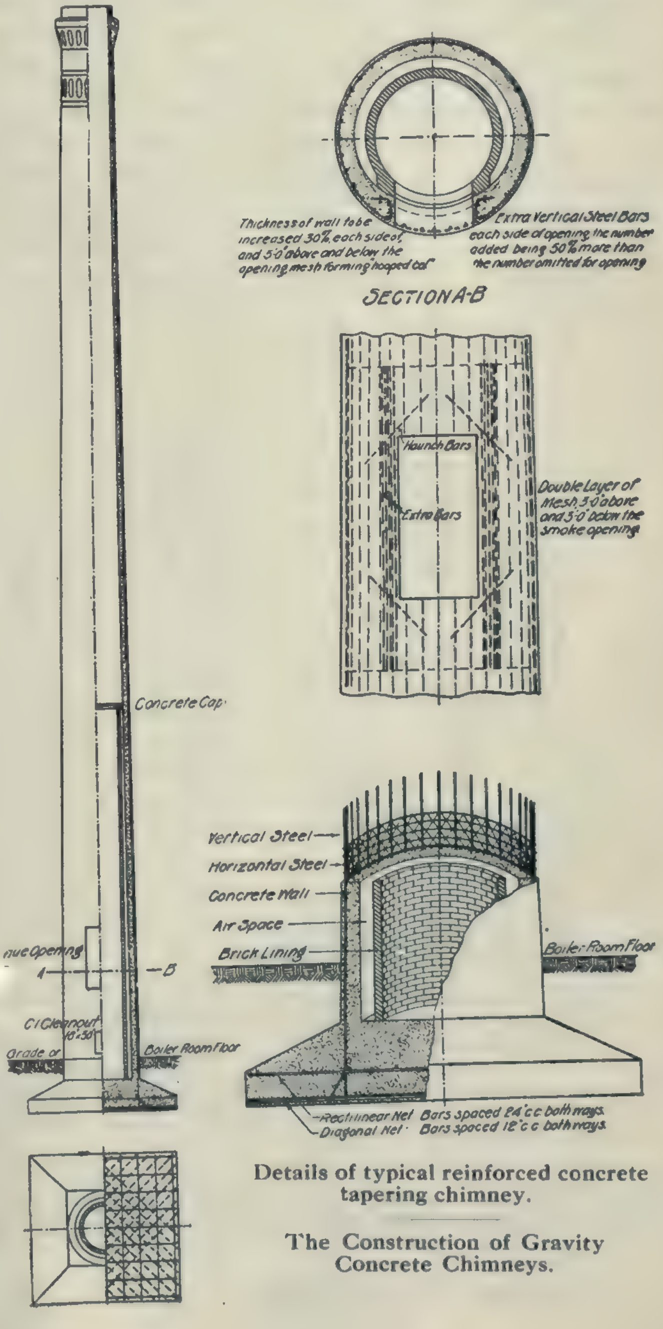
By R. S. Draper[*]

REINFORCED concrete chimneys have been so widely employed in the past ten years and the subject has been so ably covered in engineering literature, that but little remains to be said, beyond calling attention to their increasing popularity and proven permanence. However, a new type has several times been employed on important works, and while considerably more costly than the generally accepted design, has been given preference by a few consulting engineers, owing to the fact that its particular features practically eliminate danger from the personal equation in the builders, and also greatly increase the safety factors.

We refer to the "gravity" chimney, so-called by reason of its stability at all points being dependent upon weight alone, the prime requisite of the design being that the moment of stability at any or all sections exceed the wind moment. There would thus be no resultant positive bending moment, hence no tensional strain to be absorbed by the vertical reinforcement, other than that resulting from temperature changes without and within the structure.

The first "gravity" chimney of reinforced concrete was built for the Muncie Electric Company, at Muncie, Ind., 258 ft. in height over all, with a minimum inside diameter of 14 ft. 6 in. inside the lining. The shaft has a uniform taper, and is 25 ft. 3 in. in diameter at the base outside, and diminishes at the rate of 2 in. in 5 ft. to an outside diameter of 16 ft. 10 in. at the top. The inside diameter diminishes at the rate of 1½ in. in 5 ft. from 21 ft. 9¾ in. at the base to 15 ft. 6 in. at the top. The wall thickness diminishes at the rate of ¼ in. every 5 ft., from 20⅝ in. at the base to 8 in. at the top. This chimney had a nominal inside diameter of 14 ft. 6 in. and the inside diameter of the concrete wall at the top provided 1 ft. more than this, which made provision for an independent lining of fire brick, extending the entire height of the chimney. The fire brick usually used are 4½ in. in width, which leaves an air space of 1½ in. on the inside of the concrete wall at the top. The lining on the Muncie chimney was carried plumb its entire height, and was divided into three equal divisions of about 85 ft. each, of 13 in., 9 in. and 4½ in. wall. The 4½ in. wall and the inner 4½ in. of the 9 in. and 13 in. wall consisted of fire brick, and the backing consisted of a hard burned red brick of a less refractory clay. The lining was further supported by six pilasters, equally spaced, bonded into the fire brick lining, and extending into the insulating air space, but clearing the inside of the concrete wall by 1-in., permitting free and independent expansion of lining.

Two diametrically opposite openings 13 ft. high and 8 ft. wide were left for breeching connection, the stack being located midway between two batteries of boilers. A baffle plate of reinforced concrete extends diagonally across the line of breechings, and extends 10 ft. stack at an angle of 60 deg. from the centre above the top and 10 ft. below the bottom of the openings, being keyed into the lining. The concrete wall is made considerably thicker on all sides of the flue openings, the additional width of wall extending into the air space inside, and this compensates for the compressive area of concrete cut out for the openings. At the sides of fthe openings, additional vertical steel is provided to carry the temperature stresses from above and below the openings, past that point. Diagonal bars are provided at all corners of the openings to prevent cracking at those points, and to serve the purpose of forming approximate arches of the reinforcement. The stresses


Concrete Cap
Flue Opening
A
B
C/Cleanout 18"x30"
Grade or
Boiler Room Floor
Thickness of wall to be increased 30% each side of, and 5'-0" above and below the opening, mesh forming "hooped col"
Extra Vertical Steel Bars each side of opening, the number added being 50% more than the number omitted for opening
SECTION A-B
Haunch Bars
Extra Bars
Double Layer of Mesh, 5'-0" above and 5'-0" below the smoke opening
Vertical Steel
Horizontal Steel
Concrete Wall
Air Space
Brick Lining
Boiler Room Floor
Rectilinear Net Bars spaced 24" c.c. both ways
Diagonal Net Bars spaced 12" c.c. both ways

Details of typical reinforced concrete tapering chimney.

The Construction of Gravity Concrete Chimneys.

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[*] Contracting Engineer, General Concrete Construction Company, Chicago, in Concrete-Cement Age. This company designs and builds tapering concrete chimneys of the type described.

used are conservative, 16,000 lbs. for steel in tension and 350 lbs. for concrete in compression.

The mesh reinforcement used encircles the vertical reinforcement from bottom to top of shaft, and is tied to it at intervals. The vertical reinforcement consists of square twisted bars varying in number, diminishing as the top is approached, but in no case more than 18 in. apart. These serve for reinforcing against temperature stresses only, as the chimney is of true gravity design and there is in no place a bending moment resulting from wind pressure.

Application of Battering Lines and Plumb Rules*

ORDINARY tools in building and engineering work are always within the scope of mechanical application, although extraordinary or unusual tools are not. Therefore, in this article it will be my purpose to treat of one of the latter class—that of the battering rule. Take, for example, a chimney or smoke stack to be built, say 50 ft. in height, either round or square, in cross section and diminishing or battering from 8 ft. in width or diameter at the base to 4 ft. at the top. The question naturally arises how will it be possible to build this stack so as to work out exactly to the dimensions given. The answer is by the use of the battering plumb rule shown to the left at the base of the brick smoke stack or chimney illustrated in Fig. 1. Assuming that many mechanics are not familiar with the method of making this tool we offer the following suggestions:

Primarily the battering plumb rule might in practical work be compared to a simple arithmetical problem in proportion, thus: The chimney stack is 50 ft. high and diminishes or tapers on one side 2 ft. If the side of 50 ft. decreases 2 ft. in that distance, how much will it decrease in 4 ft., which we will assume to be the working length of the rule to be convenient for handling.

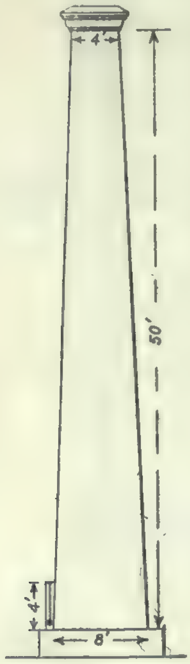


Fig. 1.—Use of battering plumb rule at base of brick smoke stack or chimney.

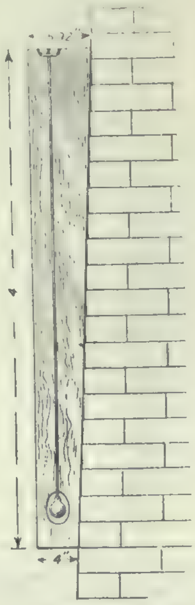


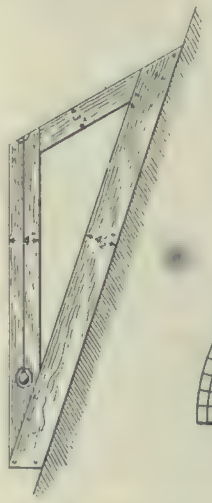
Fig. 2.—Battered plumb rule applied to brick-work of stack.

Reducing 4 ft. to inches gives 48, which multiplied by 24 in., the amount the chimney decreases in diameter, and divided by 600, the height in inches of the chimney, gives 1.92 in. batter for the 4-ft. length of rule.

To find the plumb rule batter for 100 ft. in height, divide 1.92 by 2, which gives .96 of an inch.

Continuing this operation for heights of 150, 200, 250 and 300 ft. gives as results .64, .48, .384 and .32 in. respectively.

Assuming that these simple calculations will be readily understood lesser subdivisions can be taken either by decimals or fractions as represented in Fig. 2 of the sketches.



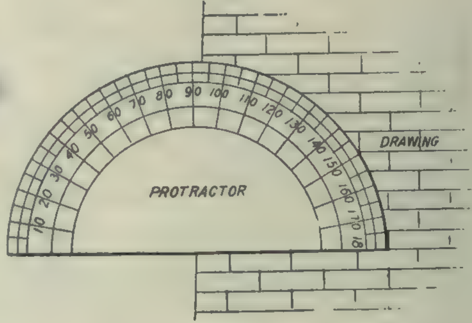


Fig. 3, on the right—Determiningthe angle or degree of batter by the protractor. On the left, Fig. 4—Framed plumb rule for a battered wall.

Another practical way of ascertaining the amount of batter is that shown in Fig. 3, which for simplicity cannot probably be excelled. The method is to take a horn or brass protractor, usually found in a set of drawing instruments, and place it on the plans, keeping the diameter line on any horizontal joint of the elevation. Then by multiplying the radius of the semicircle by the length of the plumb rule the full decrease in taper will be found.

Suppose, for example, the stack diminishes 1 deg. and that the radius of the protractor is 2 in., it will diminish 24 times 2 in. in 4 ft., or 48 in. Again, a steel square graduated to 64ths or 32nds will serve the same purpose, always maintaining extreme accuracy at the measurement points. It is best, however, to have the architect or engineer verify the slope or batter as he designs the stack. Coming now to the actual making of these rules as tools, it will be observed in Fig. 2 that there is very little difference in the tool here represented and the ordinary plumb rule with the exception that it is wider at the top than at the bottom, this being so in order to obtain the proportion of batter.

Here we might introduce the matter of curved vertical structures. For example, such a rule as that described may require to be slightly hollow on its working edge so as to form a slight entasis or curvature of the constructed mass of brickwork, concrete or whatever the material, so this hollowness must be very accurately followed in doing the actual work.

When the batter is excessive—approximately 60 deg. or more—a good practice is to build up each rule in the manner represented in Fig. 4 of 3 or more pieces of white pine, properly halved and screwed together by the carpenter so as to be firm, stable and unalterable. At the left is shown the line and plumb bob made as in the usual tools; the pieces gauged and the tool absolutely accurate. This rule should not be too heavy and can be applied with both hands and must be always true and out of wind.

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* By Owen B. Maginnis in the Building Age.

Angles and intersections in this kind of work require much definite laying out and methodical measuring. Witness Fig. 5 where one batter and one curved wall of concrete join together at an angle of 45 deg., as represented by G H on the plan. The height of the wall A B is 22 ft., as shown by the section B A C. The slope or batter of one part is 2 ft. and the projection of the curve of the other is also 2 ft., being an arc of a circle, struck from a center not in the drawing. These proportions have been somewhat exaggerated in the engraving so as to better illustrate the method to be explained.

To gain the angle and curve of intersection between these two walls in the simplest manner, first divide the altitude A D into any number of equal parts as ten, and from the points of division drawn horizontal lines as 1-a, 2-b, 3-c, etc. From their intersections with the curve, a, b, c, etc., carry lines down through the plan indefinitely.

Construct also a section of the battered wall as shown by D F E, and divide its altitude D F into ten equal parts as before, carrying lines at right angles to D F to cut the straight line D E, and from these points of intersection carry lines parallel to D F into the plan to cut lines of corresponding letter dropped from the section B A C, as shown by the curved line from G to H, which will give the true plan of the miter. From each of the intersections in the plan erect lines at right angles to the straight line G H, making the line from G equal in height to A B or E D as shown by G J, and divide it also into ten equal spaces. From the points so obtained draw lines at right angles to G J to cut lines of corresponding number brought up from the intersections previously obtained on the plan as shown by a′, b′, c′, etc. Then the curved line H J so obtained will represent a section on the curved line G H of the plan, from which it will appear that the line H J deviates from a plane an amount equal to the deviation of the curve G H from the straight line G H.

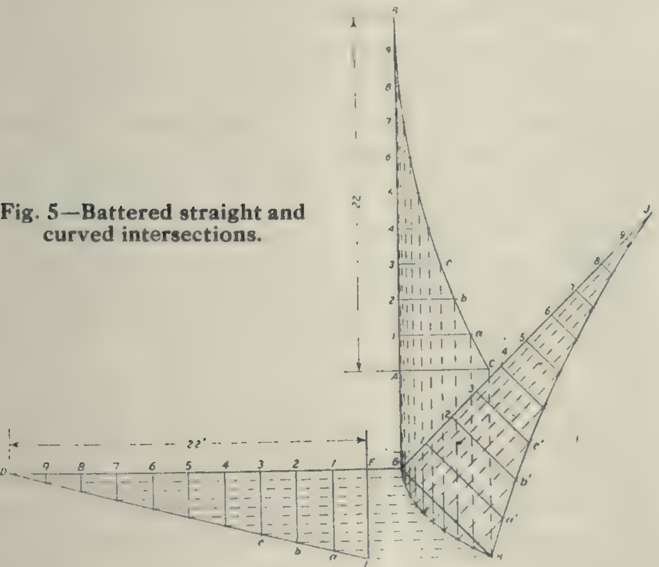

Fig. 5—Battered straight and curved intersections.

According to the United States Bureau of Standards, the melting points of fire brick are as follows: The most common fire brick, or those made of clay of which the main ingredient is kaolin, will melt at a temperature ranging from 2,831 to 3,137 degrees F.; bauxite brick, from 2,949 to 3,245 degrees, silica brick, from 3,092 to 3,101 degrees, chromite brick, at 3,722 degrees, and magnesia brick, at 4,929 degrees. These melting points, which represent the lowest temperature at which a small piece of the brick could be distinctly seen to flow, were determined in an electric vacuum furnace, the temperature being measured with an optical pyrometer.

Quality of the Material Used in Building Construction

A VERY vital matter in building construction concerns the grade and quality of materials to be employed and in one of the recent Monthly Letters of Secretary Sayward of the Master Builders' Association of Boston, he comments on the subject as follows:

"I believe that viewed through the eye of owner, architect, builder, materialman or the general public, this subject will be found to present the same aspect and thus prove that the use of the best materials is of the greatest benefit to all concerned.

First, from the standpoint of the owner it will be seen that the use of such materials leads to the highest satisfaction because best grade does what is required by the conditions perfectly and with a greater degree of permanency, thereby lessening depreciation expense. These two qualifications also make for increased rentals.

Second, from the architect's point of view best materials are productive of the best results for these reasons: (a) A first-class article reflects credit upon the architect, for it publishes his knowledge of the goods upon the market and his power to select the most suitable, whereas the use of an inferior grade may throw doubt upon the architect's discernment, whether such selection was made intentionally or not, for the general public will not stop to analyze; (b) from their greater durability, high-grade materials please the owner continuously. The architect will find his client as satisfied with his building at the end of a considerable period as he was at the end of the first few months; (c) working with first-class units the architect is able to combine them into a more effective whole from their physical adaptability and also from the greater moral incentive to good work which the use of the most suitable materials creates.

Third, as the builder and contractor view this question, the arguments in favor of the best materials are seen to be very similar to those influencing the architect. (a) Appreciation of the merits of first-class articles which have been incorporated in a building will be pretty sure to reflect credit upon the builder, although he did not specify their use; (b) a good workman is always stimulated to produce the best workmanship when the best materials are furnished; (c) good workmanship is also easier of physical accomplishment through the use of the most suitable materials; (d) deterioration of poor materials always renders the construction work liable to a verdict of bad workmanship, at least from those not specially informed.

Fourthly, we may view the question as a material dealer. Here we see that the use of an inferior article giving unsatisfactory results may reflect upon the dealer despite the fact that this inferior quality may be allowable under the specifications or due to the selection of the contractor. Presumably, also, there is more profit in handling a high-grade rather than a low-grade article.

Lastly, from the position of the general public the use of the best materials will prove most desirable because—(a) the use of an inferior product tends to demoralize the appreciation of first-class construction and consequently lowers standards; (b) buildings constructed of poor materials through the necessity for frequent and undue repairs, increase the cost of maintenance to the owner, and this is in some degree reflected on the general community.

Engineers and Contractors*

By F. W. Cable, Assoc. M. Inst. C.E., Assistant Surveyor, Westminster City Council.

THE question of the relations between the engineer and the contractor is one which has attracted a good deal of attention in late years, but no legal decisions or other outside issues will eliminate their differences, unless both are actuated by a desire to treat their differences on a broad basis, having regard to the welfare of their clients.

Individual engineers adopt different attitudes towards the contractor in the carrying out of works. There is the engineer who is very sympathetic towards the contractor, and is too ready to grant "extras," the effect being that the list of extras automatically grows out of all proportion to the job, and then the other extreme is the engineer who considers it his duty to extract the full pound of flesh out of the contractor by any means legally within his power. Both these attitudes are financially unsound from the point of view of the clients for whom the engineer is acting.

In the first case, without imputing any bad faith on the part of either the engineer or contractor, unnecessary work and materials are put into the scheme involving expenditure for which no equivalent benefit is received, while in the latter case it is unfortunately only too true that the engineer forgets that he is the legal arbitrator between the council and the contractor. It is his place to interpret the specification in such a manner as to ensure the work tendered for being carried out by the contractor in an efficient and economical manner; but it is not his duty to use any clause in the specifications to compel the contractor to do work which was not and could not have been contemplated when the tender was sent in.

It is absolutely essential that public works should be carried out as far as possible as a business undertaking and not as a speculation.

As an example of what I mean, let me suppose a contractor tenders for a scheme of sewerage, and, as is often the case, there is no anticipation of rock being met with, trial holes not even eliciting the fact. Soon after the work is commenced the contractor finds himself confronted with various sections where blasting operations have to be undertaken, and every yard of pipe laid entails a considerable loss. Now, the contractor must do one of two things, either make provision when tendering to cover the risk, or else he is speculating on the work, and, being human, must get what he can out of the remainder of the work. If he makes provision in his tender it is perfectly obvious that in the event of no rock being met with the council are losing financially to the extent of the provision thus made.

In brief, the council want certain work done, and they should pay a fair price for the work being carried out. If natural and unavoidable difficulties are met with, they are a legitimate charge to the cost of the scheme, and should be borne by the council and not by the contractor.

It was quite recently told by a well-known firm of engineers of a case where sewerage works were contemplated, and several holes were taken out for the benefit of the contractors tendering. On one side of the town a trial hole was taken out, and it was found to be solid rock. Now the contractors all tendered on the assumption that rock would be met with in this district, whereas when the work was done it was found that by mere chance the spot selected for the trial holes was on a solitary boulder of rock, and in no other spot was rock found. It will be readily seen that the ratepayers lost heavily on this occasion, quite unnecessarily.

The International Building Exposition, held in Leipzig, Germany, during the past summer, has announced its awards, and these include three American engineering organizations and an American engineer. The Alsace-Lorraine prize was awarded the Board of Water Supply of New York. The gold medal of the city of Leipzig was awarded to Gustav Lindenthal, the American Bridge Company, and the Strauss Bascule Bridge Company. Mr. Lindenthal, in connection with the American Bridge Company, exhibited plans of the Hell Gate Bridge, etc., while the Strauss Company exhibited models and photographs of its bascule and lift bridges.

Artificial marble made with white Portland cement as a base has been developed by the Art Stone Company, of Waynesboro, Penn., and very beautiful samples of the material were shown by the inventor of the process at the recent American Road Congress in Philadelphia. The process is applicable for making artificial ornamental tiling for use in any place where colored marble tiling would be applied. It is claimed that as mineral colors are used, the surface is permanent and will not fade on exposure to the light. The coloring is used in the surface only, the body of the tile being made up of ordinary cement. In order to secure a smooth, polished surface on the material, the tile is cast with its face against a sheet of glass.

The addition of finely ground blast-furnace slag to an ordinary clay of moderate fatness is said to be a simple means of producing an excellent vitrified ware suitable for stoneware and paving brick and tile. The slag, being in the form of a ready-made frit, acts as a very energetic flux, and one which is not damaged by prolonged storage. The iron compounds and other coloring agents in the slag are not usually objectionable, as the color they produce is an agreeable gray. The slag must be ground very fine as the particles are somewhat sharp and may form unpleasant specks if insufficiently ground.

In discussing the construction of concrete buildings in a paper before the Boston Society of Civil Engineers, Leonard C. Wason, President of the Aberthaw Construction Company, Boston, advises casting the stairs considerably later than the floors and in a separate operation. In casting the floors, rods are left projecting from floor to bond in the stairs, thus preserving the same measure of strength in the latter as would be the case were the whole job done at once.

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* Extract from paper read at a meeting of the Institute of Sanitary Engineers.

Drilling as a Test for Concrete

THE investigation described in this article was undertaken in order to determine the relation between the compressive strength and speed of drilling of concrete when the personal element is eliminated. It was carried on as thesis work at the University of Wisconsin and was prompted by a controversy which arose over the quality of concrete in the Southwest Land and Lake Tunnel, Chicago. In order to determine the quality, holes were drilled by hand in the concrete lining. The writer disagreed with the conclusions and, therefore, undertook these tests. The record of a portion of the hand-drilling tests is shown in Fig. 2.

The compressive tests were performed in accordance with the rules at the testing laboratory of the University of Wisconsin. The specimens upon which the compression tests were made were cylinders about 6 in. indiameter and 18 in. long. These specimens were made from the same materials and in the same manner as in the case of the boring specimens. All specimens were broken in a 100,000-lb. Riehle testing machine.

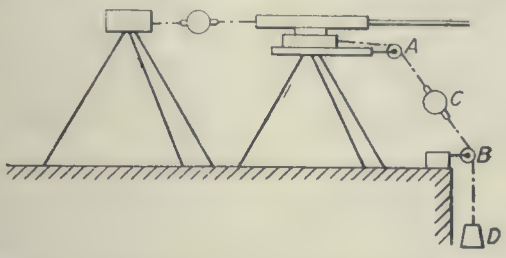


Fig. 1—Arrangement of constant feed pressure

Specifications for Drill Tests

Object.—The purpose of this experiment is to determine the speed of boring through concrete by mechanical means, when the personal element is eliminated. The ultimate object is to discover the relationship, if any, between the compressive strength of different kinds of concrete and the speed with which it can be bored. This line of experimentation is warranted, first, because of the fact that concrete tunnel linings are sometimes examined both as to the quality of the concrete and the depth of the lining by boring, and, second, because, as concrete is frequently used both in temporary and permanent building construction, it becomes necessary at times to wreck such structures, and in so doing boring is resorted to.

Apparatus.—In making complete tests two sets of apparatus shall be used. The first set is to be used in the compression tests and the second in the boring tests. The compression tests are to be performed in accordance with the standard specifications in use at the mechanical laboratory of the University of Wisconsin, and will not be discussed here. The boring tests will be made with the use of the Fort Wayne Electric Company's rock drill, type A, from which the ordinary hand feed is removed and an automatic feed with a weight substituted. There shall be suitable apparatus or means for maintaining the specimen in a rigidly fixed position with respect to the drill. Drill steels shall be of 1 7-16-in. diameter and sharp, as are usually employed in ordinary drill practice. No water shall be poured into drill hole to accelerate the boring speed.

Method of Test.—The drill shall be set up firmly, and thoroughly inspected to insure its good and efficient working order before any specimens are tested. The feed pressure in all the tests shall be about 70 lb. During the boring each drill shall be inspected from time to time, and it shall be replaced by a sharper one when it begins to grow dull. The boring shall proceed through periods of time as conditions shall dictate, and at approximately 860 r.p.m.

Data.—The data required will be the depth of each hole, the time, the total number of revolutions, the materials of which the concrete is made, their proportion, as well as the unit stress in compression for each specimen.

General.—In standardizing the methods of boring in these experiments conditions as near as those met with in actual rock drill work as possible are sought after, so that the result may be applicable to the ordinary cases of rock or concrete drilling as conducted at the present time.

Test Pieces

There were two kinds of specimens used. The first had been used in permeability tests made at the university. They had the general shape of a truncated cone, 20 in. in diameter at the base and 18 in. at the top. The height was 9 in. For the purpose of conducting the permeability tests, bottomless cast-iron jars, 16 in. in diameter, had been embedded in the concrete.

The other specimens were also in the shape of truncated cones with 20 and 18-in. diameter end areas. There were three of these, two 8 in. and one 6 in. high. The stone used was Niagara limestone taken from the marine section of the Southwest Land and Lake Tunnel in Chicago.

Drill and Motor

An electric rock drill manufactured by the Fort Wayne Company, of Madison, Wis., was used. It is known as type A, form 1, size 10, serial number 154. The motor for driving the drill was a d.c., 115-volt, 21-amp., 4-pole, compound-wound, 25-h.p. machine of 2200 r.p.m. It is known as type D, form C, serial number 32,455. The feed screw was removed from the drill so that it could slide freely in the guides, which were oiled so as to reduce the friction as much as possible.

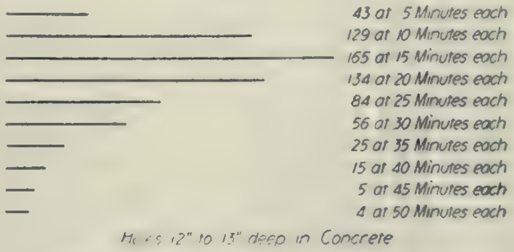


Fig. 2—Record of hand-drilled holes.

The feed pressure was supplied by a system of pulleys and weights. The drill was mounted on an extra-heavy tripod. The points of the legs of the tripod were fixed in small depressions made in the concrete floor. A chain was passed over the upper part and fastened by a turnbuckle to an anchor concreted into the floor. Before fastening the tripod its upper surface was put in a horizontal plane by the use of a spirit level.

The specimen was held firmly in the jaws of a large hydraulic testing machine. In order to secure a firm bedding, 6-in. timbers were hollowed out to the curvature of the specimen, and with other blocking placed in between the jaws of the machine and the specimen.

In order to determine the net feed pressure transmitted to the specimen, another tripod (Fig. 1) was set 4½ ft. to the rear of the machine and in line with it and the specimen. Another spring balance was fastened between the drill and the second tripod by a thin wire rope. This rope was placed as near as possible in the same horizontal line as that described by the centre of gravity of the drill as it moved in its guides. The machine was put in operation, and after a number of trials the two spring balances were found to read practically the same.

Normally, the drill makes 860 r.p.m. This was tested and it was found that the speed was not quite constant. It was therefore decided to take the total number of revoluions for the drilling of each hole. The time was taken by a stop watch and the revolutions from the shaft of the revolving helves. The drill was struck two blows, one by each hammer for each revolution.

Before beginning the drilling of each hole a slight depression was made so that, when starting, the drill would be held in one place. Preparatory to drilling the machine was moved back until the steel was about 4 in. from the concrete. The drill was then started revolving and allowed to aproach the concrete at a moderate speed. When the drill touched the concrete an assistant gave the signal, and from that instant time and revolutions were recorded. Two marks had been placed on the ways of the machine, giving the depth of the hole to be drilled. When the second mark was reached the signal was given and the counting stopped.

Weights amounting to 70 lb. were used in all but two instances. For the 70-lb. weight the net feed pressure transmitted was 68 lb. The no-load current was 2.5 amp. and the full-load varied from 14 to 16 amp.

Conclusions

As a result of the tests the following conclusions were reached:

1. The experiments were not extended enough to make it clear whether there is any definite law existing between the boring speed and compressive strength of all grades of concrete.
2. The supply of electrical power to the motor was at times not constant, and there were also occasional slight vibrations of the specimen.
3. There was undoubtedly some difference in the sharpness of even new drills.
4. Each drill grew duller as the boring progressed. The rate at which different drills grew duller varied.
5. Despite these facts, however, it would appear that, all things being equal, the rate of boring concrete would, in a general way, vary inversely as the compressive strength.

In view of the wide variation in results it is believed that the conclusion drawn from Fig. 2 are somewhat misleading. The report in which these conclusions were drawn states: "After the drillers had completed the holes in Drift 20 they had become quite expert and their work was fairly uniform, so that it was possible to form a pretty good idea of the character of the concrete from the time it took to drill the holes to a depth of 12 inches, and the men were average drillers." That the drilling furnished a very unreliable criterion as to the character of the concrete is evident for the following reasons: (1) The variation in the age of the concrete, it being from two and one-half years to six weeks old; (2) the personal equation of the drillers; (3) the condition of the drill as to sharpness or dullness; (4) the failure to differentiate between these factors.—Engineering Record.

Sand Foundations for Tall Buildings

It is a well-known fact that sand can sustain very heavy loads with comparatively little or no compression and when it directly overlays rock or other thick, hard stratum that is securely confined or otherwise protected against the possibility of lateral displacement it forms a very satisfactory foundation and will carry with safety heavy loads as long as these conditions are maintained. It is for this and other reasons that many heavy buildings of moderate height have foundations resting on the sand, usually only a few feet below the surface. Almost all of them are at or above ground water level. Heretofore they were made with timber and masonry footings, then of concrete, and now almost entirely of reinforced concrete or steel beams enclosed in concrete.

It is the general practice to support the columns of a building singly or in small groups on isolated separate footings proportioned to reduce the loads to substantially the same unit pressure on all.

When the 15-storey Spreckles Building was erected in the city of San Francisco some fifteen years ago it was built with all of its columns seated on a double grillage of continuous I-beams reaching entirely across the site in both directions and embedded in a mass of concrete more than 4½ feet thick resting on wet sand 25 feet below the surface of the street. In the case of the 26-storey St. Paul Building at Broadway and Ann street, in New York City, the columns have steel beam and girder grillage with concrete footings on the wet sand about 30 feet below the street. The Engineering Record states that the sand was loaded to 8,000 pounds per square foot and in several years has settled only a fraction of an inch and with such regularity that it has been unnecessary to adopt the special provisions designed for compensating irregular or excessive settlement.

In the new Municipal Building spanning Chambers street on Centre in New York City, a part of the foundations is carried to solid rock and part is supported on wet sand nearly 90 feet below the surface. As this building is 25 storeys high and has a 15-storey central tower rising to a height of 580 feet above the street, the pressure on the sand is 12,000 pounds per square foot.

The foundations of the 32-storey building in the city of Cincinnati consists of steel grillages enclosed in concrete and imposing a load of 11,000 pounds per square foot on dry sand about 500 feet below the street. In this case the foundations carry an estimated total load of about 104,000,000 pounds and occupy about 70 per cent. of the entire area of the building.

A trench 4 ft. wide and 7.5 ft. deep has been cut through the solid masonry and flint-rock concrete of the Pont Neuf, Paris, bridge structure with the aid of helicoidal wires and abrasive powder. The section trenched in this way, 550 ft. in length, was found to be too hard to be attacked by tools, while explosives were excluded for fear of weakening the venerable arches. Four wire cuts were made in each of the three sections, each roughly 200 ft. in length. An 18 h.p. electric motor operated the continuous-belt cutting wires, which were held taut by weights, while abrasive powder was fed into the cut.

Improved Brick-Making at Ormstown, Que.

IN common with other Canadian cities, Montreal is using more and more brick each year, one reason being that several municipalities have passed by-laws prohibiting the construction of lumber houses, and another that the building programme has naturally expanded. Architects are also alive to the possibilities of brick as a building material, and both for residences and offices it is being employed freely with artistic effect. This year a considerable amount of capital has been spent in establishing new plants and improving old ones in the Montreal district.

The Ormstown Brick Company, Limited, is one of the plants which has been extended with a view to meeting the growing demand. It is situated about 47 miles from Montreal, on the Massena Springs branch of the Grand Trunk Railway. Brick from Ormstown has been shipped into Montreal on a small scale for the past thirty years, and is favourably known for its hardness and rich red color. The company's clay beds of about 40 acres contain what is stated to be a good brick clay which will compare favourably with almost any common brick made from surface clays in Canada. Tests made by the University of Toronto from samples of clay, consisting of two feet of sandy loam, 7 feet of rather fat brown clay, and a small quantity of blue clay which underlies the brown clay, show that they work up into a mass of good plasticity with 24 per cent. of water and work easily. The drying shrinkage is 6.5 per cent. The clay gave the following results on burning:

Cone	Fire Shrinkage	Absorption
07(1850F.)	0 p.c.	15.8 p.c.
05(1922F.)	1.0 p.c.	13.5 p.c.
03(1994F.)	3.0 p.c.	8.0 p.c.

The clay burns to a good red body, almost steel hard at cone 0.7. The fire shrinkage is low and the absorption not excessive. At cone 0.3 the body is steel hard, the absorption low and the color deep rich red. The clay makes a good quality of porous field drain tile when burned to 1900 F.

A chemical analysis of a mixture of two parts of the fat brown clay and part of the blue clay gave the following results: Silica, 62.17 per cent.; ferrous oxide, 4 per cent.; calcium oxide 4.14 per cent.; aluminium oxide, 19.34 per cent. magnesium oxide, 2.80 per cent.; sulphur trioxide, .18 per cent.; loss on ignition 4.35 per cent.—a total of 96.98 per cent., the undetermined 3.02 per cent. being probably a mixture of the alkalies, sodium, and potassium and carbon dioxide. It is also stated in the report that the clay with a small admixture of sand is capable of a fast dry temperature.

Three plants are installed at Ormstown, with the following capacities during a ten-hour day—common brick, 45,000; pressed brick, 15,000; and common brick, 15,000. In addition, there is machinery for the manufacture of drain tile and terra cotta ware. The company have a Martin Pipe Rack stem dryer, which utilizes the exhaust from the engine—an economical method of drying. There are four down draft Eudaly kilns having a capacity of 130,000 each, and five Case kilns with a capacity of 300,000 each. Coal is used entirely for burning purposes, as the price of wood in the locality has advanced to a prohibitive price. Besides the pipe rack dryer, the outside drying rack and pallet system is used, the capacity being 160,000. The brick is conveyed from the machines to the dryer and from the dryers to the kiln by means of cables, thus doing away with expensive labour.

The company are now making arrangements to build a large tunnel dryer so that the output for the coming season may be trebled and that they may be in a position to take care of all orders offered them. Owing to the limited output during the last summer, orders had to be declined.

A Grand Trunk Railway siding, 1200 feet long, runs on to the property, enabling the products to be economically shipped to Montreal and border towns in the State of New York, where a considerable trade has been done, owing to a reduction in the American tariff.

An increase in the exports of manufacturers will be the leading feature in the export record of the United States in 1913. According to the Department of Commerce, the export of railway cars will show a total approximately double that of last year, the figures for the nine months ending with September being $30,500,000. Automobiles and parts, including engines and tires, show a total export value of $30,000,000 in the first nine months of this year, as against $25,000,000 for the same period of 1912. Metal-working machinery shows an increase of $1,500,000 for the same period; pipes and fittings, an increase of $3.500,000; copper manufactures, an increase of $12,750,000; while refined mineral oils for the same period show a total exportation of $102.000,000, against $88,000,000 in the same months of 1912.

"Districting" cities is a not uncommon practice in Europe, especially in Germany, but the first American city to adopt the plan is Minneapolis, Minn. A law enacted by the Legislature of Minnesota, at its last session, permits cities with a population exceeding 50,000 to establish exclusion districts. When petitioned by 50 per cent. of the property owners in a neighborhood, a City Council may, by a two-thirds vote, designate such neighborhood as a residential or an industrial district.

New Building Record for Port Arthur

Constructional Activity and Industrial Progress the Features of the Year Now Closing — Many Noteworthy Undertakings

By H. S. H. Goodier

ON the last day of the old year, the date of this publication, the city of Port Arthur can look back upon a year of unprecedented activity in constructional operations. Doubtless the records of the year will be surpassed in the years to come, but nevertheless it is to 1913 that we shall turn back as the date which marks the dawn of better days for the lake port—the year which ushered in an era of prosperity for Port Arthur and witnessed the introduction of metropolitan standards and metropolitan achievements.

Port Arthur's first building to approach skyscraper dimensions—the Whalen building. Estimated cost $500,000. Contractors, Canadian Stewart Company.

With the rapid growth of industrial life at the head of the Great Lakes, Port Arthur has been brought face to face with a number of fair-sized problems, not the least of which has been the housing of many hundreds of workmen. For many years this problem appeared to be almost insurmountable, but its solution is now being worked out by more than one company, among which may be mentioned The Canadian Resources Development Company, who commenced their house-building campaign as recently as June 20 last. In the first place this company planned to erect six five-roomed cottages as an experiment, but the structures were hardly completed when the erection of fifty more was authorized by the head office in Liverpool, Eng. These houses were erected at the record rate of nearly two a day. They are comfortable and compact, plastered inside, and wired for electric light. The accommodation comprises verandah, dining-room, two bedrooms, bathroom and storeroom. There are now approximately seventy buildings on the property.

At the corner of May street and Central avenue a site of seventy-five acres has been laid out for athletic grounds on which comfortable buildings have been erected for the Port Arthur Winter Sports Club.

Quite a small colony of wooden residences has sprung up at Ray Park and even more enterprising plans are to be undertaken next season.

There has been marked activity in the north end of the city during the last few months, notably at Gresley Park, a sub-division occupying an excellent situation overlooking Thunder Bay and Lake Superior and connected with Port Arthur by the street railway. The leading constructional firms look forward confidently to establishing new records in 1914. The optimistic forecasts are based in part upon a report that a considerable amount of English capital has been enlisted on behalf of several important development schemes. One firm is said to contemplate the erection of not less than seven hundred houses and one hundred stores in the sub-division extending north from Gresley Park.

On the lake front at the south end of Port Arthur there has been built at a cost of $1,100,000 the first

Prospect Avenue School, Port Arthur, erected at a cost of $100,000.

On the right the new government elevator at Port Arthur erected at a cost of $1,100,000; capacity 3,250,000 bushels. On the left Thunder Bay elevator; capacity 1,750,000 bushels.

terminal government elevator in Canada. This elevator has a capacity of 3,250,000 bushels. We reproduce herewith a photograph of this structure. To the left of the picture may be seen the Thunder Bay elevator which has a capacity of 1,750,000 bushels. These two new plants play no small part in the grain storage capacity at Port Arthur which is now over 16,000,000 bushels. On the near right of the government elevator is the Davidson-Smith elevator and flour mills which are now in course of construction. The elevator will have a capacity of 750,000 bushels and the flour mills an ultimate capacity of 2,500 barrels.

One of the views reproduced herewith shows the eight-storey Whalen building, a handsome building faced with white terra cotta, erected by Mr. Jas. Whalen and associates at a cost of some $500,000. The contractors are the Canadian Stewart Company.

In the centre of the city is the new Government Armoury, the home of the 96th, Lake Superior Regiment, which is being built by the Dominion Government at a cost of $200,000. This building is of handsome red pressed brick and stone. The difficulties of the basement work can be understood when the nature of the surrounding ground is considered.

The largest industry at the head of the lakes, employing one thousand men all the year round, is the plant of the Western Dry Dock and Shipbuilding Company, Port Arthur, Out of these yards has been turned the flagship of the Northern Navigation Company, the steamer Noronic, the largest passenger boat on the Great Lakes. This boat, which is 385 feet long, was launched on June 2, after being completely built at Port Arthur at a cost of $750,000. There is now building at the plant of the Western Dry Dock and Shipbuilding Company the largest bulk freighter in the world, the vessel having a total length of 625 feet.

St. Paul's new Presbyterian church, Port Arthur. A well-designed building estimated to cost $100,000, exclusive of furnishings.

The fine weather of the fall and winter has been greatly in favor of outdoor work of all kinds, and as a result a great deal of late building is being carried on, especially in the residential sections. Houses started a few weeks ago, when the contractors had little hopes of doing more than the basement work until next spring, are now well under way. The excavation work for the large theatre on Arthur street is now completed and the concrete work for the basement is finished and the forms removed. The contract is let for the superstructure for $50,000 to Messrs. Seaman & Penniman, of Port Arthur, and this is to be proceeded with at once. The exterior of the handsome new Molsons Bank building is almost completed.

With all this building finished or in such good progress, 1913, with its millions of dollars of expenditure, appears to have set a record that will be hard to beat. And yet indications are that 1914 will eclipse 1913! Cathedrals for both the Anglican and Roman Catholic communities and a handsome new building for the Bank of Montreal are among the larger building prospects for the coming year. The Contracts Department of the Contract Record will have a serial tale about Port Arthur which should make interesting reading.

The B.C. Movement of the Canadian Society

NOTEWORTHY among the news articles contained in this issue is a report on the next page relating to the British Columbia members of the Canadian Society of Civil Engineers. As is well known to those who have followed the proceedings of the society in the columns of this journal, the engineering profession in British Columbia has been clamouring for provincial organization for a very long time. Now a resolution has been passed and it would appear that the parent society would have to accede to the request of the far western section of its membership. The matter was brought up very enthusiastically at the last general convention of the society in Montreal, and a great deal of correspondence bearing upon the question was received and published by this journal subsequently, so that it is unnecessary to go into a lengthy review of the pros and cons; suffice it to say, for the information of those who may be newcomers in the field, or who may have overlooked this development, that the present movement is being undertaken by the Vancouver and Victoria Branches of the Canadian Society of Civil Engineers, with a view to establishing a provincial division for the purpose of looking after purely provincial interests and legislation in British Columbia, which is so remote from the headquarters of the society in Montreal. The facts are set forth very clearly by the Engineering Record in an interesting editorial, from which we extract below. We are pleased to note that the editorial comments of our contemporary are thoroughly in accord with the stand taken by this journal from the outset.

"Both the American and the Canadian societies of civil engineers have established branches in many of the leading cities, which serve an excellent purpose of bringing together local members of the parent society. But they are limited in their activities chiefly to the reading and discussion of papers, and never represent more than the members resident in or near a single city. Never have municipal and government problems been of such importance to the engineer as at present, and any means whereby his influence can be strengthened deserves careful consideration.

"A move toward better territorial organization, the outcome of which will be watched with interest on both sides of the international border, is the united action of the two British Columbia branches of the Canadian Society of Civil Engineers in asking for the formation of a provincial "division," whose primary object would be the building up of a strong organization by increasing the membership and uniting the influence of the members within the province. It was at first requested that this division be given power to pass on the qualifications of applicants for membership and to veto elections of undersirable candidates, that it receive a rebate from all annual dues collected in the province, that it elect its own officers and be given power to discipline members of the society resident within the province. The council of the parent society decided that no special privileges could be accorded British Columbia, but that an amendment to the by-laws of the parent society would be in order which would make possible the organization of provincial divisions throughout the Dominion. It was decided, however, that these divisions could not be allowed the power of disciplining members or vetoing applications. After some correspondence, two amendments were drawn up, one by the parent society and one by the British Columbia branches. These are now being submitted to the corporate membership for letter ballot, the results of which will be known January 19, 1914.

"The British Columbia members have shown a disposition to accede to the wishes of the parent council, but they feel that a division formed on the basis of the by-law prepared by the council will be practically useless. Western members of the Canadian Society of Civil Engineers themselves say that in western Canada membership in the society carries little weight, and the general interest in the new movement by the British Columbia membership shows that the present status is not entirely satisfactory. The code of professional ethics recently debated by the Pacific Northwest Society of Engineers and the activities of the Oregon Society of Engineers prove that the interest of Western engineers in professional organizations is not limited to the passive functions of presenting papers at local meetings and reading reports on what has been done at Eastern headquarters.

"It is manifest that some sort of a division which will have a greater range of activity than the present branch would increase the influence of the parent society at the same time that it would afford the individual members a much-needed opportunity to have a voice in affairs of general interest to the profession. While the parent society does well to reserve certain powers which properly belong to the controlling body of the national organization, it might be well, nevertheless, to permit the formation of divisions with a sufficient range of power to make them effective in representing local interests. The division, under a good and sufficient plan of control, would be better for the individual than an independent organization, but if no encouragement or support is given in the formation of such divisions there will be a tendency to transfer activities to local organizations, in which the needs of the district and its professional men are better understood."

B. C. Engineers Active for Provincial Division

On December 13, at the closing session of the second annual convention of the British Columbia members of the Canadian Society of Civil Engineers, held in Vancouver, a resolution was passed in favor of establishing a British Columbia division within the jurisdiction of the parent society.

Resolutions were also passed in favor of giving wide publicity to all proceedings of the society, with published lists of practising engineering firms, and of approaching the management of the new British Columbia University with a view to representatives of the society being appointed to make suggestions in the way of the course of studies in reference to the engineering college.

Many addresses were delivered on interesting subjects and there was full discussion of the views presented, the consensus of opinion being that students should be given a stronger business training.

Education and Training

Mr. H. K. Dutcher, in speaking on "The Education and Training of Engineers" referred to the multiplicity of subjects which were taken. In regard to the training at colleges he offered the criticism that frequently there was too much crowded into the subjects, and that there was a tendency to emphasize some subjects to the detriment of others; the student had to be rushed through in such a way that he had not time to absorb the subjects in the way he should do. More results would be arrived at if more subjects were combined. He considered that it would be much better if lecturers had their addresses printed and circulated among the students, so that more time could be given up to discussions. He believed that to be successful, in the engineering college at the University care should be taken that the department should not go under the name of engineering, but under that of applied science, separate from other courses.

Knowledge of Business

In the discussion which followed, Mr. C. H. Stone, in pointing out conditions and offering suggestions, expected great things from the University, and had no doubt the expectations would be realized. Mr. W. A. Clement spoke in favor of stronger business training. Mr. Hayward said that only one out of ten who started out in engineering courses made a success. He considered it was a mistake to give too many subjects. What the student wanted was to get down to the beginning of things.

Mr. G. R. G. Conway, who presided, laid stress on the need for culture, and, therefore, thought classical education was a good thing. At the same time it was important that an engineer should be a business man.

Mr. Dutcher moved a resolution to the effect that the University be approached later on to appoint one or more representatives of the society as a committee to help guide the management in the way of the course of studies, which was unanimously carried.

An address followed on "The Professional Status of the Engineer in British Columbia." This was given by Mr. F. C. Gamble, Provincial Consulting Engineer.

THE ANNUAL BANQUET

At the annual banquet, held on December 13, Hon. W. R. Ross, Minister of Lands, spoke on the natural resources of British Columbia. He said that the production from the province's mining, lumbering, fishing, agricultural and manufacturing industries last year totalled in excess of a hundred and forty million dollars. In the five past decades the mining industry alone had produced over four hundred and thirty million dollars, and a year or two more like the last, which had produced over thirty-two million dollars, would place the output from mining at over the half-billion mark. He dealt with the vast forest areas, the tremendous water-power available and the province's coal area, the largest in America. The engineering fraternity, he said, bore an important relation to the development of these natural resources. Almost the entire success in many lines depended on the economics of engineering, and he felt that the men of that profession, realizing their responsibility, would rise to the occasion and do as well by British Columbia as nature had done by the province. There were many evidences in things they could all see around them that engineers were meeting conditions with the best in their power, wresting from the mountains and streams and forests the wealth that was theirs, and creating it into something of benefit to society. Mr. Ross dealt at some length with the work of the water branch of the lands department. It had been in operation for some years, but results were slow of attainment owing to the territory to be covered. But he said that they had shown that contiguous to Vancouver there was sufficient water to supply a city of seven million people, more than enough for the London of to-day. He hoped to live to see the time when Vancouver's population would be a million. Around Vancouver two companies had developed water-power and will be in a position to give 150,000 horse-power. Next summer they would have parties along the lines of the G. T. P., the C. N. P., the Kettle Valley and the P. G. E. railways investigating water powers in the districts which would be available for settlement with the completion of the new roads.

Others from Victoria included Messrs. W. J. Dart, F. C. Gamble, A. Horton and C. H. Rust.

Annual Meeting Victoria Branch C.S.C.E.

The annual meeting of the Victoria Branch of the Canadian Society of Civil Engineers was held on Thursday, December 11th, at the club rooms, 534 Broughton street, when the following officers were elected for 1914: Executive —Mr. F. C. Gamble, Chairman of Branch; Mr. D. O. Lewis, Vice-chairman; Mr. A. E. Foreman, Treasurer; Mr. R. W. Macintyre, Secretary, and Messrs. E. H. Harrison and Lewis W. Toms. Auditors—Messrs. H. A. Icke and F. A. Richardson.

The chairman gave a brief review of the work accomplished during the past year. While advocating a change of officers from year to year, he expressed his appreciation of being elected by acclamation to a third term in the chair.

Mr. J. B. Holdcroft read an interesting paper, illustrated with diagrams, on "Cellular Design of Vibrated Concrete Construction, with Especial Reference to Its Use in Sub-Aqueous Work," which evoked an animated discussion.

Sand-Lime Brick Men in Session at Harrisburg

Canadians Elected to Important Offices

THE tenth annual meeting of the Sand-Lime Brick Association was held at Harrisburg, Pa., December 9-10. The president, Mr. S. O. Goho, reviewed the work of the past year in an interesting address.

Touching the status of the industry, he said: "I know of no organization of manufacturers in any line which stands more firmly and consistently for quality than does the sand-lime brick industry. The ever-present question has been how to make better brick, and when questions of economy in operations have been debated, it has always been taken for granted that they were not worth consideration if they involved a product in the slightest degree below the best. There is no doubt that this attitude of our members is a permanent one. It will become stronger as the years go by, and this Association will do more than its share in establishing high standards of honor and service in building material. On the other hand there are some considerations worthy of note at this time suggested by certain tests reported at our last meeting. There is in them no great reason for discouragement and not the slightest reason for alarm. All data regarding building material has value only when the data is compared with data regarding similar material.

"Now it is the policy of this Association to refrain from fault-finding and criticism when discussing the merits of our product as compared with clay brick. Many of our members have had no experience with clay brick, but those who have know that makers of clay brick have troubles of their own. Some years ago a public school building was under construction in this city. The contractor bought and stacked on the job about 500,000 hard burned shale bricks. The contractor met financial reverses and abandoned the contract. While the re-letting of the contract was pending, the brick stacked in piles, went through an ordinary winter. The new contractor took over the brick, expecting to get 500,000 brick. With the advent of spring it was found that the hard-burned shale brick had turned to dirt and it wasn't good, clean dirt at that. The factory that made these brick is still working. There was no demand for it to make good. So far as I know the incident has not interfered with a single sale for the plant, and aside from a few persons directly interested the affair passed without notice.

"I have seen hard-burned shale brick dumped on the job, hot from the kiln, break and split while still hot, until the pile seemed to have a creeping, crawling, sort of life. I have seen clay brick stacked under cover at the kiln turn to dirt piles over winter, but I have yet to know of a plant that closed down for this reason.

"I refer to these things, not to find fault with clay brick, but to emphasize the fact that in the midst of entirely new problems of manufacture, management and marketing, we are making magnificent brick and making new standards—standards to which the other fellow will some day have to measure up."

Sand-Lime Brick in Canada

Of the various papers presented, Canadian interest centred on "Sand-Lime Brick in Canada," by Mr. W. H. Terry, of the Harbor Brick Company, Toronto. There was a full discussion on this paper opened by Mr. W. D. MacFarlane, of Winnipeg. At the election of officers Mr. S. O. Goho, of Harrisburg, was re-elected president, and Mr. W. H. Terry, of Toronto, vice-president. Mr. George Silvester, of Calgary, was elected District Representative for Canada. The next annual meeting will be held at Dayton, Ohio, December 8-9, 1914. It will be recalled that the 1912 convention took place in Toronto, the sessions being held at the King Edward Hotel.

Personal Mention

Professor L. A. Herdt, of Montreal, has been appointed to report on electrical conditions in the city of Quebec.

Mr. F. C. Gamble has been elected for the third year to the chairmanship of the Victoria, B.C., Branch of the Canadian Society of Civil Engineers.

Mr. A. R. Tibbits, of Ottawa, inspecting officer of harbor commissions, has reached Vancouver to assist the harbor commissioners in permanently organizing in that city.

Mr. J. D. Breckon will probably be appointed to take charge of the Vancouver waterworks system under the superintendence of the City Engineer, Mr. F. L. Fellowes.

Mr. Thos. Seidl, chief engineer for Messrs. Escher Wyss & Company, Montreal, is visiting the headquarters of his company at Zurich. He will be absent about a month.

Mr. H. B. A. Vogel, of South Vancouver, has been appointed secretary of the newly created North Fraser Harbor Commission, which will attend to the harbor development works.

Mr. A. K. Robertson, C.E., Vancouver, has been elected a Member of the American Society of Civil Engineers. Mr. C. E. Bee, Division Engineer, Southern Alberta Land Company, becomes an Associate of the same body.

Mr. T. H. Hogg has been appointed to represent the graduate body of the Faculty of Applied Science on the Senate of the University of Toronto. The appointment is made to fill the vacancy caused by the resignation of Mr. C. H. Mitchell.

Mr. C. B. Vorce has severed his connection with the British Columbia Electric Railway Company for whom he was construction engineer for three years. It is expected that he will enter the consulting engineering field in New York City.

Mr. R. H. Cunningham, B.A.Sc., the new manager of Canadian Hoskins, Limited, Walkerville, Ont., was connected for several years with the Hoskins Manufacturing Company of Detroit, and received his present appointment upon the opening of the Canadian branch factory.

Mr. J. W. Helps, late Industrial Engineer Toronto Hydro-electric System, read an interesting paper on "Scientific Illumination" at the last monthly meeting of the Central Railway and Engineering Club of Canada, held in Toronto. The paper was illustrated with lantern views.

Mr. W. G. Gordon has been appointed Transportation Engineer for the Canadian General Electric Company, Limited, and will take charge of all inquiries in connection with electric traction. He has had wide experience in connection with not only city and inter-urban electric traction, but also trunk line electrification. He is a graduate of Cornell University.

Messrs. A. M. Grace, W. D. L. Hardie and Arthur Reid have been appointed Commissioners of Lethbridge, which city is just entering upon the commission form of municipal government. The Lethbridge charter provides for three commissioners, and it is significant that the new Commissioners are all engineers. Mr. Hardie, who is mayor of the city, is a civil and mining engineer; Mr. Reid, Commissioner of Public Utilities, is an electrical engineer; and Mr. Grace, Commissioner of Public Works, is a civil engineer.

Mr. J. E. Griffiths, Public Works Engineer, will be appointed by the Federal Government Deputy Minister of Public Works, in succession to Mr. W. W. Foster. Mr. Griffiths has been in the Government service since 1897, and for sixteen years prior to joining the Public Works department was employed by the Canadian Pacific Railway on construction work west of Winnipeg, when the first steel was laid, and later as resident engineer between Donald and Kamloops. Some five years ago he was loaned by the Government to the Canadian Pacific Railway Company, who, in turn, despatched him to South America to enter the employ of the Trans-Canadian Railway Company, in connection with winter operations over the Andes and the construction of large snowsheds there.

Canadian City Engineers

Mr. S. B. Bennett, Nanaimo, B.C.

The present city engineer of Nanaimo, B.C., Mr. S. Barlow Bennett, was born at Burslem, Staffordshire, Eng., and was educated at Earl Granville's School and The Endowed School, Newcastle-on-Tyne. He served an apprenticeship in sanitary engineering and afterwards took a three years' course at the Municipal School of Technology, Manchester, where he became a silver medallist. Later he entered the Armstrong College at Newcastle-on-Tyne and spent several years in the chemical laboratory, chiefly with a view to studying chemistry as applied to engineering and the analysis of water supplies. Later he took the civil engineering course leading up to Intermediate Science. For several years he practised drainage engineering in Manchester and acquired considerable experience in the reconstruction of slum areas, town planning, sewerage and other municipal work. Next he obtained an appointment as sanitary expert to the Durham County Council, which was followed in 1911 by his acceptance of the city engineership of Nanaimo.

City Engineer Bennett, of Nanaimo, B. C.

Mr. Bennett is a member of the Royal Sanitary Institute, the Institute of Sanitary Engineers and the Technical Teachers' Association. He has been a frequent contributor to the technical press and is the author of a well-known book on practical sanitary science. Much of his leisure time is devoted to research on "Dangerous Occupations," a topic upon which he has lectured before a number of societies. Mr. Bennett has not become a sanitary expert by devoting himself exclusively to this special study for he confesses to having certain hobbies, foremost among which is the making of geological microscopical sections.

Sir William Henry Bailey, chairman and managing director of W. H. Bailey & Company, Limited, Salford, Eng., and one of the pioneers of the Manchester Ship Canal, died recently.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For the past year the building permits of Maisonneuve, P.Q., totalled $2,337,323.

The Mimico village council decided at its last meeting to invite the ratepayers of Mimico to take a plebiscite on the question of a waterworks and sewerage scheme for the district.

Extensions to the Berlin waterworks system, costing $100,000, are practically completed, and water from nine artesian wells is now pumped by hydro power instead of steam plant.

The extensive stone crushing plant of the Canadian Northern Railway at the western portal of the Mount Royal tunnel has been destroyed by fire. The machinery has been badly damaged.

The Dominion Textile Company is to erect a new mill and make a large extension to its present structure at Montmorency Falls. The mill will cost in the vicinity of $750,000, and work will be commenced next summer.

At Hamilton, recently, Judge Snider gave judgment for the full amount in an action brought by Messrs. Mills & Hutton, architects, for $529, balance due for work in connection with remodelling the basement of the Hamilton city hall.

Messrs. P. H. Secord & Son, Brantford, have received the contracts for erecting the new public school at Port Dover, to cost $28,000, also for building the new armories at Haileybury for the Federal Government, at a cost of $36,000.

A new road, to be known as the Norfolk and Elgin Railway, will apply for incorporation next session. It will commence at Simcoe, Ont., and will extend to a point within three miles of the shore of Lake Erie and thence to Port Burwell, Ont.

The Canada Cement Company's new mill at the east end of Montreal, which has but recently gone into operation, has a daily capacity of 12,000 barrels. This brings the total capacity of the entire company's plants to approximately 12,000,000 barrels a year.

The ratepayers of Port Arthur have been asked to vote on a proposed by-law to authorize the issue of debentures for $202,167 for the extension of the waterworks system of the city; also for $75,000 to provide for the erection of a courthouse and jail for the district of Thunder Bay.

The Engineers' Club of Montreal have formally opened the extension to their premises in Phillips Square. The addition and the partial reconstruction of the old house have been made necessary by the growth of the membership which now numbers 480. Mr. H. H. Vaughan presided at the opening dinner.

It is announced that the Canadian government has purchased three miles of the most valuable portion of the harbor front of Quebec city at a cost of $250,000. The government is said to have under consideration extensive plans for its development. Details may be announced at the coming session of parliament.

It is estimated by Mr. George Janin, chief engineer of the city of Montreal, that the purchase of materials for the public works department next year will cost the city $1,227,104. Of this sum $835,104 will be needed for paving material, $19,500 for bricks for sewer work, and $372,500 for purchases in connection with the laying of new water mains.

According to official information from Ottawa the main feature of the public works carried out during the past season has been harbor improvements. The total appropriation for this purpose amounts to $28,214,000. This sum covers harbor dredging and river work. Seventeen million dollars will about represent the amount spent by the end of the present fiscal year.

A report from Ottawa states that the next waterway scheme which the government will undertake is the new Sault Ste. Marie canal. It is understood that an appropriation will appear in the estimates of the Minister of Finance to begin work. The new Soo canal is part of the government plan to furnish a waterway from the Atlantic to the head of navigation on the Great Lakes.

It is rumored that Judge Winchester's recent report on the investigation of Toronto schools may be followed by litigation on the part of the Board of Education against certain contractors who were alleged to have used material inferior to what was called for in the specifications. In the matter of the radiation and carpentry contracts, the judge estimates the loss as the result of shortages at $23,637.

In reply to a communication from the Montreal Builders' Exchange, advocating a Federal bankruptcy law, the Hon. C. J. Doherty, Minister of Justice, expresses the opinion that such a law is desirable. The Exchange pointed out that at present each province has its own law, with consequent confusion to business men distributing goods over the whole Dominion. Mr. Doherty has promised to lay the matter before the Cabinet, and adds: "Personally, I am of the opinion that such a law, provided its provisions be carefully considered and adapted to the needs of the country, would be highly desirable."

An action by the Ambursen Hydraulic Construction Company of Canada, Limited, Montreal, against the Donnacona Paper Company, Quebec, has been settled by consent. The plaintiffs entered into a contract to construct a dam for a hydro-electric development on a 15 per cent. basis, but after two months' work were stopped, on the ground that the methods were too costly. The plaintiffs thereupon sued for breach of contract and for damages, and the defendants entered a counter-claim for a large amount. Under the settlement the Ambursen Company will receive $16,000 for commission and an agreed sum for damages, the counter-claim being withdrawn.

The Asbestos Manufacturing Company, Limited, of Montreal, recently held a two days' conference of salesmen and branch managers at their Montreal offices in the E. T. Bank Building. The discussions included a paper on Asbestos Textiles by Mr. H. V. Everham, Jr., of Boston; a discussion on Asbestos Pipe Coverings and contract covering work by Mr. F. F. Cooper, of New York City; addresses on the manufacture and uses of Linabestos, their new wall covering, and other items of manufacture of this company. The representatives were entertained by the company at luncheon on the

11th, and on the same afternoon an inspection trip was made to the large plant at Lachine. The convention was concluded by a dinner.

The contract for the new factory for the Canada Nail and Wire Company, Limited, which is to be located at Coldbrook, near the Ford Motor Company's plant, three miles from St. John, N.B., will be awarded as soon as the company has received its charter. The structure will probably be of brick. A new warehouse has just been completed to accommodate the traffic of the Red Cross Line steamer between St. John and New York. This is only a weekly service started in the autumn, but the steamer is doing a steadily growing business. The Partington Pulp and Paper Company have considerably enlarged their St. John plant this year and are now completing a new warehouse and a conveyor to carry the pulp from the mill to the warehouse.

According to the annual report of the Dominion Bridge Company, the net profits for the year were $832,778. The output of the various plants were 76,073 tons, an increase of 13,026 tons over the previous year, which would have been considerably larger but for the congested condition of all steel mills during the early portion of the year. The value of the business entered during the year was $6,500,000, and the gross value of the contracts charged up $5,621,000. Work to the value of $8,650,000 is being carried forward into the new year. Extensions were carried out at the Lachine, Winnipeg, Toronto, and Ottawa plants. The following officers were elected: President, Phelps Johnson; first vice-president, G. H. Duggan; second vice-president, F. L. Wanklyn; directors, R. B. Angus, Chas. Cassels, Norman Dawes, C. B. Gordon, J. K. L. Ross, J. M. McIntyre, H. W. Beauclerk; secretary-treasurer, R. M. Davy.

WESTERN CANADA

It is announced that an order has been placed with Cranbrook, B.C., quarrymen for the delivery of cream-colored marble to be used in the construction of the new $300,000 Morman Temple at Cardston, Alta. Work on the structure starts in the spring.

Contractors are now preparing to put in the coffer dam on the new $450,000 arch bridge over the river at 25th street, Saskatoon, Sask. Work will be pushed throughout the entire winter and in the spring a large gang of men will be employed. The bridge in question will connect the city with the provincial university.

Work is expected to begin by January 15 on the construction of a new store for the Hudson's Bay Company at Victoria, B.C. The first four storeys will involve an outlay of $450,000. Tenders for the work were received up to December 27, and these will be gone into at once under the superintendence of Mr. Burbidge, commissioner of works.

The Geijsbeek Engineering Company, clayworks engineers, Portland, Ore., have let the contract for two large factory buildings for the B. C. Pottery Company, Limited, at Victoria, B.C. The contract was awarded to C. W. Carkeek & Company, of Victoria, and amounts to $14,000. These buildings will be used for the manufacture of high glazed sewer pipe, drain and partition tile.

In their town planning scheme which the Saskatoon city commissioners will submit, it is proposed to restrict business enterprises to certain sections of the city, except in cases where two-thirds of adjoining property owners sign a petition asking for a store in a purely residential district. The scheme will also make impossible the erection of shacks on property adjoining good residences. It is possible that apartment houses will only be permitted on business streets, but this point has not been definitely settled. The Parks Board is to ask the government for a grant of $30,000 as an instalment for 1914.

Canadian Railroad Development

The new Canadian Northern line between Toronto and Ottawa will be ready to receive regular freight business on January 3.

The Southampton railway extending from Millville to St. John River, N.B., a distance of thirteen miles, is stated to have been granted a double subsidy of $6,400 a mile by the federal government.

According to Mr. B. B. Kelleher, chief engineer, the driving of the last spike on the Grand Trunk Pacific may be expected in April next. The eastern and western ends of the line will be connected about one hundred miles west of Fort George.

The Hon. Frank Cochrane has signed the agreements for the carrying out of the big terminal works undertaken by the city of Quebec. These involve the construction of both union and freight depots, for the joint use of the G. T. R. and C. P. R., extensive car shops at St. Malo and a large freight yard at St. Foye. In addition a tunnel is to be built between the union station and the one situated on the harbor front.

A grand total of 1,700 miles of railway has been under construction during this season by the C. P. R., according to a statement made by Mr. J. G. Sullivan, chief engineer of the western lines of the company, on his return to Winnipeg after an extended tour of the work. The amount of work handled by the construction department of the company, which totals 30,000,000 cu. yds., represents more material than was moved during any period in the construction of the Panama Canal.

The government intends giving the Grand Trunk Pacific Railway a further guarantee of $2,000 a mile and in addition $1,300,000 to cover the cost of two railway projects, one of which is on the line from Young to Prince Albert. The Hon. J. H. Calder, Minister of Railways in the Saskatchewan legislature, has announced that the work on the Grand Trunk Pacific project over the Saskatchewan River will be commenced this month. All the grading of the line has been completed to a point within the city limits of Prince Albert.

The most important move in connection with the development of terminal facilities at Courtenay Bay, N.B., since seventy acres were purchased as a site for terminals for the Grand Trunk Pacific, was taken when plans were filed at the registry office for a right-of-way one hundred feet wide from a point a little over a mile from the city, on the line of the Intercolonial Railway, to a point on Courtenay Bay, at the foot of Egbert Street. It is estimated that this right-of-way will cost between $150,000 and $200,000. Nearly all of the property needed is under option, but some must be expropriated. This spur line will contain three crossings, all of which it is said will be overhead. It is believed that this action has been taken in order that the St. John Valley Railway may come to terminals at Courtenay Bay; and, as the St. John traffic of the Grand Trunk Pacific is expected to come over the St. John Valley Road, this spur would be used in connection with the traffic of that road as well.

Obituary

Mr. Thos. Sinclair, a well-known Brandon architect, died very suddenly on December 19. He had only returned from St. Boniface hospital about two weeks- before his death.

Mr. Charles S. Musson, travelling freight agent for the Nickel Plate Road in Chicago and an old-time constructing engineer on Canadian railroads previous to 1888, died December 14 at Wilmette, Ill.

Sasgen Derricks and Winches

The Sasgen Derrick Company, 13 Jarvis Street, Toronto, are patentees and manufacturers of builders and contractors' derricks and winches of the most practical and up-to-date type. These derricks are all fitted with steel and malleable castings which make the machines light while at the same time adding materially to their strength. The Sasgen Peerless circle swing steel derrick is claimed by the makers to be the most practical and convenient derrick for hoisting building material of various kinds. It is a full circle swing, portable, steel derrick with self-lubricating bearings, folding mast and bottom, and can be used by hand, horse or power without changing the boom. This derrick, when taken apart, is light and compact enough to be placed in your automobile to remove from job to job.

The Sasgen reinforced circle swing derrick for building and structural work is claimed by the manufacturers to be absolutely unrivalled. The derrick is so constructed that it can be used by hand or power. The Sasgen stiff-legged derrick is built with a split mast and boom and is equipped throughout with all-steel fittings, as also are the gears and frame of their double drum hoisting winch. Other makes include the Pole derrick, used extensively by carpenters and masonry contractors, and Top Point and setter derricks, which are an improvement, in many ways over the old setter derricks. This progressive firm also manufacture single and double drum geared winches, which are made from malleable and crucible steel, including gears, and are equipped with band brakes, the double drum having a special lever for shifting pinions into or out of large gears, by which means both pinions are worked simultaneously.

The Sasgen Derrick Company will ship these machines to reliable or rated contractors on trial. Special illustrated pamphlet and price list will be mailed upon request.

We have received from Messrs. Lecky & Collis, Limited, sole Canadian agents for Messrs. Swift, Levick & Sons, Sheffield, Eng., a copy of a particularly interesting catalogue of tool steels, drill steels, files, drills, etc., issued by the latter firm. The publication is styled a catalogue but it is more in the nature of a printed manual on the manufacture of steels and methods of use. It is well illustrated and contains a number of useful tables. Among the interesting features is a description of the "Wakfer" patent file which is said to be the invention of a practical engineer and is designed to give a greatly increased cutting power, requiring the minimum of labor in working. Clogging of the teeth of the file is prevented by means of graduated clearance tunnels which greatly enhance the efficiency of the tool. The head office of Messrs. Lecky & Collis, Limited, is at Napanee, Ont., and the firm has a branch office and warehouse at Montreal.

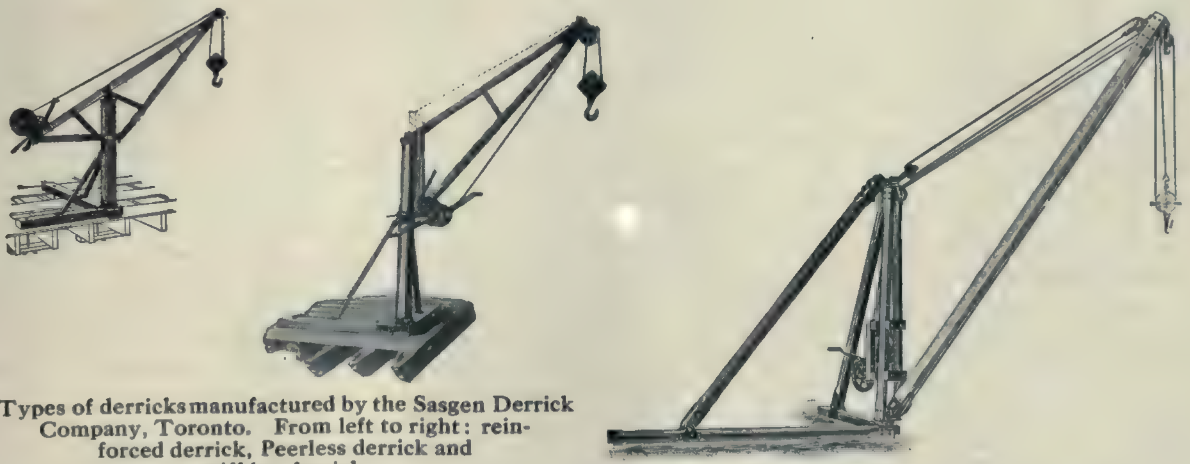
In an article relating to the new Y. M. C. A. building at Brantford, published in our special number devoted to brick and clay products (December 10, 1913), it was stated that the pressed brick were furnished by the Milton Pressed Brick Company, but we are now advised that the Toronto Pressed Brick & Terra Cotta Company were the contractors for the brick.

Messrs. Siemens Company of Canada, Limited, have favored us with one of their 1914 diaries which is provided with all the accessories which go to make up a good diary and in addition contains a host of useful trade information. The diary is gilt-edged and bound in red morocco.

The annual meeting of the Manitoba Branch of the Canadian Society of Civil Engineers was held recently in Winnipeg when Professor Brydone-Jack was elected chairman (in succession to Mr. J. G. LeGrand), and Mr. G. E. Bell, secretary-treasurer.

The tenth annual convention of the National Association of Cement Users is scheduled to be held in Chicago, February 16-20 contemporaneously with the National Conference of Concrete Road Building. Mr. E. E. Krauss, Harrison Building, Philadelphia, is Secretary of the Convention, and Mr. J. B. Beck, 72 West Adams Street, Chicago, is Secretary of the Conference.

A particularly appropriate souvenir, combining the qualities of attractiveness and originality, is to hand from the Canadian Supply and Contracting Company, Limited, Toronto. This takes the form of a plated combination desk calendar and clock. The date numerals and months of the year are printed upon revolving pads, whilst the clock is of just the dimensions to render it both useful and ornamental without being too conspicuous on the office table. The Canadian Supply and Contracting Company, Limited, whose headquarters are in the Nicholls Building 220 King Street West, Toronto, are well-known as structural water-proofing engineers and contractors, dealing in roofing, water-proofing and insulating material.



Types of derricks manufactured by the Sasgen Derrick Company, Toronto. From left to right: reinforced derrick, Peerless derrick and stiff leg derrick.

The Manufacture of Sand-Lime Brick at St. Lambert, Que.

THE enormous increase of building in the Montreal district has naturally resulted in a heavy demand which last year was only partially met by local yards. The outcome is an increase in the number of brick-making plants, and more active competition for business. One of these plants was built by the Canada Brick Company, Limited, with head office in the Transportation Building, Montreal. The president is Mr. C. H. Cahan, K.C.; the vice-president Mr. H. A. Lovett, K.C.; the directors, Messrs. R. Brutinel, G. F. Gyles and A. G. Cameron, and the manager, Mr. B. F. Bowler. The issued capital is $500,000.

The plant is at St. Lambert, P.Q., on the south shore of the St. Lawrence, and occupies a site with excellent shipping facilities, a siding of the Grand Trunk running into the works. Operations were commenced in July, 1912, but it was found necessary to remodel a portion of the plant, and it was in January of this year that bricks were produced on a market basis. Sand lime bricks are manufactured—and these are made on the Division method. The process, which is patented, is used in Russia, Germany, and the United States. It consists of mixing, in certain proportions, lime, ground sand, and unground sand, so as to make a firm sound brick, with the requisite bonding qualities. The brick has been found to have a crushing strength of three tons per square inch, with an absorption of 9.7. It is claimed that the cost is low, that the bricks are regular in size, that the grey effect is pleasing, and that the product is more durable and more fire-resisting than the ordinary plastic brick. It is also claimed that owing to the uniformity of the brick a saving of from ten to twenty per cent. can be made in the labor on structures built of the Dominion Silicate brick. The weathering qualities are stated to be excellent as they harden with age, and frost has no deteriorating effect. The sand comes from South Durham, P.Q., and the silicate lime, 100 per cent. pure, from Phillipsburg, P.Q.

The buildings and yard at St. Lambert are 400 ft. long and 150 ft. wide. The plant is housed in a building of two storeys, the greater portion of the machinery being situated on the ground floor. It is capable of turning out 40,000 bricks a day. The sand is elevated from the railway cars into a sand bin on the upper floor, and from there is conveyed on a belt into the dryer, from which it falls into an elevator boot, and is again elevated. From there it is conveyed to the tube mill below; lime is also sent down from a second shoot, and these two materials are ground in the mill by means of a number of pebbles.

The lime is stored in a separate shed, and after being crushed is sent to the upper floor by a canveyor, and thence, as previously stated, it goes into the tube mill. When the ground mixture of sand and lime leaves the mill it is in the form of a fine flour, and as it passes into a mixer there is added a proportion of unground sand. Water, is also added to hydrate the lime, and when the three constituents have been thoroughly mixed they are elevated into a huge steel cone-shaped silo. This has two divisions, and the material is stored in one of these for twenty-four hours before being used; the second contains the material which is required for immediate use. The material is conveyed from the silo by a belt, and is then given a thorough and final mixing. Once more it is elevated, from which point it comes down to the rotary press, turning out 22,000 bricks per day of ten hours.

When thus pressed into firm shape, the bricks are loaded on to trucks, containing 1,000 bricks. As soon as a truck is filled, it is run on rails to the other end of the building to the hardening cylinders, two of which are in operation when the plant is fully occupied. The cylinders are 65 feet long, with rails on the bottom, and are capable of receiving 22 trucks, or 22,000 bricks. The trucks are run in, the cylinder sealed by means of a tight-fitting iron door, and steam turned on. Here the bricks remain twelve hours and are thoroughly cooked, after which they are taken out and shipped or stored. The empty trucks are sent back, by means of transfer tracks, and a return track, to the moulding machine.

Both steam and electric power are used. The boiler generates steam for the hardening cylinders, and sand dryer, and for heating the building. Electricity is supplied by the Montreal Light and Power Company, three motors being installed. The tube mill, elevators, mixers and press are run by this power, which is also used to light the building.

The chief portion of the machinery was supplied by the Berg Machinery Manufacturing Company, Toronto, this including the sand dryer and the hardening cylinders; the tube mill came from Canadian Allis-Chalmers, Limited; the press was made by the American Clay Machinery Company, Willoughby, Ohio; and the lime crusher by the Sturtevant Mill Company, Boston.

The Canada Brick Company have made housing provision for their employees by erecting two houses near the plant. One is a fairly large building, one end being occupied by the married men and the other by the unmarried men.

During the present year the company have supplied brick for some of the largest structures in Montreal, as well as sending their products as far west as Deseronto, Ont. The Montreal buildings include the new Protestant High School, Grenadier Guards new Armoury, Bank of British North America, and the Versailles Building.

So successful has the use of burned earth material for ballasting railroad tracks proved in Texas and other parts of the south-west that the Missouri, Kansas & Texas Railroad Company recently entered into contract with Butler Bros., of Dallas, for the burning of more than one million cubic yards of this class of road surfacing. It is stated that approximately $1,700,000 is involved in this contract. It is the largest award of the kind ever made in that part of the country. The material will be sufficient to ballast about 600 miles of railway in Texas. The contractors will erect kilns or burning pits at Hillsboro, Granger, Reedville and Rogerville, all in that state. It is estimated that it will require approximately 250,000 tons of lignite coal to burn the tonnage of earth specified in the contract. The raw material will be obtained from the surface of large tracts of land which have been leased for the purpose.

The great man is not he who has been favored with opportunity but he who has made opportunities for himself.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Campbellton, N.B.
Quotations f.o.b. Campbellton are required by town council for the following road machinery: 15-ton steam road roller; stone crusher, capacity 20 to 25 tons per hour, complete with elevator and screens; portable engine and boiler, 20 h.p.; spreader wagon. Clerk, J. T. Reid. Engineer, R. J. S. Sly.

Toronto, Ont.
The following paving is planned by the Board of Control. Commr. of Works, R. C. Harris. General contractors, Constructing & Paving Co., Confed. Life Bldg., $2,929. Asphalt on Janet Ave., transferred from Commr. of Works, also concrete curb on Melgund Rd., at 41c per lineal ft.

The Board of Control recommends construction of 6-in. duplicate water main on west side of Carlaw Ave., from Bay to Gerrard St., at an estimated cost of $6,340. Commr. of Works, R. C. Harris.

The Board of Control, have recommended the construction of a sewer on O'Connell Ave., by day labor. Commr. of Works, R. C. Harris.

Vernon, B.C.
A report has been submitted to the Municipal Council regarding the extension to the sewage system, etc. The estimated cost is $90,000. Clerk, D. G. Tate. Consulting Engineers, Cummins & Agnew.

Windsor, Ont.
The Water Commissioners have applied for an order in council to permit the laying of a new intake pipe opposite the present waterworks site. Clerk to Council, Stephen Lusted.

Winnipeg, Man.
Tenders will be received until 8th Jan. for the supply of the following cast-iron water piping, required by Board of Control. 35,000 ft., 6-in. pipe; 6,500 ft., 10-in. pipe; 2,000 ft., 12-in. pipe. Specifications, etc., at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

Tenders will be received until Jan. 8th for the following sewers, planned by the Board of Control. Ash St. from Godfrey to Haskins Ave., and Haskins Ave. from Oxford to Ash St. Specifications at office of Engineer. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St.

Tenders will be received until Jan. 2nd for the following valves, required by Board of Control. 300 6-in. valves for domestic water works system. Specifications, etc., at office of Engineer. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Stamford Twp., Ont.
Waterworks equipment planned by Twp. Council. Clerk, Carleton Munroe, Southend. Engineer, C. Gardner, Niagara Falls. Hydrants, The Darling Pump Mfg. Co., $3,380. Valves, Canadian Fairbanks-Morse Co., Ltd., 26 Front St. W., Toronto.

Toronto, Ont.
Concrete sidewalks planned by Board of Control. Commr. of Works, R. C. Harris. Contracts transferred from Commr. of Works to following:—General contractor, H. Mitchell, 464 Brock Ave., Bracondale Rd. General contractors, Queen City Concrete Paving Co., 179 Broadvnew, Gertrude Place. A. Johnson, 35 Burgess Ave., Ossington Ave. All at $1.14 per lineal ft.

Grading planned by Board of Control. General contractors, Grant Contracting Co., Front St. E., Braemore Gardens, $1,295. A. Johnson, 35 Burgess Ave., Hiawatha Ave., at $220. Ramsay Contracting Co., 39 Indian Rd. Cres., McGregor Ave., at $574.50.

Cast-iron pipe required by Board of Control. General contractors, National Iron Works, Toronto, 6-in. pipe, at $7.40 per length. General contractors, Can. Allis-Chalmers Co., King W., 3-in. pipe, at $5.00; 4-in., at $4.60; 8-in., at $10.00; 10-in., at $14.00; 12-in., at $19.00 per length.

Railroads, Bridges and Wharves

Asphodel Twp., Ont.
The location of C. P. R. shelter station on E. ½ on lot 18, con. 4., has been authorized.

Montreal, Que.
Hutchison, Wood & Miller, Royal Insurance Bldg., as architects for the owners, are receiving tenders now to replace corner of R. MacFarlane & Co.'s building at St. James and Richmond Sts., recently destroyed.

North Timiskaming, Que.
Bridge planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. Tenders received by Sec., until Jan. 12th for sub-structure and approaches of highway bridge. Plans, etc., at offices of Dist. Engineer., Confed. Life Bldg., Toronto, Post Office, Montreal, and Postmaster at North Timiskaming. Works consists of: (a) 3 concrete piers on piles and stones; .b) 2 concrete abutments with wing walls; (c) reinforced concrete culverts; .d) 2 earth approaches; 10,600 cu. yds. dry excavation; 5,200 lin. ft. piles; 70,000 M.B.M. timber (hemlock, spruce, cedar or pine). The above is for a 2-span bridge 480 ft. long. Superstructure of steel is not included in this tender.

Province of Nova Scotia
Tenders will be received by Dominion Govt., Dept. of Railways & Canals, Secretary, L. K. Jones, Ottawa, until Jan. 6th, for the construction of a line of railway from North Sydney to Leitches Creek. Plans, etc., at office of Station Master, North Sydney, Chief Engineer, Moncton, and at Dept., Ottawa.

Ottawa, Ont.
Work on the Morrisburg & Ottawa Railway has been postponed until spring. Secretary, R. S. Bishop, Canada Life Bldg. General contractors, R. J. Tierney Company.

Port Stanley, Ont.
It is understood that a site is to be deeded to the Government by the London & Port Stanley Railway Commsn., to provide for the erection of a freight shed.

Vancouver, B.C.
The Dom. Govt. Dept. of Public Works, Sec., R. C. Desrochers, Ottawa, contemplate the construction of a bridge to span False Creek, from the "Reserve" to mainland opposite.

Westville, N.S.
A brick construction extension to the waterworks pumping station is contemplated by town council. Clerk, Alex. W. McBean.

CONTRACTS AWARDED

College Bridge, N.B.
Station, cost $4,300, planned by the Intercolonial Rly. General manager, F. Gutelius, Moncton, N.B.. General contractors, Gaudet & Dupuis.

Ottawa, Ont.
Pontoon bridge, cost $7,895, Bank St., planned by City Council and County of Carleton. Mayor, J. A. Ellis. City Engineer, Arch. Currie. General contractor, John Lowry, Pretoria Ave.

Roy's Beach, B.C.
Wharf, cost $6,300, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, R. H. Wood.

Westville, N.S.
Freight shed, cost $1,750, planned by Intercolonial Rly. General manager, F. Gutelius, Moncton, N.B. General contractors, McLeod & Simms.

Public Buildings, Churches, Schools, etc.

Brighton, Ont.
A new school will probably be erected next summer by the Municipal Council. Clerk, A. Mark.

Chilliwack, B.C.
The council have submitted to the ratepayers a by-law asking for authority to raise by debenture the sum of $22,000 to be applied towards the construction of two new schools, one at Sardis

and one at Rosedale, and to build an addition to the school building at Atchelitz.

The township authorities are seriously considering the advisability of erecting a new town hall. A site for the building will probably be selected near the city and a by-law submitted for authority to raise the necessary funds by debenture.

Charlottetown, P.E.I.
A site has been purchased by the St. Dunstan Cathedral authorities upon which it is proposed to erect a Hall for the League of the Cross Society. It is probable that some time will elapse before a start is made on this building.

Haileybury, Ont.
A new edifice with parsonage will be erected next spring by the congregation of the Baptist Church, of which the Rev. R. M. Carkner is Pastor.

Kamloops, B.C.
A by-law to provide $15,000 for the Royal Inland Hospital has been introduced by the City Council.

London, Ont.
Lord Roberts Chapter Daughters of the Empire propose erecting an ornamental granite fountain to commemorate Queen Victoria. Pres., Mrs. E. B. Smith, Worthy Rd. Vice.-Pres., Mrs. Dr. Niven, 423 Colborne St.

Ottawa, Ont.
Tenders will be received by Dominion Government, Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, until 4 p.m. Jan. 14th, for a stone construction addition to the Royal Mint Refinery, Sussex St. It is estimated that the cost will be $100,000.

Additions to university estimated to cost $150,000, are planned by the University of Ottawa. Sec., Rev. J. L. Binet. Architect, C. P. Meredith, 126 Sparks St., who expects to call for tenders first 2 weeks in January. Four storeys, 130 x 52, Indiana limestone and reinforced concrete construction.

Ottawa, Ont., Eastview
A by-law will be submitted to ratepayers on Jan. 5th for endorsement of the proposal to erect a Town Hall, Fire and Police Station, at a cost of $25,000 to $30,000. Mayor, C. Gladu, McArthur Rd.

Port Alberni, B.C.
Public building planned by Prov. Govt. Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. Tenders received by Minister until 4 p.m. Dec. 31st. Plans, etc., at office of Wm. Henderson, Res. Engr., Victoria, Postmasters, Port Alberni and Nanaimo and Caretaker, Public Bldg., Vancouver.

Regina, Sask.
The Regina Trades & Labor Council, St. John and Tenth Ave., propose erecting a 2-storey labor temple, at an estimated cost of $30,000. Sec.-treas., W. E. Coch, 1852 St. John St.

St. Catharines, Ont.
The St. Thomas Anglican Trustees have under consideration the erection of a new Sunday school. Two storeys, 40 x 70, brick construction, stone foundation, asbestos roofing, electric lighting, steam heating, maple floors. The estimated cost is $12,000. Architect, Joseph Daw, 165 St. Paul St.

The congregation of the British Methodist Episcopalian Church have decided to make certain alterations to their church building. Two storeys, 16 x 26, frame construction, stone foundation, shingle roofing, hot air heating, hard wall plastering, also to build a rectory, frame construction, stone foundation, shingle roofing, hot air heating plate glass. Architect, Joseph Daw, 165 St. Paul St.

Sydney, C.B.
The Y. M. C. A. authorities are contemplating a new building.

Toronto, Ont.
Congregations of St. Enoch's and St. Gile's Presbyterian Churches are to be amalgamated shortly; building to include club rooms, gymnasium, etc., is contemplated. Pastor of St. Enoch's, Rev. Robt. Hamilton, 45 Isabella street.

Tenders for Hester How School addition were not opened by Board as the city refused permission to erect additions.

Vancouver, B.C.
Lodge Hall, Homer street, for Fraternal Order of Eagles. Architect, Emil Guenther, Northwest Trust Bldg. Three storeys, part basement, 120 x 50, brick construction. Plans are being prepared and work is to start early next spring.

Victoria, B.C.
The Dom. Govt. Dept. of Public Works has purchased a site bounded by Blanchard, Collinson and Burdette Sts., for the erection of a court house. Sec., R. C. Desrochers.

Westville, N.S.
A fire hall and hose-drying tower is contemplated by town council. Clerk, Alex. W. McBean.

Wilkie, Sask.
A site has been purchased cor. Main and Imperial streets, by the Dominion Govt., Dept. of Public Works, Secretary, R. C. Desrochers, Ottawa, for the new post office. It is estimated that the cost of the building will be $35,000.

CONTRACTS AWARDED

Vancouver, B.C.
Addition to hospital, cost $199,921, planned by General Hospital Board. Managing Sec., Geo. Haddon. Architect, A. A. Cox, Carter-Cotton Bldg. General contractors, Baker, Whipple & Campbell. Three storeys, mill and brick construction.

Business Buildings and Industrial Plants

Aylmer, Que.
Plans are to be prepared for dairy farm buildings for Silver Springs Dairy Farms, Ltd. (formerly Clark's Dairy, Ltd.). Architect, C. P. Meredith, 126 Sparks St., Ottawa.

Blenheim, Ont.
Guild & Connor have decided to erect a two storey cement block building with a frontage of 50 feet on Talbot street and 104 feet on Marlboro street, with a depth of 75 feet. The upper floor will be provided with a large lodge room.

Chemainus, B.C.
Machinery has been purchased for a sawmill with a daily capacity of 50,000 ft. which P. Welch, 325 Howe St., Vancouver, proposes to erect on the Pacific Great Eastern Ry. Engineers, J. B. Weir & Co., 737 Pacific St., Vancouver.

Ft. William, Ont., Mt. McKay
Ratepayers will vote on by-law to raise $30,000 for the purpose of acquiring, establishing and equipping stone quarry, and to construct and equip an extension of the street railway to such quarry. Clerk, A. McNaughton.

Grimsby, Ont.
Alterations to stores and printing office proposed by J. A. Livingston & Son. West wing, 148 x 40, east wing, 60 x 40, plate glass, store fronts. Plans in progress.

Hamilton, Ont.
The Arcade, Ltd., Manager J. P. Whelan, 43 James St. N., propose making an addition of two storeys to their store. Architect, W. A. Edwards, 7 Hughson St. S.

G. W. Robinson & Co., James St. S., propose to build 2 additional storeys, structural steel and brick construction, felt and gravel roofing.

The Park Theatre Co. (B. G. Anderson, Buffalo, N.Y.)., have obtained license to build a moving picture theatre at an estimated cost of $11,000. 36 x 100, hollow tile and brick construction, stone and concrete foundation, felt and gravel roofing, gas and electric lighting, steam heating, maple and pine floors, seating.

Iona, C.B.
The Iona Gypsum Co., Ltd., have selected a site about a mile and a half from here on the shore of the Big Bras d'Or Lake and will shortly erect a plant, including mill, warehouse, mixing building and power house. The capacity will be about 1,400 barrels per diem.

London, Ont.
It is understood that A. J. May, 185½ Dundas street, is considering the possibilities of an artificial ice rink.

Plans are prepared for a garage and boiler room, for Hobbs Hardware Co., Richmond St. Manager, C. A. Whitham. Architects, McBride & Gilbert, Edge Block. One storey, 40 x 54, reinforced concrete construction, concrete foundation, felt and gravel roofing, electric lighting, steam heating, concrete floors, fireproof doors, architectural iron railings.

Additions are proposed by the Home Bank of Canada, 394 Richmond St. Manager, W. J. Hill, and the architect, Vicar Munro, Bank of Toronto Bldg., will receive tenders until Jan. 3rd. 55 x 25, Indiana limestone and granite construction, stone foundation, felt and gravel roofing, electric lighting, oak and maple floors, plumbing, mosaic tiling, plate glass, cornices, bank fixtures.

Montreal, Que.
Workshop, Marcil, for O. Denault, 257 Clifton Ave. Two storeys, 25 x 70, concrete foundation, felt and gravel roofing. Permit issued.

P. G. Demetres, 559 St. James St., has purchased a site on Mt. Royal Ave. for the erection of a theatre and apartment house.

Two stores and flats, cost $8,000, Des Carriers, for J. P. A. Belanger, 2125 St. James. Architect, Chas. Bernier, 40 St. James. Three storeys, 50 x 50, concrete foundation, felt and gravel roofing. Plans in progress.

Niagara Falls, Ont.

Wm. Place, Morrison St., expects to start work March 1st on a dry goods store with offices and flats. Two stys., 50 x 90, concrete foundation, waterproofed, brick construction, patent roofing, store fronts and fixtures. The cost is estimated at $18,000.

Toronto, Ont.

Stores, apartments and garage, Church street, for J. M. Cowan (in trust), 65 Adelaide E. Three storeys, 36 x 120, brick and steel construction, brick foundation, felt and gravel roofing, gas and electric lighting, steam heating, maple and birch floors, lime and sand plastering, plate and leaded glass, galvanized iron, mantels. Plans drawn.

Vancouver, B.C.

Cold storage warehouse, Water Street, for Vancouver-Prince Rupert Meat Co., 125 Hastings St. W. Architect, company's staff. Brick and mill or concrete construction. Plans being prepared.

CONTRACTS AWARDED

Montreal, Que.

Alterations to store, $5,500, St. Ambroise, for Dom. Textile Co., Ltd., 78 St. Ambroise. General contractor, C. E. Deakin, 41 Mayor St. 1½ storey, 75 x 50, concrete foundation, felt and gravel roofing.

Residences

Hamilton, Ont.

Residence, $12,000, Wentworth, for Adam Inch, Mount Hamilton. Architect, F. W. Warren, 808a Bank of Hamilton Bldg. Two storeys, basement and attic, 34 x 44, stone foundation, pressed brick construction. Work will not start until spring.

Residence, $9,000, planned by Architect, F. W. Warren, Bank of Hamilton Bldg. 2½ storeys, 46 x 32, stone foundation and construction. Work will not start until spring.

London, Ont.

Apartment house, Dundas St., cost $5,000, is contemplated by T. B. Escott, 566 Dundas St. Architect, A. Nutter, Dom. Bank Bldg., who will receive tenders. Two storeys, 40 x 62, red brick construction, concrete foundation, slate roofing, electric lighting, hot air heating, oak floors, plumbing, lime and sand plastering, mosaic tiling, one dumb waiter, skylights.

Montreal, Que.

Five flats, Iberville, for J. Thompson, 1169 Cartier, and J. Forbes, 535 Papineau ave. Three storeys, 25 x 41, concrete foundation, felt and gravel roofing. Permit issued.

Five flats, cost $4,000, Valois, for Toussaint Goudreault, 152 Forsythe. Three storeys, 25 x 51, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, cost $5,000, for Emile Mitchell, 200 Berri. Three storeys, 25 x 42, concrete foundation, felt and gravel roofing. Permit issued.

Eight flats, $6,000, Poupart, for J. P. A. Belanger, 2125 St. James. Architect, Chas. Bernier, 70 St. James. Three stys., 60 x 30, concrete foundation, felt and gravel roofing. Plans in progress.

Six flats, St. Hubert, for N. Gariepy, 3613 Berri. Three storeys, 25 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Six flats, St. Hubert, for V. Pelletier, 2684 Chateaubriand. Three storeys, 25 x 47, concrete foundation, felt and gravel roofing. Permit issued.

Three flats, Regina Ave., cost $9,000. Nap. Cousineau, 2580 Clarke. Three storeys, 25 x 72, concrete foundation, felt and gravel roofing. Permit issued.

Niagara Falls, Ont.

Day & Co., 418 Herkimer St., Hamilton, will start work as early in spring as possible on 130 residences at an estimated cost of $3,000 each. 2½ storeys, pressed brick construction, concrete block foundation, shingle roofing, gas and electric lighting, hot air heating, oak, pine, spruce and maple floors, plumbing, hard wall plastering, wood lath, mantels.

Toronto, Ont.

Four residences, $8,000, 8 Fort Rouille St. Owner, general contractor and carpenter, G. K. Halladay, 199 Dunn Ave. Two storeys, 60 x 42, brick construction. Tenders wanted for lath and plastering and wiring.

One detached residence for J. W. Lainsom, owner and general contractor, 262 Western Ave. Two storeys, 22 x 34, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One detached residence. Owner and general contractor, J. Bell, 185 Humberside Ave. 2½ storeys, 24 x 32, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences for J. H. Stanford (in trust), Bloor and Ossington. Architect, J. H. Stanford. Two storeys, 33 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, mantels. Plans drawn.

One pair residences, $5,000, for W. H. Mallory (in trust), 31 Queen St. W. Architect, who is open to receive tenders. 2½ storeys, 34 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

One detached residence. Owner and general contractor, R. A. Shields, 121 Hilton ave. Two storeys, 22 x 35, brick construction and foundation, shingle roofing, gas and electric lighting, hot water heating, oak and pine floors, lime and sand plastering, wood lath, mantels, built-in fireplaces. Plans drawn.

One pair residences, Kent road. Owner and general contractors, Hale & Corby, 333 Lippincott street. 2½ storeys, 33 x 40, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

Six pair residences, $20,400, Laughton Ave. Owner and general contractor, Robt. M. Mackay, 72 Indian Rd. Cres. Mason and carpentry, day labor. Will let plastering, painting, heating, plumbing and electrical. 2½ storeys, 32 x 38, brick construction and foundation, shingle, felt and gravel roofing, electric lighting, hot air heating, oak and birch floors, lime and sand plastering, built-in fireplaces, mantels. Plans drawn.

Two detached residences, cost $5,000. Owner and general contractor, W. Williams, 20 Cloverdale Rd. Two storeys, 20 x 42, brick construction, stone foundation, shingle roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

A. G. Strathy, 123 Simcoe street, will receive tenders for all trades for altering three residences on Cumberland street into apartments.

Geo. A. Brown, 37 Dorval Rd., is open for tenders (all trades) on 2 pair semi-detached residences. Two storeys, brick construction, shingle roofing, gas and electric lighting, hot air heating, lime and sand plastering, wood lath.

One pair residences, Rosemount, cost $5,000. Owner and general contractor, J. Edmonds, 71 Oakwood Ave. Owner superintends construction. Two storeys, 34 x 42, brick construction, stone foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built in fireplaces, mantels. Plans drawn.

Three residences, Morley Ave., for W. Wallace (in trust), 1 Dundee Ave. Tenders wanted for wiring, drains, tinsmithing and plastering.

W. T. Pearce, 838 Keele St., has just purchased corner Queen and Dunn building which he proposes remodelling into apartments.

One pair residences, Fulton, cost $5,000, for S. Robertson, 42 Fernbank Ave. Two storeys, 33 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built in furplaces, mantels. Plans drawn.

CONTRACTS AWARDED

Ottawa, Ont.

Residence for A. D. Helmer, 117 Bank St. General contractor, James Hutt, 381 Lisgar. Painting, F. W. Penny, Eastview. Additional contract awarded. Tenders still open on plastering, heating, plumbing and electrical. 2½ storeys, 35 x 22, brick veneer construction.

Residence. Owner and general contractor, C. D. Joyce, 1102 Somerset. Heating, J. R. Cameron, 488 Lewis. Plumbing, L. Gendron, Hull, Que. Two storeys, brick veneer construction. Additional contract awarded.

Residence, $4,500, for I. Villeneuve, 164 Bayswater Ave. Additional contract awarded. Electrical, C. C. Gould, 219 Florence.

Toronto, Ont.

One pair residences for W. F. Jifknes, 388 Clinton St. Architect, J. G. Hedges, 210 Clinton St. Mason, R. S. Scrimgeour, 170 Concord. Carpenter, H. G. Life, 110 Armstrong. 2½ storeys, 32 x 47, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and spruce floors, lime and sand plastering, wood lath, built-in fireplaces, mantels.

Tenders and For Sale Department

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on **Tuesday, the 3rd day of February, 1914**, for about forty-two miles of steel pipe, fifty-four inches internal diameter, about thirty-two miles of steel pipe fifty-eight inches internal diameter, and about eleven miles of steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for bridge substructure and approaches at North Timiskaming, P.Q.," will be received at this office until 4 p.m. on **Monday, January 12, 1914**, for the construction of the substructure and approaches of a highway Bridge at North Timiskaming, County of Pontiac, P.Q.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineers, Confederation Life Building, Toronto, Ont., Post Office, Montreal, and on application to the Postmaster at North Timiskaming, P.Q.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 19, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—52858. 52-53

WANTED

A Small Thew Shovel.

Apply

Credit Forks Tile & Brick Co.,
262 Yonge St., Toronto.

53-1

Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition to Refinery, Royal Mint, Ottawa, Ont.," will be received at this office until 4 p.m., on **Wednesday, January 14, 1914**, for the above mentioned addition.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C .DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 47485. 53

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent. an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

STEAM PUMPS

Sales agents for Canada are wanted by one of the world's largest manufacturers of steam pumps. Only firms with high class connection will be considered. Apply Box 924, Contract Record, Toronto. 51-53

Representatives Wanted

Large firm manufacturing gravitation and pressure filters wants to secure reliable representatives for Canada. Successful installations in all parts of the world. Apply Box 923, Contract Record, Toronto. 51-53

Power Plants, Electricity and Telephones

Charlottetown, P.E.I.

The Maritime Trust Corporation, Halifax, N.S., has ordered entire new electric lighting and power plant from England, to be installed by next May.

Davidson, Sask.

By-law authorizing the installation of electric lighting and power plant, at a cost of $8,500, was passed by ratepayers

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FOR SALE

Steam Driven Air Compressors

thoroughly refitted

1-500′ Second Hand re-fitted Air Compressor, Compound Steam and Duplex Air Cylinder.
1-1200′ Re-fitted Air Compressor, Compound Steam, and two Stage Air Cylinders.

For particulars and prices write

The Jenckes Machine Company

SHERBROOKE, QUE. Limited

Montreal Office, - - - - E. T. Bank Building

50-53

Dec. 19th. Owner, Town Council. Clerk, A. J. Robertson.

Ft. William, Ont.
The municipal council (Clerk, A. McNaughton), propose submitting by-laws to raise $238,000 for improving and extending railway system, and $90,000 for the purpose of improving and extending the municipal telephone system.

Ottawa, Ont.
City municipal electric department intend buying stoves, etc., and selling to citizens at cost. Chairman, Mayor J. A. Ellis. Engineer, Supt. Brown, City Hall.

Penetanguishene, Ont.
Electric line to run through Midland and connect with C. P. R. at Port McNicoll is under consideration by the Town Council. Ontario Hydro Power Commission will be asked for estimates and detail.

CONTRACTS AWARDED

Toronto, Ont.
Pump, etc., for high level pumping station required by Board of Control. General contractors, Can. Allis-Chalmers Co., King W. One 7½ and one 20 million gal. pump, at $29,835 and $29,355 respectively. General contractors, Turbine Equipment Co., Peterkin Bldg., Bay St., one 7½ and one 20 million gallon pump, at $26,500 and $26,500 respectively.

Boilers, etc., for pumping station, required by Board of Control. General contractors, Can. Allis-Chalmers Co., King W. Four boilers complete with superheaters, $18,695, steam piping complete, $2,840. General contractors, Jeffrey Mfg. Co., coal handling apparatus, $21,300.

Miscellaneous

Brantford, Ont.
Application has been made to Public Works Dept., Ottawa, for permission to lay gas pipe from Tilbury to London and Brantford.

Calgary, Alta.
Public School Board has approved the purchase of the following manual training equipment:—4 wood turning lathes, at $600; 1 motor generator, $150; cold metal work equipment, $50; printing outfit, estimated at $1,000; 1 oilstone grinder, $155; 2 safety switches, $16; one 36-inch band saw, motor driven, $370.65; 1 variety saw bench, with attachments, $218.57; one 5 h.p. motor, $65; one 6 h.p. motor, $98.62; one 1 h.p. motor, $51; installation estimated, $225. Sec., Mr. Brady, Mortlake Block.

Ft. William, Ont.
Ratepayers will vote on by-law to raise $10,000 for the purpose of establishing and equipping playgrounds. Clerk, A. McNaughton.

Galt, Ont.
A by-law is to be submitted to the ratepayers authorizing the expenditure of $15,000 for making permanent additions and improvements to the waterworks system.

London, Ont.
Isolated steam heating plant for three-storey warehouse, boiler pipes, etc., required by Hobbs Hardware Co., Richmond St. Manager, C. A. Whitwam. Architects, McBride & Gilbert, Edge Blk. Plans drawn.

Oshawa, Ont.
Tenders received by Dom. Govt. Dept. of Marine and Fisheries, Acting Deputy Minister, C. Stanton, Ottawa, until Jan. 12th, for removal of elevator and coal shed from Government reserve.

Winnipeg, Man.
Switching gear, cost $15,000, required by Board of Control. Sec., M. Peterson. Engineer, J. G. Glassco, 54 King St. Switching gear and accessories for King St. sub-station. Specifications at office of Engineer. Tenders received by Board until Jan. 29th.

CONTRACTS AWARDED

Biggar, Sask.
Fire apparatus required by town council. Messrs. Dunlop Tire & Rubber Co., Ltd., Canada Bldg., Winnipeg, and Consolidated Rubber Co., awarded 500 ft. each of 2½-in. hose.

Toronto, Ont.
Fire hose required by Board of Control. General contractors, Dunlop Tire & Rubber Co., Booth Ave. 1,000 ft., 4-ply, 42 lbs. chemical engine hose, at 40c per ft.

Iron fence required by Board of Control. General contractors, Dyer Fence & Supply Co., Ltd., 645 King E. Fence on Beaty Blvd., King West, at $1.00 per lineal foot.

Canada Lumberman & Wood Worker

Contractors' Lumber

THE most natural place to find information concerning lumber and timber is in a lumber paper.

The "Canada Lumberman" has a special department which tells of odd lots of lumber that are on the market. If you knew of them could you not often save money by buying at a reduced price instead of paying yard prices?

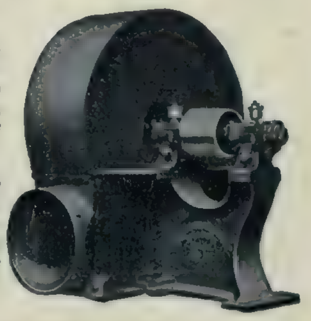
Published on the 1st and 15th of each month. Subscription price $2.00 a year. Sample copy free. Write us.

Canada Lumberman
220 King St. West, - - TORONTO

If You Are in the Market for a Fan, This Will Interest You

Geo. E. Nissen & Co., Winston,—Salem, N. C., writes that they have been using a STURTEVANT Blower in their smith shop for the past twenty years "without one minute of attention, only for oil."

Is it any wonder that when the abovementioned company needed additional fan equipment they wrote to the builders of the fan that gave them such service?



This is only one of hundreds of letters that we are continually receiving.

Sturtevant
(REG. U.S. PAT. OFF.)
STOCK FANS

are built to give years of dependable service.

The Sturtevant Engineering Organization is fully conversant with fan applications.

If you have a problem that can be solved by a fan they will tell you how to solve it.

Write us asking for catalog and stating fully your requirements.

B. F. STURTEVANT CO. OF CANADA, LIMITED
GALT, ONTARIO
Eastern Sales Office: 919 New Birks Bldg., Montreal
Western Sales Office: J. A. McTaggert, & Co., Winnipeg, Man.

Business Notes

Aylmer, Ont.

Furniture store of Luther A. Ball, Talbot St., damaged by fire. Loss estimated at $4,000, covered by insurance.

Alvinston, Ont.

The warehouse of Percy Wills has been damaged by fire to the extent of about $5,000. Partly covered by insurance.

Berlin, Ont.

The tannery of Breithaupt Leather Co., 19 Queen St. N., was recently damaged by fire. The Leech House, bark mill, beam house, boiler and engine rooms being badly gutted. The loss is estimated at $70,000.

Carman, Man.

The implement warehouse and contents of Bridge & McCullough, Fournier Ave., has been totally destroyed by fire. Loss covered by insurance.

Montreal, Que.

The apartment house situated 147 Bishop St., owned by A. Giguere, 294 Park Lafontaine, has been destroyed by fire. Estimated loss $75,000.

The stone crusher building and machinery of MacKenzie, Mann & Co., Ltd., 411 Dorchester W., was destroyed by fire. Estimated loss $5,000. Company will purchase new electrical machinery at once.

Ottawa, Ont.

Stables of Magistrate O'Keefe, Queen St., destroyed by fire.

Sault Ste. Marie, Ont.

Vertical boiler and crane machinery of The Foundation Co., Ltd., Sussex St., destroyed by fire.

Oakville, Ont.

St. Judes Anglican Church has been damaged by fire to the extent of $4,000.

Parry Sound, Ont.

The factory of The Thompson Boat Works, with a number of gasoline launches were destroyed by fire.

Smithville, Ont.

Fire destroyed the stores occupied by E. & J. Morgan, grocers and general merchants, loss $8,000; Frank Hayes, jewellery and hardware, loss $25,000, will rebuild; Fred Joyner, barber, loss $3,000, equipment required; Lloyd Patterson, grocer, loss $2,000, public library and the furniture of the Masonic Lodge were also destroyed.

Toronto, Ont.

Simpson Ave. Methodist Church Sunday School badly damaged by fire, estimated loss $16,000. Partly covered by insurance. Pastor, Rev. E. E. Scott, 28 Simpson Ave.

New Companies

Fort George Citizens' Water Co., Ltd., has been incorporated with a capital of $25,000, with head office at Fort George, B.C., to carry on business as a power company and to supply water for domestic and other purposes, etc.

Maysmith and Lowe, Limited, has been incorporated with a capital of $10,000, with head office at Victoria, B.C., to carry on business as electrical and mechanical engineers and general contractors.

Metropolitan Electric Co., Ltd., has been incorporated with a capital of $10,000, with head office at Vancouver, B.C., to carry on business as an electric light company in all its branches.

National Stores, Limited, has been incorporated with a capital of $200,000, with head office at Vancouver, B.C., to carry on business as general contractors.

Ardley Lumber and Shingle Co., Ltd., has been incorporated with a capital of $15,000 with head office at Vancouver, B.C., to carry on business as manufacturers of lumber, shingles, etc.

Grandview Iron Works, Limited, has been incorporated with a capital of $25,000, with head office at Vancouver, B.C., to carry on business as ironfounders, manufacturers of agricultural machinery, implements, etc.

Electric Patents, Ltd., has been incorporated with a capital of $10,000, with head office at Vancouver, B.C., to carry on business as manufacturers of electric fittings, etc.

Vancouver Iron & Metal Co., Ltd., has been incorporated with a capital of $25,000, with head office at Vancouver, B.C., to carry on business as ironfounders, etc.

The Provincial Sand and Gravel Co., Ltd., has been incorporated with a capital of $100,000, with head office at Saskatoon, Sask.

American Titanic Iron Company, Ltd., has been incorporated with a capital of $1,000,000, with head office at Quebec, Que., to carry on business as iron and steel manufacturers. The provisional directors are S. N. Parent, barrister, of Ottawa, Ont.; E. Roberge, legislative councillor, of Lambton, Que.; N. T. Twigeon, manufacturer, of Beauseville, Que.; L. A. Cannon and G. Parent, barristers, of Quebec, Que.

Fraser & Chalmers of Canada, Limited, has been incorporated with a capital of $100,000, with head office at Montreal, Que., to carry on business as manufacturers of mining machinery, etc. The provisional directors are J. J. Creelman, G. S. Stairs and P. F. Casgrain, advocates, all of Montreal.

Russell Jennings Manufacturing Co., Ltd., has been incorporated with a capital of $50,000, with head office at St. Catharines, Ont., to carry on business as manufacturers of implements, machinery, etc. The provisional directors are A. L. Jennings, Chester, Conn., U.S.A., manufacturer; J. K. Kernahan and F. J. Graves, brokers and J. S. Campbell, barrister, of St. Catharines, Ont.

The Caughnawaga Light, Heat & Power Co., Ltd., has been incorporated with a capital of $50,000, with head office at Caughnawaga, Que., to carry on business as an electric light company in all its branches.

Beaver Coal and Power Co., Ltd., has been incorporated with a capital of $1,000,000, with head office at Montreal, Que., to carry on business as general contractors, etc. The provisional directors are F. H. Markey, K.C., W. W. Skinner, K.C., G. G. Hyde and G. Williamson, advocates, and R. C. Grant, accountant, all of Montreal, Que.

Louis Garbi, Limited, has been incorporated with a capital of $45,000, with head office at Montreal, Que., to carry on business as general contractors. The provisional directors are Louis Garbi, civil engineer, L. Gosselin, advocate, both of Montreal, Que., and L. Boyer, advocate, of Westmount, Que.

The Northern Canada & Peace River Development Co., Ltd., has been incorporated with a capital of $100,000, to carry on business as a general land and building company, with head office at Ottawa. The provisional directors are M. E. Arbey and O. H. Jaegar, journalists, J. E. Lesieur and J. B. Gourgon, clerks, and R. O. Dawson, accountant, all of Ottawa.

Windsor Properties, Limited, has been incorporated with a capital of $32,000, to carry on business as a general land and building company, with head office at Rodney, Ont. The provisional directors are W. N. Lusty, contractor, E. J. Schmid, jeweller, A. C. Schleihauf, agent, and J. Kivell, all of Rodney, Ont., and H. W. Schweitzer, real estate dealer, of London, Ont.

The Hepworth Silica Pressed Brick Co., Ltd., has been incorporated with a capital of $125,000, to carry on business as brick manufacturers, etc., with head office at Hepworth, Ont. The provisional directors are J. Douglas and J. E. Campbell, manufacturers, and F. Campbell, physician, all of Hepworth, Ont., and L. Bloc, music dealer, and M. Forhan, gentleman, both of Owen Sound, Ont.

The Canadian Steel Studding and Manufacturing Co., Ltd., has been incorporated with a capital of $30,000, to carry on business as manufacturers of steel for building purposes, etc., with head office at Victoria, B.C.

Northwestern Construction Co., Ltd., has been incorporated with a capital of $25,000, with head office at Saskatoon, Sask.

Deer Park Land Co., Ltd., has been incorporated with a capital of $35,000, to carry on business as a general land and building company, with head office at Victoria, B.C.

The Credit Valley Stone Co., Ltd., has been incorporated with a capital of $250,000, to carry on business as operators of stone quarries, etc., with head office at Toronto. The provisional directors are R. A. Reid and H. R. Moses, barristers, both of Toronto.

Construction Supply Co., Ltd., has been incorporated with a capital of $60,000, to carry on business as general contractors, etc., with head office at Toronto. The provisional directors are W. Bain, bookkeeper, J. Ellis, J. J. Dashwood and R. Gowans, clerks, and J. S. Lovell, accountant, all of Toronto.

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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	18 00
Grey Stock Bricks	18 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	$80 00 to $150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—		
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00
Pine—		
1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
⅞ x 8 and 10 in. pine shelving	36 00	42 00
⅞ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or headed sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	
Pine trim for paint finish—		
4 in. casing per 100 ft.	2 00	
5 in. casing per 100 ft.	2 50	
8-in. pine base, per 100 ft.	3 50	
10 in. pine base, per 100 ft.	4 50	
4 in. pine window stool	2 75	
Shingles—		
XXX B. C. Clear Shingles, per M.	3 75	
N. B. Extras	3 75	
N. B. Clears	3 10	
No. 1 pine lath, per M.	5 00	
No. 2 pine lath	4 50	
No. 1 spruce lath	4 00	
Cedar Posts—Fence—		
5 in. at small end, each	25	
7 in. at small end, each	35	
Hemlock lath	3 50	
Dimension Timber up to 32 feet:		
8x8, 10x10, 10x12, 12x12, 12x14		32 00
8x10, 8x12, 10x14, 14x14		34 50
8x14, 12x16, 14x16, 16x16		34 50
10x16, 14x18, 16x18		35 50
8x16, 12x18, 18x18		36 00
10x18, 14x20; 16x20		36 50
8x18, 12x20, 18x20		37 00
10x20		37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22		38 50
12x22		39 00
10x22		39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24		40 50
12x24		41 00
10x24		41 50
8x24		43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	$4 25	$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	$3 25	$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	$3 50	$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.

High grade compression work, 55 and 5 per cent.

Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.

Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.

No. 4 compression bath cock ...... net$1.85

No. 4½ Fuller's .... net$2.35

Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, $7.50; less 5 per cent.; lead waste, $9.00, less 5 per cent.; caulking lead, 6½ cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black		Galvanized
¼ inch	$2.16	¼ inch	$3.06
⅜ "	2.16	⅜ "	3.06
½ "	2.72	½ "	3.57
¾ "	3.11	¾ "	4.26
1 "	4.59	1 "	6.29
1¼ "	6.21	1¼ "	8.51
1½ "	7.43	1½ "	10.18
2 "	9.99	2 "	13.19
2½ "	16.38	2½ "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.

7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, $1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, $1.55.

Crushed stone, 2-inch, $1.40; 1-inch, $1.45; ⅜-inch, $1.45.

Burnt River rubble stone delivered, $16 to $17 per toise.

Plain steel bars, $2.25.

Square twisted bars, ¼ to 1¼, $2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, $15 to $18 per toise.

Brown coursing stone, delivered, $3.75 per yard.

Grey coursing stone, delivered, $2.50 to $2.75 per yard.

Sand, for cement or brick work, $1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to $1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, $1.30 per ton.

Steel channels and beams, angles and plates, $2.65 to $3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from $8.00 to $8.50, bags extra; sanded, $4.00 in car lots; hydrated lime, $10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, $1.50 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, $9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, $7.00 to $8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3½c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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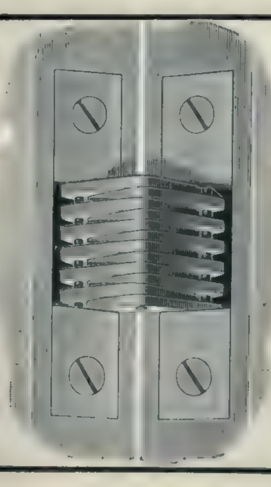

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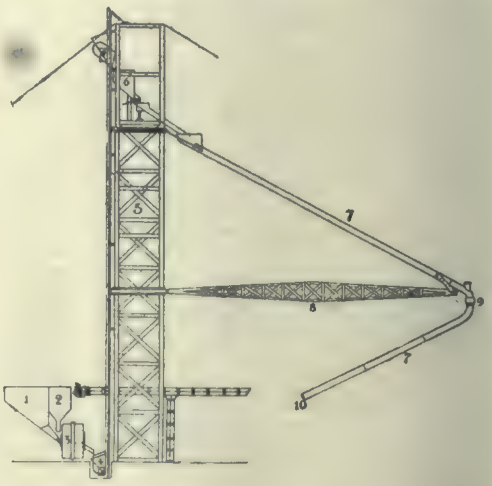

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